Secondary School Teachers' Awareness of, Access to and Adoption of Artificial Intelligence for Teaching in Ilorin-West, Nigeria

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Abstract

Artificial intelligence (AI) in education refers to the ability of a computer system to perform human tasks, such as thinking and learning. Benefits of AI for teaching are yet to be explored in the Nigerian educational system because there are substantial socio-cultural and organizational challenges. The study hence investigated secondary school teachers' awareness of, access to and adoption of AI for teaching. Specifically, the study: (i) assessed teachers' awareness of AI for teaching; (ii) determined teachers' access to AI tools for teaching; (iii) examined factors that affected teachers' adoption of AI for teaching and (iv) assessed public and private school teachers' access to AI for teaching at secondary schools in Ilorin-West, Kwara State, Nigeria. A descriptive research design of the survey type was adopted. A total number of 200 computer studies teachers participated from fourteen secondary schools where information and communication technology facilities are available. Descriptive statistics of frequency count, percentages and means were used to answer the research questions. T-test was used to test the hypothesis at 0.05 level of significance. Findings established that secondary school teachers:

- *are not aware of AI for teaching;*
- *did not have access to AI tools for teaching;*
- *lack of funds and infrastructural facilities are some of the factors that affect teachers' adoption of AI for teaching and*
- *there was no significant difference between public and private secondary school teachers' access to AI for teaching.*

The study concluded that 59.8% of teachers in secondary schools are not aware of AI and do not adopt it for teaching. This has great implications for raising the awareness of the benefits of implementing AI in the teaching process. Hence, the study recommended, among others, that teachers should be enlightened about the benefits of new technologies for smart teaching.

Keywords: *access, adoption, artificial intelligence, teachers' awareness, teaching*

1. Introduction

Research and development have heightened the discovery and invention of different innovations through science and technology in every facet of human endeavour. This 21st Century world is in a state

of flux, change is not only imminent but also so fast that there is a need to stay at alert in order to keep pace with developments in the world of technology.

Technology has influenced almost every aspect of life and education is no exception (Abdulla, 2023). Moreover, technology is an integrating activity, which draws on many different disciplines; it has practical and experimental elements. It depends on fusing the qualitative with quantitative aspect of design. By this activity, our world is fashioned and it determines much of the quality of our life. Technology can be a powerful tool for transforming learning. It can help affirm and advance relationships between educators and students, reinvent our approaches to learning and collaboration, shrink long-standing equity and accessibility gaps, and adapt learning experiences to meet the needs of all learners (Obielodan *et al.*, 2021). Ng *et al.* (2023) stated that the COVID-19 pandemic has catalyzed a significant shift to online/blended teaching and learning where teachers apply emerging technologies to enhance their students' learning outcomes.

Consequently, the integration of emerging technologies in the teaching and learning process increases the interest of learners and the quality of outcome in educational process. It brings about innovations, creativity, and flexibility to learning, thereby equipping both the educators and the learners with necessary problem-solving and survival skills in a digital world (Edah, 2019). Further, Oliveira *et al*. (2019) carried out a review of literature on emergent technologies from the field of science education. The study showed that emergent technological artifacts such as computer simulations, virtual labs, mobile devices and robots are increasing the experience of learners. This study, therefore, shows that emerging technologies have revealed a wide range of potential possibilities for teachers' improvement. Thus, introducing smart teaching, which is the adoption of information and communication technologies (ICTs) for teaching the twenty first century generation via the use of artificial intelligence has become a priority.

Popenici and Kerr (2017) observed that John McCarthy offered the first and most comprehensive definition of artificial intelligence (AI). AI is based of the assumption that every aspect of learning or any other feature of intelligence can be described precisely as a property of a machine or program; the intelligence that the system demonstrates. Moreover, AI can also be defined briefly as the "… branch of computer science that deals with the simulation of intelligent behavior in computers and their capacity to mimic, and ideally improve, human behavior (Naqvi, 2020)."

Studies conducted by Joshi (2019) and Batta (2018) revealed AI in two different categories: (i) strong or generalized AI - which is capable of understanding, improving, and solving problems, usually using machine learning. Machine learning is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without being explicitly programmed; and (ii) weak or applied AI that is limited to performing specific tasks such as recognizing, searching, or analyzing certain components. Currently, the generalized AI exists in theory, but only the weak or applied AI like Cognii, Socrative, Gradescope, ChatGPT, Duolingo, Amazon Alexa, Replika, Why2-Atlas, ETeacher and Google Assistance, among others, have been developed.

Consequently, AI is one of the essential driving forces of the 21st Century as it is rapidly transforming almost all human endeavours. In this sense, it would be naive to conclude that the technology will not have an impact on education given the fact that the possibilities are profound because there have been mind-blowing developments in the evolution of AI and the remarkable role it has played in human lives (Holmes, Bialik & Fadel, 2019). Yeruva (2023) also stated that AI has been transforming various industries and education is no exception.

AI is evolving at an accelerated pace, influencing the deep essence of higher education services. In applying AI in education, the teacher can become free from certain routine tasks and can concentrate on establishing links with students, getting to know them, and mastering skills that will accompany them on their journey towards their human development (Ikedinachi *et al*., 2019). Moving forwards, Seo *et al*. (2021); Mercader and Gairín (2020) and Vazhayil, *et al*., (2019) asserted that AI systems

offer effective support for online learning and teaching, including personalizing learning for students, automating teachers' routine tasks and powering adaptive assessments. `

Consequently, teachers' awareness of AI utilization has only been investigated by a few scholars. This has resulted from an overall lack of experience of teachers regarding how AI can be utilized in the classroom, as well as nonspecific ideas of what AI-adopted tools would be like. This state-of-the-art technology has also considerably influenced educational practices, and efforts constantly made to incorporate AI into teaching. Because of this, public and private school ownership has vital roles to play. For three decades, educators have utilized AI techniques to advance learning management systems, assessment instruments, and other learning support tools in various STEM subjects (Hwang & Tu, 2021). This has not taken place in the research site and, hence, the study examined teachers' awareness of, access to and adoption of AI for teaching in Ilorin-east Local Government Area of Kwara State, Nigeria.

2. Review of Related Literature

Various studies were reviewed in the process of the research. For example, Incerti (2020) stated that, the crucial role of teachers in the teaching and learning process could not be overemphasized; therefore, their awareness of AI is also extremely important for AI integration for smart teaching. This becomes more evident when new ideas are to be introduced to students in the secondary school educational level. Luckin *et al*. (2016) reported that teachers had been influenced by the concept of AI disseminated through the media and science fiction. Hence, this caused them to consider AI to be an occupational threat that would replace them in their jobs rather than to support the enhancement of teaching and learning.

Teachers' awareness of AI in another study according to United Nations Educational, Scientific and Cultural Organization (UNESCO, 2019) is shown by the number of countries that have developed a national AI strategy, which is increasing. France, China and, lately, the United States are examples of the kind of comprehensive strategies that, despite a huge focus on research and development, assign a major role to the development of an AI-capable workforce. In all these three cases, most attention is given to higher education, because of its obvious links with research and development, but also to technical and vocational education. Finland, meanwhile, has chosen a different pathway by creating a national platform to achieve rapidly the goal of 1% of the total population being AI-literate.

A study conducted by Nam and Min (2022) on awareness of teachers about AI revealed that efforts have constantly been made to incorporate AI into teaching and learning; however, the successful implementation of new instructional technologies is closely related to the attitudes of the teachers who lead the lesson. Furthermore, Aldosari (2020) believed that transferring smart products to countries will not work without awareness of many great roles played by AI, in terms of its advantages or disadvantages in academic processes, whether that be administrative procedures or teaching and learning processes.

However, Panigrahi (2020) study contributed to raising teachers' expectations for significant changes in the educational field, such as the implementation of AI in different educational settings. Despite several initiatives regarding curricula, tools, professional development and pedagogy, there is a lack of effective access to technical tools that also acts as a major barrier to the successful adoption of technology in education as expressed by Bingimlas (2009). The successful implementation of new instructional technologies by teachers are, hence, related by the attitude of the teachers that lead the lesson (Fernández-Batanero *et al*., 2021).

Consequently, teachers need to learn not only how to use technology but also, how to adopt it successfully into their curricula. In addition, in order to be open to adopting advanced technology into their teaching, teachers need to understand the importance of educational technology and the affordances that it can bring to instruction. In the same vein, when it comes to AI, a great number of

teachers and school officials have not yet experienced AI-based learning support and might simply recognize it as just a slightly more advanced educational technology (Kim & Kim, 2022).

The International Conference on Artificial Intelligence and Education, organized by UNESCO and China, May 16-18th, 2019, recommended encouraging fair and comprehensive adoption of AI in education. The continuous development of technology has led to more interest in AI (UNESCO, 2019). Moreover, studies have revealed that the COVID-19 pandemic has led to an unprecedented adoption of technology for education. It has also turned a crisis into an opportunity, and catalyzed a shift to AI-driven smart teaching and learning (Green *et al*., 2020).

Adoption of AI for instruction have shown promise for supporting teachers in various way for teaching. For example: providing instruction in mixed-ability classrooms; providing students with detailed and timely feedback on their writing products and freeing teachers from the burden of possessing all knowledge and giving them more room to support their students while they are observing, discussing, and gathering information in their collaborative knowledge-building processes (Hrastinski *et al*., 2019).

Consequently, the adoption of AI for teaching complex concepts in secondary schools in Nigeria, and the essential role AI plays in the technological advancement of the society, cannot be overemphasized (Edidiong & Jude, 2022). However, importantly, Alkanaan (2022) stated that careful planning of the adoption of AI by educational institutions requires starting with science teachers. Therefore, it is high time to prepare teachers for the adoption of AI for teaching (Nazaretsky, *et al*., 2021). However, not all teachers can be asked to become experts in AI, but they must at least be prepared to work in the schools of the future, to have awareness of adopting AI at the same time.

3. Statement of the Problem

The relevance and importance of AI in education is emphasized by the adoption of AI tools to improve mobility and the production of knowledge capacity among teachers. Nwile and Edo (2023) opined that, the adoption of artificial intelligence tools enhances the efficiency of the educational system. These great values cannot be harvested or implemented in Nigeria because there are substantial socio-cultural and organizational challenges that undermine the adoption and implementation of AI across the country.

Manasi, Panchanadeswaran and Sours (2023) claimed that the adoption of AI is currently occurring at an unprecedented pace in this present era of technology advancement. Wogu *et al*. (2018) stated that amidst this unprecedented adoption of AI, teachers worry that relying too much on AI systems might compromise the student's ability to learn independently, solve problems creatively and think critically. Teachers may not have rich technical knowledge to use AI educational applications to facilitate their teaching, not to mention developing students' AI digital capabilities. As such, there is a growing need for teachers to equip themselves with adequate digital competencies to adopt AI in their teaching environments (Ng *et al*., 2023; Kiemde & Kora, 2020, 2021).

The fear of job loss poses threats and Korinek and Stiglitz (2017) asserted that the advancement in AI technologies would bring about job losses or job polarization. These have manifested in different studies as it was revealed that science teachers might have a low level of awareness about the use of AI, and there is a need to raise that awareness in order to understand the general characteristics of AI and how to adopt it for teaching (Alkanaan, 2022; Shin & Shin, 2020). Therefore, to make a successful transition to knowledge-based education, the introduction of AI would be a necessary tool to shift Nigerian education from analog to digital (Alimi *et al*., 2021). The study, therefore, explored teachers' awareness of, access to and adoption of artificial intelligence for teaching in Ilorin-east Local Government Area of Kwara State, Nigeria.

4. Objectives and Research Questions for the Study

Specifically, the study:

1. assessed teachers' awareness of AI for teaching in secondary schools;
2. determined teachers' access to AI tools for teaching in secondary schools;
3. examined the factors that affect teachers' adoption of AI for teaching and
4. assessed public and private schools' teachers' access to AI for teaching in secondary schools.

The study provided answers to the following research questions:

1. Were teachers aware of AI for teaching?
2. What is teachers' access to AI tools for teaching?
3. What are the factors that affect teachers' adoption of AI for teaching? and
4. What is the level of public and private schools' teachers' access to AI for teaching?

The following hypothesis was formulated and tested at the 0.05 level of significance:

H_0: There is no significant difference between public and private secondary school teachers' access to AI for teaching

5. Research Design

This study employed descriptive research of the survey type. It was a study designed to represent the interest of the participants in an accurate way. This method was considered the most suitable design for this study because it involves selecting a chosen sample from a large population. The population for this study comprised all computer studies secondary school teachers in Ilorin-west local government area of Kwara State, Nigeria. The researcher involved two hundred (200) respondents available and an adapted questionnaire was employed from various researcher like Alimi, *et al*., (2021); Ayanwale *et al*., (2022); Nuhu and Onojah, (2021); Schroer, (2020); and Zhao, Xiaofan and Heng (2022) with a 97% return rate. The data obtained from the administer questionnaire were subjected to descriptive statistics of frequency counts, percentage and means to answer the three research questions. T-test was used to test the hypothesis at 0.05 level of significance.

6. Data Analysis and Results

Table 1: Distribution of the Paticipants

Gender	**Frequency**	**Percentage**
Male	86	43.0
Female	114	57.0
Total	200	100.0

Table 1 revealed that 86 (43.0%) of the respondents were male while 114 (57.0%) of the respondents were female.

Table 2: Distribution of the Participants Based on School Ownership

School Type	**Frequency**	**Percentage**
Public	116	58.0
Private	84	42.0
Total	200	100.0

Table 2, showed the participants' distribution based on school ownership. The table showed that 116 (58.0%) of the participants are from public school while 84 (42.0%) of the respondents are from private schools.

Research Question One: What is teachers' awareness of AI for teaching in secondary schools?

Table 3: Frequency and Percentage of Teachers' Awareness of AI for Teaching in Secondary Schools

S/N	Items	Aware	Not Aware
1.	Cognii	88 (44.0%)	112 (56.0%)
2	Socrative	78 (39.0%)	122 (61.0%)
3	Gradescope	83 (41.5%)	117 (58.5%)
4	ChatGPT	93 (46.5%)	107 (53.5%)
5	Duolingo	57 (28.5%)	143 (71.5%)
6	Amazon Alexa	94 (47.0%)	106 (53.0%)
7	Replika	46 (23.0%)	154 (77.0%)
8	Why2-Atlas	65 (32.5%)	135 (67.5%)
9	eTeacher	96 (48.0%)	104 (52.0%)
10	Google Assistance	104 (52.0%)	96 (48.0%)
	Percentage (%)	804 (40.2%)	1196 (59.8%)

Table 3 showed the teachers' awareness of AI for teaching in secondary schools. It is also revealed that 40.2% of the sampled secondary school teachers indicated they are aware of AI for teaching, while 59.8% of the sampled secondary school teachers indicated that they are not aware.

Research Question Two: What is teachers' access to AI tools for teaching in secondary schools?

Table 4: Frequency and Percentage of Teachers' Access to QI Tools for Teaching

S/N	Items	Accessible	Not Accessible
1.	Cognii	66 (33.0%)	134 (67.0%)
2	Socrative	95 (47.5%)	105 (52.5%)
3	Gradescope	61 (30.5%)	139 (69.5%)
4	ChatGPT	88 (44.0%)	112 (56.0%)
5	Duolingo	51 (25.5%)	149 (74.5%)
6	Amazon Alexa	75 (37.5%)	125 (62.5%)
7	Replika	37 (18.5%)	163 (81.5%)
8	Why2-Atlas	63 (31.5%)	137 (68.5%)
9	ETeacher	93 (46.5%)	107 (53.5%)
10	Google Assistance	85 (42.5%)	115 (57.5%)
	Percentage (%)	714 (35.7%)	1286 (64.3%)

Table 4 shows the teachers' access to AI tools for teaching in secondary schools. It revealed from Table 3 that 35.7% of the sampled secondary schools' teachers indicated that they have access to AI tools for teaching while 64.3% of the sampled secondary school teachers indicated that they do not have access to AI for teaching.

Research Question Three: What are the factors that affect teachers' adoption of AI tools for teaching in secondary schools?

Table 5: Frequency and Mean Score of the Factors that Affect Teachers' Adoption of AI for Teaching

S/N	Item	SA	A	D	SD	Mean
1.	Lack of training and professional development opportunities related to AI in teaching is a challenge.	110	60	20	10	3.35
2.	Limited access to AI tools affects the adoption of AI for teaching.	110	70	20	0	3.45
3.	Resistance from colleagues or administrators towards adopting AI in teaching.	40	50	110	0	2.65
4.	Insufficient funding and resources allocated to support the implementation of AI technology in classrooms.	100	90	10	0	3.45
5.	Lack of awareness or understanding of AI tools and their potential benefits in teaching.	110	60	20	10	3.35
6.	Perception of AI as replacing the role of teachers or diminishing the importance of human interaction.	40	70	90	0	2.75
7.	Uncertainty about the effectiveness and reliability of AI in improving teaching and learning.	30	100	70	0	2.80
	Grand Mean (X)					3.11

Key: SD = Strongly Disagree, D= Disagree, A = Agree, SA = Strongly Agree

Table 5 shows the factors that affected teachers' adoption of artificial intelligence for teaching in secondary schools. All the items received a mean score above the benchmark of 2.45 with limited access to AI tools that affect the adoption of AI for teaching. Insufficient funding and resources allocated to support the implementation of AI technology in classrooms having the highest mean score of $\bar{x}$ = 3.45 while resistance from colleagues or administrators towards adopting AI in teaching with lowest mean score of $\bar{x}$ = 2.65. Based on the value of the Grand Mean 3.11out of 4.00 maximum value obtainable, which falls within the decision value for ***Positive***, it can be inferred that there are factors hindering the integration of AI tools for teaching.

Hypothesis One: There is no significant difference between public and private secondary school teachers' access to AI for teaching.

Table 6: T-test for Difference between Public and Private Secondary School Teachers' Access to AI for Teaching

School	N	X	SD	Df	T	Sig.(2-tailed)	Decision
Public	116	16.50	2.77	198	0.458	0.648	Not Rejected
Private	84	16.33	2.19				
Total	200						

Table 6 indicates that Df (198), t= 0.458, p= 0.648 and so the formulated null hypothesis was not rejected. Thus, the stated null hypothesis established that, there was no significant difference between public and private secondary school teachers' access to AI for teaching.

7. Summary of Findings

The findings of this study based on the formulated research questions and the hypotheses were summarized as follows:

1. Secondary school teachers in Ilorin-west are not aware of AI for teaching;
2. Secondary school teachers in Ilorin-west do not have access to AI tools for teaching;
3. Lack of funds and infrastructural facilities are some of the factors that affect teachers adoption of AI for teaching and
4. There was no significant difference between public and private secondary school teachers' access to AI for teaching.

8. Discussion

This study investigated teachers' awareness of, access to and adoption of AI for teaching in secondary schools. Research question one seeks to investigate teachers' awareness of AI for teaching in secondary schools. The result of the data analysis was that secondary school teachers in Ilorin-west are not aware of AI for teaching. The findings of this study agreed with the result of Ghasemizad, Mohammadkhani, and Saadatrad (2019) which stressed that the awareness of the ability of AI in education and its adoption by institutions and individuals vary greatly but are are generally low. Moreover, it is revealed that teachers do not understand the fundamental concepts, such as big data structures, computational thinking concepts, or ubiquitous computing approaches, which further indicate a poor awareness state in the potential of AI among teachers (Vazhayil, *et al*., 2019).

The result of this study also confirmed the observation of Alkanaan (2022) that "… there is a low level of pre-service science teachers' awareness of employing AI in science education, with a marked decrease in awareness of how to employ AI in science education." Aldosari (2020) further revealed that there is a decrease in the level of awareness of the mechanisms of applying AI and that there is a need to spread awareness across educational environments on the possibilities of using AI applications in education. Incerti (2020) concluded by expressing that it is important to increase the awareness of specialists of the requirements of adopting AI in education.

This study further affirmed that secondary school teachers in Ilorin-west do not have access to AI tools for teaching. The results confirmed the assertion of Mercader and Gairín (2020) that despite the great potentials of AI-enabled learning; the pervasive use of technology in education does not guarantee teachers' ability to access technology in classrooms. This means that, despite the teachers' prior knowledge about technology - smartphones, tablets, laptops and so on - in their domain, this does not guarantee accessibility to AI tools for teaching.

Nazaretsky, *et al*. (2021) agreed with the findings of this study through the quotation that teachers are reluctant to accept AI-based recommendations when it contradicts their previous knowledge about their students. Therefore, teachers do not have access to AI applications for instruction. Nevertheless, accessibility to AI is crucial because the availability of AI in instruction enables students to work to the successful conclusion of problem-solving and other great benefits of AI (Nuhu & Onojah, 2021).

The finding of this study equally found that there are factors that affect teacher's adoption of AI for teaching. Factors like uncertainty about the effectiveness and reliability of AI, insufficient funding and resources; perception of AI as replacing the role of teachers and limited access to AI are all important. This is in agreement with Motahhare, *et al.* (2019), which stated that theories and beliefs, whether accurate or not, shape the nature of user awareness, interaction and experience of AI. Other hindrances are speculation that AI will replace teachers in the field of education (Hrastinski *et al*., 2019); lack of access to digital infrastructure, education, inadequate data, public policies and funding (Kiemde & Kora, 2020, 2021). Misunderstanding, misleadingness, limitations, and hidden ethical issues behind different platforms have been identified. In disagreement with the findings of this study, Akgun &

Greenhow (2022); Korinek and Stiglitz (2017) asserted that the advancement in AI technologies could bring about job losses or job polarization.

9. Conclusion

The study concluded that teachers in Ilorin-west LGA are not aware of AI tools, which affected access to it and therefore resulted to non-adoption of it for teaching in secondary schools. A very large number 59.8% of teachers have never heard about AI at all. Teachers' awareness of AI is the first thing that must be addressed in order to achieve a technology oriented educational experience in Nigeria's secondary schools. The lack of awareness of and access to AI tools or technologies resulted in the lack of adoption and lack of skill in using them. Therefore, there is a need to create more awareness about AI for teaching in every aspect, either physically in workshops, Seminars, staff meetings and so on or virtually, as for social media platforms.

9.1. Implications of the Findings

The findings of this study have great implications on raising the awareness of the magnanimous benefits of implementing AI in the teaching process for teachers in secondary schools. This study advocates that AI tools be available and accessible to teachers. The awareness and accessibility to AI will motivate, prioritize and encourage the teachers to adopt and utilize AI tools. Its adoption will positively influence teachers' attitudes towards these technologies for teaching in order to improve efficiency, efficacy, productivity, quality of instruction delivery and interactive engagement with their students. Eventually, it will help learners to gain better learning experiences, thereby improving their performance academically and in other ways.

9.2. Limitations of the Study

The study is limited to computer studies teachers' awareness, access and adoption of AI in Ilorin-east, Kwara State, Nigeria and thus the results cannot be generalized. Future researchers may consider other variables and subject teachers in secondary schools for further studies.

9.3. Recommendations

Based on the findings, these recommendations are provided:

1. Constant awareness in secondary school teachers about new technologies in the field of education, through seminars and workshops by education stakeholders should be encouraged;
2. Stakeholders in charge of secondary school education should provide teachers with necessary tools and devices alongside digital skills, policies and infrastructures that would provide access to adopting AI for teaching and
3. Lack of access to AI tools and technologies should be addressed by the educational stakeholders, ranging from the provision of adequate funding and provision of digital literacy skills for teachers irrespective of their departments.

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