Teachers' Perception Towards the Integration of Artificial Intelligence in the Teaching of Mathematics in Senior Secondary School

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Abstract

In many societies today, Artificial intelligence (AI) has developed into a disruptive force, and the system of education is only one example of how this technology is being used. Therefore, this study looked at the teachers' perceptions in terms of perception, attitude, and experience towards incorporating AI into mathematics education in senior secondary school in Remo, Ogun State, Nigeria. Three research questions were raised to gather data from the respondents. A descriptive survey research design was used in this study with a sample comprised of 60 respondents, with 30 teachers from private and public senior secondary schools each selected from 20 schools. The instrument used was the Teacher Perception Towards AI Questionnaire (TPTAQ) with a reliability coefficient of 0.77. The results revealed that the perceptive level of the teachers towards AI integration was found to be high in terms of perception, attitude, and experience, showing that teachers embrace the use of AI in mathematics education in schools. Therefore, educators are advised to be well-trained in the application of AI technology to mathematics education.

Keywords: AI, Attitude, Experience, Integration, Mathematics, Perception.

INTRODUCTION

Gaining digital skills is crucial for interacting with the modern technology environment and establishes the foundation for digital literacy and artificial intelligence. Beyond only knowing how to utilize digital tools and platforms, digital and AI literacy also includes critical thinking, problem-solving, creativity, and understanding the ethical implications of AI. (2024 World Economic Forum). According to Zhengyu et al. (2021), the concept of artificial intelligence was originally put forward in a 1956 Dartmouth seminar. Artificial intelligence was characterized at the time as a robot that could replicate intellectual traits that could be precisely stated or learning qualities. The capacity of a computer to see patterns, make decisions, adjust to change, and learn from experience is referred to as artificial intelligence (AI), according to Jaijun et al. (2022). The many AI technologies and algorithms are discussed in this definition. In the field of education, artificial intelligence (AI) has significant applications in machine learning, data mining, and learning analytics. Research on how AI might assist students in completing challenging pedagogical tasks in STEM education has also been prompted by the astounding advancement of AI algorithms. (Kim and Kim, 2022).

Artificial Intelligence (AI) is the capacity of digital computers or computer-controlled robots to carry out activities often performed by intelligent humans. According to Jaijun et al. (2022), artificial intelligence (AI) is the capacity of robots to adjust to novel circumstances, handle scenarios that arise, solve issues, provide answers, and devise strategies.

Artificial intelligence (AI) applications in learning environments are still mostly unknown to many, even though many of us may have developed a limited understanding or experience of AI in popular applications through the media or in our daily lives, Hesham et al (2023). Furthermore, Mohammad et al. (2024) noted that the rapid expansion of AI has raised expectations due to the technology's ability to transform pedagogical approaches and produce significant gains in teaching-learning. Education policy makers, practitioners, and the general public have not given special attention to the role that AI can play in raising the quality of education. The increase in AI spending in the fields of business, healthcare, cyberspace, and the military cannot surpass the attention and interest in AI education, Indra et al (2023).

The use of artificial intelligence (AI) has become a revolutionary force in many spheres of society; The educational system is by no means an isolated instance of this advancement in technology, according to Mohammad et al (2024). Additionally, Artificial Intelligence (AI) is gaining ground quickly in every facet of human existence. Daily living has evolved since AI became widely available. Researchers and AI scientists are working tirelessly to make human existence more pleasant and technologically sophisticated via the use of AI tools and approaches, Hesham et al (2023). According to Indra et al. (2023), AI may be used in every subject of study, including physics, psychology, health education, language, art, and mathematics. It is not limited to any one scientific discipline. As the amount of digitalization in education systems increases globally, with many countries enacting laws and action plans to expedite the process, Abiodun et al. (2023) reported that the problem of how to effectively incorporate digital technology into methods of instruction and learning becomes crucial.

Although the use of AI in education is still in its infancy, humans are already successfully influencing societal growth by combining human intellect with the great efficiency of machines, Zhang et al (2021). Implies that the acceptability of AI in our local society is still low. Furthermore, Mohammad et al. (2024) asserted that the manner that technology is used has significantly changed during the last few decades in education. Conversely, artificial intelligence broadens the scope of possibilities by enabling customized learning and promoting critical thinking and social engagement. Also, new applications of mathematics in dynamic technologies, including dynamic geometry, statistics, and robotics, are encouraged by mathematical advancements in these areas. Additionally, Manuel-Juan et al., (2020) list three strategies for integrating technology into the classroom: arranging a lesson plan that incorporates technology into problem solving while also considering students' mathematical activity; utilizing only dynamic problem representations to demonstrate mathematical relationships; and placing less emphasis on students' mathematical activity.

Although AI-enabled learning aids have a lot of promise, the fact that technology is being used extensively in education does not guarantee that teachers will be able to use it successfully in the classroom or that their instruction will be of the highest quality, (Kim & kim, 2022). In education, according to Hesham et al. (2023), rather than coming up with ways to help teachers grade more papers accurately, why not use computerized technology to automate teachers' laborious efforts and free them up to work on more creative projects that will allow them to deliver the learning process in a successful and productive way.

According to Ahmet & Fatih (2020), effective teachers will continue to be required in the future to provide lessons that'll increase students' emotional intelligence, creativity, and communication skills. As to the authors' claim, advancements in automation and artificial intelligence would ultimately enhance human qualities. Even as artificial intelligence studies are addressed in education. He goes on to say that those who can use intelligent systems or technologies would overcome those who cannot, not artificial intelligence (AI) or robots replacing human labor. Kim & Kim (2022) state that after decades of professional development on educational technology integration, many instructors continue to have a negative opinion of and reluctance to use technology in the classroom. As an alternative, they keep employing the same tools and teaching techniques and are against the application of anything that might have negative consequences.

According to Zhengyu et al. (2021), Artificial intelligence's advancement has relieved instructors of a great deal of laborious and repetitive administrative work. Additionally, Indra et al. (2023) noted that in order to optimize the learning process, teachers might take use of the convenience provided by AI. Predictive analytics and facial recognition technologies, for instance, are provided by AI. Teachers may utilize this feature to examine how their students behave and what attitudes they have by examining their facial expressions while they are studying. This facilitates instructors' ability to take preventative and remedial measures in order to help students meet their learning objectives. Consequently, instructors ought to assume the duties of mentors, teaching their students lifetime abilities and communication stepping outside beyond their comfort zones and focusing on matters of life. Ahmet & Fatih (2020) contend that the function of teachers in the educational setting will no longer be the same. In order to properly deploy AI in this context and encourage a collaborative and participatory mindset, teachers must obtain sufficient training. A more globalized and linked form of education is emerging as a result of studies on the possibilities of AI-driven social and cooperative learning, (Shumakova, 2024).

According to Salome et al. (2023), Several of the educational tasks that are probably to be automated by artificial intelligence are creating course material and performing administrative chores. It's fascinating to observe that attitudes toward AI systems tend to be influenced by the name "AI," which is related to these perceptions. There are actually two different perspectives on AI, and people's opinions toward it are more contrasting. other individuals may have a positive perception of AI; they are the ones who perceive its benefits and prospects. On the other hand, other people may be adverse to AI and particularly express concern about AI replacing human labor in the workplace. Furthermore, the World Economic Forum (2024) indicated that education institutions need to change in order to assist students' study alongside these developing technologies and to prepare them for

the technology-driven economy of the future. They continued by saying that incorporating AI technology into evaluations for education might provide teachers with data-driven, real-time insights into student learning patterns, help them discover their students' areas of strength and weakness, and enable them to evaluate training on a broad scale. Additionally, it facilitates the more effective evaluation of non-standard assessments, informs curriculum creation and instructional decision-making, and raises the standard of teaching as a whole. Most people believe it to be beneficial for learning (Renz & Hilbig, 2020).

Nonetheless, other researchers discuss reluctance from academics to the use of new technology (Nazaretsky et al., 2022; Rienties, 2014). In fact, estimates indicate that even if the application of AI will lead to the creation of new employment, it will also replace certain human resources (Chassignol et al., 2018) and automate 38% of present occupations by 2030 (Sindermann et al., 2021). Furthermore, Hesham et al. (2023) examined the ways in which artificial intelligence (AI) can strengthen the teaching and learning process, while Indra et al. (2023) employed a semi-systematic literature review to examine the intricacies of possibilities, difficulties, dangers, and obstacles related to using AI into education. Less human resources in education would equate to fewer teachers (Bates et al., 2020), the potential for teacher shortages still seems to be one of the primary concerns. Sara et al (2022) opined that AI education is becoming more and more of an initiative, and the majority of research on combining digital skills with AI education in the classroom focuses on the viewpoint of the student or on educational or governmental laws. The study of teachers' viewpoints on AI instruction has only recently begun.

Knowing teachers' attitudes and perspectives on AI education is crucial since they play a major role in creating creative educational pathways and bringing innovation into the classroom. According to research from the World Economic Forum published in 2024, some instructors are completely excluding artificial intelligence (AI) from the classroom due to worries about student cheating and data privacy. Others are looking for methods to integrate technology in the classroom in a way that is acceptable and develop critical thinkers who can work with AI, taking into account the ways that the nature of work is changing and how this will affect both the labor markets of today and future.

In order to guarantee that there is a large pool of new talent entering the teaching field in the future, that educators receive fair compensation, and the perception of teaching as a high-potential, high-growth career in the future, governments and other stakeholders will need to undertake a substantial amount of work, according to the World Economic Forum (2024). By assisting people already employed in the teaching profession and making sure that teaching becomes a "future ready" career, artificial intelligence (AI) and other developing technologies have the potential to contribute to the achievement of these aims. Even if artificial intelligence (AI) and other cutting-edge technologies can't completely replace human teachers, they can quickly close some of the gap. A lot of educators are already aware of the advantages of this kind of help. For example, in November 2023, 42% of primary and secondary teachers in the United Kingdom employed generative AI to help them with their academics, a huge rise from 17% in April 2023. AI integration as a tool for current educators and as a tempting extra skill set for potential educators in the future can be supported by governments, businesses, and civil society in addition to new incentives and structural frameworks designed to develop, attract, and retain talent within the education sector. Furthermore, in order to execute customized learning successfully, Sangheethaa & Arun (2024) said that instructors must have sufficient training in the usage of AI-powered platforms and technologies. This can be difficult, especially for teachers who might not be as tech-savvy as they are.

According to Gerald et al. (2000) and 2016, the Will, Skill, and Tool (WST) model provides a theoretical framework for understanding the factors impacting students' adoption of digital tools in the educational setting. The model's three main components are Will, Skill, and Tool, which stand for the attitudes and abilities of instructors as well as the resources at their disposal. The term "teacher's will" describes how they feel about particular technology. Stated differently, if the educator believes that incorporating technology into the classroom may enhance the learning experience for their pupils. It covers attitudes, values, and motivations related to technology. These can be either positive, if there is a prevalent idea that technology can support learning or negative, if there is a prevalent concern of associated hazards, like seclusion or problems usage. The skill component relates to instructors' level of conviction about their digital skills. However, it's crucial to remember that this is all about perceived skill levels, so it's possible that reaching the greatest degree of digital proficiency is not always necessary for teachers if they feel they are competent enough to use technological resources in the classroom. The final component, tool, speaks to the actual availability of software, PCs, laptops, tablets, and other digital teaching tools.

Research has generally shown that schools take a while to implement new digital technologies as well as to maintain the functionality and modernity of their present technology. Purchasing digital gadgets for schools is a frequent activity that increases the quantity of instruments. But this frequently occurs without taking into account the attitudes and professional growth of the instructors. Furthermore, it has been demonstrated that a number of variables, including the nature and number of technical resources available, influence ICT incorporation into

instructional strategies. Teachers often possess a medium or moderate degree of digital competency, despite the fact that technological resources are important in higher education and secondary schooling. However, it's important to include things like attitudes, views, and methodical ICT applications (Juan-Manuel et al, 2020).

The WST model's components can be used to explain why technology is accepted in classrooms. For instance, it was shown that there are notable positive relationships between technology's application in education and feelings of efficacy and efficiency (i.e., positive will). Teachers, meanwhile, may have technological anxiety. As a result, individuals may have a negative attitude toward the rapid advancement of technology or demonstrate a decreased willingness to adapt. According to Juan-Manuel et al. (2020), one of the things that affects how instructors utilize ICT is their impression of it. But attitude also plays a role in conditioning. Teachers' attitudes may be characterized as a framework for action that is in line with their views. Three characteristics were used in a recent study to categorize attitudes: active, cognitive, and behavioral. The emotions and sentiments that influence decision-making are a part of the active dimension. With respect to the cognitive component, each teacher's experience-related beliefs and values uphold it. Lastly, the instructor's behaviors and intentions are the main emphasis of the behavioral component, when they are required to behave in a certain situation.

Teachers must also understand the connection between their education and their job in the classroom; otherwise, they may view the introduction of a new subject, such artificial intelligence (AI), as an inefficient use of time, Sara et al (2022). It is important for educators to acknowledge the ways in which their recently acquired information might aid students in their overall growth, including but not limited to creating links between academic material and practical applications, Thomas et al. (2020). For this reason, AI should complement instructors rather than take their place in their roles. AI enables instructors to concentrate on developing connections, recognizing the unique requirements of each student, and encouraging motivation by relieving them of repetitive work. This synergy highlights the importance of the human aspect in education while simultaneously increasing the efficacy of instruction. Careful thought and methodical application are necessary for the successful incorporation of AI into educational frameworks and procedures (World Economic Forum, 2024).

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) has projected that 44 million more teachers would be required by 2030 in order to meet the challenging objectives outlined in the Sustainable Development Goal (SDG), It aims to ensure inclusive and equitable education and give everyone the opportunity to continue learning throughout their lives. Both established and emerging economies are impacted by this severe and widening teacher shortage. But in Sub-Saharan Africa, where universal preschool education would require an extra 15 million teachers by 2030, the scarcity is especially severe (World Economic Forum, 2024). It is based on the above that this study looked at teachers' sentiments on AI's application in mathematics teaching in senior secondary schools in Remo North, Ogun State, Nigeria.

Research Questions

The study was guided by the following questions:

1. To what extent do senior secondary school math teachers' attitudes influence the integration of AI in their pedagogy?

2. what is the extent to which senior secondary school teachers perceive using AI in mathematics teaching?

3. How does the level of experience of mathematics teachers in using AI impact their perception in integrating AI to teach in secondary schools?

METHOD

A descriptive survey was the method of research employed in this study, it is embraced to enable the researchers to carefully describe and explain factual and detail information of the opinion of the respondents on the perception, attitude and level of experience of the teachers in Remo division of Ogun State in the direction of using AI into mathematical instruction in senior secondary schools. All the teachers in public and private senior secondary schools in Remo Division of Ogun State, Nigeria made up the population. The sample comprises of 60 respondents, with 30 teachers from private and public senior secondary schools each selected from 20 schools. The instrument used was Teacher perception towards AI questionnaire (TPTAQ) adapted from Abiodun et al (2023) and Ezenwobodo (2024) with the reliability coefficient of 0.82 and 0.72. the modified tool is divided into three sections. Section A consists of the demographic information of the teachers, the demographic information entails the teacher's name, school and sex. Section B consists of 20 items eliciting information on the perception, attitude and level of experience of educators toward incorporating AI into mathematics instruction in senior secondary schools. The instrument is made up of four-point rating system of Strongly Disagreed (SD), Strongly Agreed (SA), Disagreed (D), and Agreed (A), which allowed respondents to express how much they agreed or disagreed on the raised items. The questionnaire was revalidated using face and content validity. Twenty (20) teachers participated in trial testing of the validated tools from another division of Ogun state different from the samples in order to assess the

instruments' dependability. The reliability of the questionnaire was assessed using the Cronbach alpha coefficient, which yielded a value of 0.77. permission was taken from the school authorities and the consent of the teachers were sought before the distribution of the instrument which lasted four weeks, the filled instruments were collected and examined using percentage, mean, and standard deviation descriptive statistics to answer the raised questions.

RESULT AND DISCUSSION

Result

This section presents the results of the study. The results are presented below with tables and discussions. Table 1 provides data for the first research question. Table 2 provides data for the second research question. Table 3 provides data for the third research question.

Table 1. Teachers' perception of the integration of AI in the teaching of mathematics

s/n	Statement	SA	A	D	SD	Mean	Std.	Decision
1.	I prefer using AI in the classroom to teach students in mathematics class.	14 (23.3%)	2 (3.3%)	34 (56.7%)	10 (16.7%)	1.93	1.246	Rejected
2.	I used AI to prepare my lesson notes and prepare students' assignments	32 (53.3%)	8 (13.3%)	13 (21.7%)	7 (11.7%)	2.98	1.242	Accepted
3.	I normally utilize online learning materials when teaching mathematics	28 (46.7%)	18 (30.0%)	10 (16.7%)	4 (6.7%)	3.067	1.103	Accepted
4.	I used to participate in seminars, workshops, and conferences for the training of teachers in mathematics on the use of AI	20 (33.3%)	21 (35.0%)	11 (18.3%)	8 (13.3%)	2.170	1.092	Accepted
5.	I used AI to produce visual displays of information (charts, graphs, pictures, video, etc.)	25 (41.7%)	17 (28.3%)	11 (18.3%)	7 (11.7%)	2.93	1.133	Accepted
6.	Mathematics learning through AI provides flexibility to the study at a time convenient to the learners	33 (55.0%)	13 (21.7%)	9 (15.0%)	5 (8.3%)	3.17	1.667	Accepted
7.	Using AI can simplify most mathematical concepts	35 (58.3%)	15 (25.0%)	3 (5.0%)	7 (11.7%)	3.37	0.882	Accepted
8.	I believe that AI are user friendly and the service is compactable with the way that I teach mathematics in the classroom	31 (51.7%)	12 (20.0%)	2 (3.3%)	15 (25.0%)	3.20	0.935	Accepted
9.	I feel confident when using AI to teach mathematical concepts	37 (61.7%)	12 (20.0%)	2 (3.3%)	9 (15.0%)	3.40	0.867	Accepted
10.	AI can increase my competency solving mathematics	21 (35.0%)	22 (36.7%)	5 (8.3%)	12 (20.0%)	2.98	0.947	Accepted

The average of a coded, four-point structured questionnaire anchored on a continuum of strongly agreed (SA) as four points, agreed (A) as four points, disagreed (D) as three points, and strongly disagreed (SD) as one point yields the mean benchmark of 2.5. From table 1, the means of nine (9) items is greater than the mean benchmark

of 2.5. hence it is concluded that the incorporation of AI in mathematics education is well-received by teachers of mathematics.

Table 2. Teachers' attitude towards the integration of AI in teaching of mathematics

s/n	Statement	SA	A	D	SD	Mean	Std.	Decision
1.	AI, in my opinion, is a crucial and useful tool for studying mathematics.	17 (28.3%)	20 (33.3%)	5 (8.3%)	18 (30.0%)	2.88	1.009	Accepted
2.	AI technology has the potential to improve math instruction's efficacy.	25 (41.7%)	16 (26.7%)	4 (6.7%)	15 (25.0%)	3.03	0.973	Accepted
3.	I believe AI integration will make mathematics education more engaging for students	21 (35.0%)	19 (31.7%)	8 (13.3%)	12 (20.0%)	2.88	1.043	Accepted
4.	I am concerned that AI might make teachers to be lazy	22 (36.7%)	20 (33.3%)	9 (15.0%)	9 (15.0%)	2.92	1.062	Accepted
5.	I think my school ought to become proficient in using AI technology.	30 (50.0%)	21 (35.0%)	5 (8.3%)	4 (6.7%)	3.27	0.919	Accepted

From table 2, the mean of all the items is greater than the mean benchmark of 2.5. Hence, it is concluded that senior secondary school math teachers' attitudes influence the integration of AI in their teaching practices.

Table 3. Teacher's level of experience towards the integration of AI in teaching mathematics

s/n	Statement	SA	A	D	SD	Mean	Std.	Decision
1.	I've used AI learning resources for mathematics before	22 (36.7%)	17 (28.3%)	9 (15.0%)	12 (20.0%)	2.87	1.081	Accepted
2.	My prior experience with AI in education has improved my opinion of its application in teaching mathematics	27 (45.0%)	17 (28.3%)	9 (15.0%)	7 (11.7%)	3.03	1.088	Accepted
3.	Instructors are more likely to succeed if they have employed AI to teach mathematics	18 (30.0%)	19 (31.7%)	7 (11.7%)	16 (26.7%)	2.80	1.005	Accepted
4.	I am open to exploring new AI technologies for teaching mathematics	14 (23.3%)	17 (28.3%)	9 (15%)	20 (33.3%)	2.60	1.012	Accepted
5.	My knowledge of AI in mathematics has increased my desire to see it used in instruction	35 (58.3%)	19 (31.7%)	5 (8.3%)	1 (1.7%)	3.40	0.886	Accepted

From table 3, the mean of all the items is greater than the mean benchmark of 2.5. Hence, it is concluded that the level of experience of mathematics teachers in using AI impact their perception of integrating AI to teach in secondary schools is moderately high.

Discussion

The result shows that the incorporation of AI in mathematical education is seen favorably by teachers of mathematics. This implies that the level of teachers' perception towards AI integration is on the acceptable note in Remo Division of Ogun State, with teachers showing high interest in using AI in the process of teaching and learning, formulations of notes and level of flexibility towards teaching and learning. This result aligns with the finding of Salome et al (2023); Ahmed et al., (2022); Asmatahasin et al., (2021) who concluded that teacher's level of acceptance of AI to support their teaching activities is on the high side and that there is not fear of threat of AI replacing their job, hence support the integration of AI. The finding corroborates with the finding of Ezenwobodo (2024) that AI technology, according to mathematics instructors, can improve how well mathematics is

taught. Also, the result revealed that senior secondary school mathematics teachers' attitudes influence the incorporation of AI into their instructional strategies. This result shows the positive attitude of educators toward the incorporation of artificial intelligence reflecting how usable the integration of AI will help them during the instructional procedure, though some show pointed to the fact that that it may make some teachers lazy in the execution of their job. Additionally, it shows how teachers in Remo are positive about the integration of AI therefore want the school to ensure the integration. All this positive attitude of teachers may have been influenced by their use of technological gadgets outside school and within the school. This finding is in line with Mohammad et al., (2024) that says teachers adequate training in AI promote participative attitude but negate the finding of Ahmet & Fatih (2020) that the perception towards AI by teachers and academicians suffers a lot of setbacks. Finally, the result shows that level of experience of mathematics teachers in using AI impact their perception in integrating AI to teach in secondary schools is moderately high. This outcome revealed that teachers have been familiar with some technological tools that gave them the opportunity to experience how AI functions, for example the use of Meta AI on WhatsApp. I think this contribute to the familiarity shown in the result leading to the level of experience towards AI integration. This aligns with Ezenwobodo (2024) and Abiodun et al (2023) that find out that the opinion of the respondents shows that students who use AI for learning mathematics excel academically in the subject due to their experience level of the technological tool. Though not in line with the submission of Kim & Kim (2022) that teachers are reluctant to use technology. The outcomes of these results corroborate the conclusion of Ezenwobodo (2023), that integrating technology into math lessons would increase the capacity of students to resolve issues and the quality of instruction in mathematics as a whole. Showing that teachers embrace the use of AI to mathematics education.

CONCLUSION

The study's conclusions lead to the conclusion that educators in Remo, Ogun State, Nigeria possess high perceptions, attitudes, and level of experience in the direction of using AI in mathematical instruction in senior secondary school. That is teachers highly embrace the use of AI to education of mathematics in schools. Despite the positive perception of the teachers towards artificial intelligence integration in mathematics education in secondary school, some limitation was raised and observed such as inadequate teachers, electricity, internet and accessibility of AI tools though some of the private schools are already technology driven but level of usage is low. The implication of this study will assist the teachers to efficiently deliver their duties and it will offer both teachers and learners the opportunity to be creative

and develop good problem-solving skills. It is therefore recommended that teachers should be well trained on using artificial intelligence (AI) in mathematics education. More so, schools should make adequate provision of necessary tools and equipment.

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