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Assessment of Artificial Intelligence Awareness Level and Utilization Strategies Among Mathematics Students in Tertiary Institutions in Imo State

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Abstract

This study assessed artificial intelligence awareness level and utilization strategies among mathematics students in tertiary institutions in Imo State. Based on the purpose of the study, three research questions guided the study. A descriptive survey research design was adopted for the study. The population for the study comprised of all the 123 mathematics students in tertiary institutions in Imo State. The sample of 80 mathematics pre-service teachers using purposive sampling technique. The instrument used for data collection is a structured questionnaire titled: Artificial intelligence Awareness and Utilization Strategies Questionnaire (AIAUSQ). The AIAUSQ has three sections. Section A contained items designed to elicit demographic information, Section B measures Artificial Intelligence Awareness and utilization scale it has four dimensions namely (a) Cognitive Awareness (knowledge level): it involves knowing about the existence of a concepts. (b) Comprehension Awareness (Understanding Level): At this stage the students understand how the concepts work and its relevance, (c) Application Awareness (Usage Level): this involves the ability to use the knowledge in practical situations and (d) Attitudinal Awareness (feelings and perceptions): this reflects students' feelings, perception and disposition towards the concepts. The AIAUSQ was validated by one expert in mathematics education and one expert in educational technology. Test re-test technique was employed to determine the reliability of the instrument; a pilot study was carried out by the researchers on two occasions on randomly selected students who were not part of the study. The data collected on the two administrations were collated and analyzed using PPMC analysis, the result yielded a reliability coefficient of 0.89 which shows that the instrument was reliable. The data collected were collated and analyzed using mean and standard deviation. The study concluded that mathematics students in tertiary institutions in Imo State utilize a few common

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AI tools, especially ChatGPT, MATLAB, Grammarly/QuillBot, and Khan Academy AI learning platforms, while many specialized mathematics AI tools remain underutilized. The findings further revealed that pre-service teachers possess a high level of awareness regarding artificial intelligence, including cognitive, comprehension, application, and attitudinal awareness. It was recommended that tertiary institutions in Imo State should organize regular workshops, seminars, and training programmes to improve students' and lecturers' knowledge of specialized AI mathematical tools such as Wolfram Alpha, GeoGebra, Symbolab, and Maple.

Keywords: Assessment, Artificial Intelligence, Awareness, Utilization strategies and mathematics.

Introduction

The rapid advancement of Artificial Intelligence (AI) has significantly transformed various sectors of human life, including education. Artificial Intelligence refers to the simulation of human intelligence processes by machines, particularly computer systems, which are capable of learning, reasoning, problem-solving, and decision-making. In the educational sector, AI has introduced innovative tools such as intelligent tutoring systems, automated grading systems, virtual assistants, and adaptive learning platforms that enhance teaching and learning processes. In recent years, universities across the globe have increasingly integrated AI technologies into teacher education programmes. Pre-service teachers' students undergoing training to become professional educators are expected to be knowledgeable about emerging technologies, including AI, to effectively function in modern classrooms. Their level of awareness and ability to utilize AI tools play a crucial role in shaping future teaching practices and improving learning outcomes.

Awareness of AI involves understanding its concepts, applications, benefits, and ethical implications in education. However, studies have shown that many pre-service teachers possess varying levels of awareness regarding AI technologies. While some demonstrate familiarity with tools such as Chatbots, machine learning applications, and automated instructional systems, others have limited exposure and understanding. The concept of awareness level refers to the degree to which an individual possesses knowledge, understanding, and consciousness about a particular subject, phenomenon, or issue. It goes beyond mere recognition and includes the ability to comprehend, interpret, and apply information meaningfully in real-life situations. Awareness level is often viewed as a continuum, ranging from low awareness (little or no knowledge) to high awareness (deep understanding and active application). It reflects not only whether a person has heard about a concept but also how well they understand it and their readiness to use that knowledge effectively. In educational contexts, awareness level is particularly important because it influences students' engagement, learning outcomes, and ability to adopt new innovations such as digital technologies and artificial intelligence. Awareness level is the extent of an individual's familiarity with and understanding of a specific concept or innovation., It is the degree of cognitive recognition and knowledge that enables individuals to respond appropriately to a given phenomenon., It encompasses perception, knowledge acquisition, and the ability to apply learned information in practical contexts. In summary, awareness level is a multidimensional concept that captures the depth of knowledge, understanding, and practical engagement an individual has with a particular subject. In research, it serves as a

critical variable for assessing how well individuals are informed and how effectively they can utilize innovations like artificial intelligence.

Artificial Intelligence (AI) has become a transformative tool in modern education, providing innovative strategies that enhance students' learning experiences, engagement, and academic performance. These strategies are grounded in adaptive technologies, data-driven instruction, and intelligent systems that support individualized and collaborative learning. Utilization strategies, on the other hand, refer to the methods and approaches adopted by pre-service teachers in integrating AI tools into teaching and learning. These strategies may include the use of AI-powered applications for lesson planning, classroom management, personalized instruction, assessment, and feedback. Effective utilization of AI requires not only awareness but also competence, training, and positive attitudes toward technology. The major utilization strategies are discussed below.

Personalized Learning: One of the most significant strategies through which students utilize AI is personalized learning. AI-driven systems analyze learners' data, including performance, preferences, and pace, to tailor instructional content accordingly. This approach moves away from the traditional "one-size-fits-all" model and allows students to learn at their own speed while focusing on their individual needs. AI-powered personalized learning platforms recommend suitable learning materials, adjust content difficulty, and provide targeted feedback. Personalized learning is an instructional approach that tailors' educational experiences to meet the individual needs, preferences, abilities, and interests of learners. It represents a shift from the traditional teacher-centered model to a learner-centered paradigm, where students take active roles in their learning processes. According to Pane, Steiner, Baird, Hamilton, and Pane (2017), personalized learning refers to instructional strategies that adapt the pace, content, and learning pathways based on individual learner differences. This approach ensures that each student receives targeted support, thereby improving engagement and academic outcomes. Similarly, Walkington and Bernacki (2020) define personalized learning as a system that integrates learners' interests and prior knowledge into instructional design to enhance motivation and understanding. In the context of Artificial Intelligence, personalized learning is driven by intelligent systems that analyze learners' data and provide adaptive learning experiences. Holmes, Bialik, and Fadel (2019) describe personalized learning as the use of AI and data analytics to customize learning environments, enabling real-time adjustments to content and instruction. These systems rely on machine learning algorithms to identify patterns in student performance and deliver appropriate interventions.

Furthermore, Zawacki-Richter, Marín, Bond, and Gouverneur (2019) emphasize that personalized learning involves the use of digital technologies to create flexible learning environments where students can control the time, place, and pace of learning. This flexibility enhances autonomy and promotes self-regulated learning among students. Personalized learning also incorporates adaptive learning technologies, which automatically modify instructional materials based on learners' responses. According to Khosravi, Kitto, and Knight (2019), adaptive systems use learning analytics to provide individualized feedback and recommendations, thereby improving learning efficiency. These technologies are particularly useful in large classroom settings where individualized attention is difficult to achieve. In addition, personalized learning supports differentiated instruction by addressing diverse learning styles and abilities. Tomlinson (2017) explains that personalized learning aligns with differentiated teaching practices by providing varied instructional methods and resources tailored to individual learners. This ensures inclusivity and equity in education. Another important dimension of personalized learning is learner autonomy. According to Ryan and Deci (2020), personalized learning fosters intrinsic motivation by allowing students

to make choices about their learning activities. This aligns with the principles of self-determination theory, which emphasizes autonomy, competence, and relatedness as key drivers of motivation. Empirical studies have also highlighted the effectiveness of personalized learning. For instance, Hwang, Xie, Wah, and Gašević (2020) found that personalized learning environments significantly improve student engagement, achievement, and retention. Similarly, Peng, Ma, and Spector (2019) reported that AI-supported personalized learning enhances students' problem-solving skills and academic performance. This enhances student engagement and improves learning outcomes by aligning instruction with individual learning trajectories. Furthermore, adaptive learning systems employ machine learning algorithms to continuously refine instructional delivery, making learning more efficient and inclusive.

Intelligent Tutoring Systems: Students also utilize AI through intelligent tutoring systems (ITS), which function as virtual tutors providing real-time guidance and feedback. These systems simulate one-on-one tutoring by offering step-by-step explanations, answering questions, and monitoring student progress. Research indicates that ITS can significantly improve students' understanding of complex concepts by providing immediate feedback and adaptive instruction. These systems use natural language processing and machine learning techniques to deliver personalized assistance and conversational support Additionally, ITS enhance problem-solving skills by guiding learners through structured learning processes and identifying areas of weakness.

Academic Writing and Research Support: AI tools are widely used by students to support academic writing and research activities. These tools assist in grammar checking, plagiarism detection, paraphrasing, and citation generation. AI-based writing assistants help students improve the quality of their academic work by providing suggestions for clarity, coherence, and organization. Moreover, AI enhances research processes by enabling quick access to scholarly materials, summarizing large volumes of information, and identifying relevant sources. This reduces the time spent on manual research and improves academic productivity. AI-driven educational technologies have been shown to significantly improve students' writing skills and research efficiency.

Automated Assessment and Feedback: Another key utilization strategy is the use of AI for automated assessment and feedback. Students engage with AI-powered systems that provide instant grading of assignments, quizzes, and examinations. These systems use algorithms to evaluate both objective and subjective responses, offering immediate feedback that helps students identify areas for improvement. Automated assessment tools enhance learning by promoting continuous evaluation and self-reflection. They also reduce delays in feedback, enabling students to make timely corrections and improve performance. AI-based assessment systems contribute to more efficient and accurate evaluation processes in education.

Study Planning and Learning Analytics: Students utilize AI for effective study planning and time management through learning analytics systems. These systems track students' academic activities, analyze learning patterns, and provide recommendations for improvement. AI can generate personalized study schedules, send reminders, and monitor progress toward academic goals. Learning analytics also enable students to identify their strengths and weaknesses, thereby promoting self-regulated learning. By leveraging data-driven insights, students can optimize their study strategies and achieve better academic outcomes. AI-driven analytics systems play a critical role in enhancing decision-making and academic planning.

Collaborative Learning and Interaction: AI supports collaborative learning by facilitating communication and interaction among students. AI-powered platforms enable group

discussions, peer feedback, and shared learning experiences. Chatbots and virtual assistants can mediate discussions, provide suggestions, and enhance engagement in collaborative tasks. This strategy promotes active learning and knowledge sharing, allowing students to learn from one another. AI tools also help manage group dynamics by tracking participation and providing feedback on collaborative performance.

Accessibility and Inclusive Learning: AI technologies are instrumental in promoting inclusive education by supporting students with diverse learning needs. Tools such as speech-to-text, text-to-speech, and real-time translation enable students with disabilities to access educational content more effectively.AI-driven adaptive systems also cater to different learning styles, ensuring that all students have equal opportunities to succeed. Research highlights that AI enhances educational equity by providing personalized and accessible learning environments.

Accessibility and Inclusive Learning: Students utilize AI tools to enhance problem-solving skills and critical thinking. AI-powered applications provide step-by-step solutions to complex problems, particularly in subjects such as mathematics and science. These tools also offer practice exercises, simulations, and interactive learning experiences. By engaging with AI systems, students develop analytical skills and gain deeper understanding of subject matter. AI-based learning environments encourage independent learning and foster higher-order thinking skills.

Academic writing and research support: refer to the processes, tools, and strategies that assist students in producing scholarly work and conducting systematic investigations. With the emergence of Artificial Intelligence (AI), these processes have been significantly enhanced through intelligent systems that support writing, editing, data analysis, and information retrieval. Academic writing is a formal style of communication used in educational and research settings to present ideas, arguments, and findings in a structured and evidence-based manner. According to Hyland (2019), academic writing involves critical thinking, clarity of expression, logical organization, and adherence to disciplinary conventions. It requires students to synthesize information from various sources and present it coherently. AI-powered tools have transformed academic writing by providing automated support for grammar correction, style improvement, paraphrasing, and referencing. According to Li, Diao, and Li (2023), AI writing assistants enhance students' writing quality by offering real-time feedback on sentence structure, vocabulary usage, and coherence. These tools help reduce errors and improve overall readability, thereby supporting students in producing high-quality academic texts. In addition, AI plays a crucial role in research support by facilitating literature review, data collection, and analysis. Research support involves accessing relevant academic resources, organizing information, and generating insights. According to Dwivedi et al. (2023), AI technologies such as natural language processing and machine learning enable efficient searching, summarizing, and categorization of scholarly articles, thus reducing the time required for research.

Furthermore, AI tools assist students in plagiarism detection and citation management. Proper referencing is a key component of academic writing, ensuring academic integrity and credibility. According to Park (2022), AI-based plagiarism detection systems help students identify unintentional similarities and improve originality in their work. Similarly, citation management tools automate referencing processes, making it easier for students to adhere to academic standards. Another important aspect of AI-supported academic writing is content generation and idea development. AI systems can suggest topics, generate outlines, and provide draft content that students can refine. While these tools enhance productivity, they

also require critical evaluation to ensure accuracy and originality. According to Cotton, Cotton, and Shipway (2024), students must develop AI literacy to effectively use these tools without compromising academic integrity. AI also supports collaborative research and writing. Cloud-based AI platforms enable students to work together on documents, share feedback, and co-author research papers in real time. This promotes teamwork and enhances the quality of academic outputs. According to Holmes et al. (2022), AI-driven collaborative tools improve communication and coordination among students engaged in research projects.

Assessment and feedback: are fundamental components of the teaching and learning process, serving as critical tools for measuring students' academic progress and enhancing learning outcomes. Assessment refers to the systematic process of collecting, analyzing, and interpreting information about students' performance, while feedback involves providing information to learners about their performance with the aim of improving future learning. According to Black and Wiliam (2018), assessment is a continuous process that helps educators understand students' learning needs and adjust instructional strategies accordingly. It encompasses both formative assessment, which occurs during the learning process, and summative assessment, which evaluates learning outcomes at the end of an instructional period. Feedback, on the other hand, is an integral part of assessment that provides students with insights into their strengths and areas for improvement. In recent years, the integration of Artificial Intelligence (AI) has significantly transformed assessment and feedback processes in education. AI-powered systems enable automated assessment, real-time feedback, and data-driven decision-making. According to Luckin et al. (2016), AI enhances assessment by providing adaptive testing, instant grading, and personalized feedback tailored to individual learners' needs. AI-based assessment tools utilize machine learning algorithms and natural language processing to evaluate both objective and subjective responses. These systems can assess essays, short answers, and problem-solving tasks with a high level of accuracy. According to Holmes, Bialik, and Fadel (2019), AI-driven assessment systems improve efficiency and consistency in grading while reducing human bias and workload.

Furthermore, AI facilitates formative assessment by providing immediate feedback during learning activities. Instant feedback allows students to identify errors and make corrections in real time, thereby enhancing learning retention and performance. According to Hattie and Timperley (2007), effective feedback answers three key questions: "Where am I going?", "How am I going?", and "What should I do next?". AI systems are capable of addressing these questions by delivering targeted and actionable feedback. Another important aspect of AI in assessment is learning analytics. AI systems collect and analyze large amounts of data on students' learning behaviors, performance patterns, and engagement levels. According to Ifenthaler and Yau (2020), learning analytics provide valuable insights that help students monitor their progress and make informed decisions about their learning strategies. Additionally, AI supports adaptive assessment, where the difficulty level of questions is adjusted based on students' responses. This ensures that assessments are aligned with students' abilities and provide a more accurate measure of their knowledge and skills. According to Shute and Rahimi (2021), adaptive assessment enhances fairness and improves the validity of evaluation processes.

Study planning and learning are central components of effective academic performance, involving the organization, regulation, and execution of learning activities to achieve specific educational goals. Study planning refers to the systematic arrangement of study schedules, tasks, and strategies, while learning encompasses the cognitive, behavioral, and emotional processes through which knowledge and skills are acquired. According to Zimmerman (2002), effective study planning is a core element of self-regulated learning, where students

actively plan, monitor, and evaluate their learning processes. This involves setting goals, selecting appropriate strategies, managing time, and reflecting on outcomes. Students who engage in structured study planning tend to demonstrate higher academic achievement and improved learning efficiency. In contemporary education, Artificial Intelligence (AI) has significantly enhanced study planning and learning processes through the use of intelligent systems and learning analytics. AI-powered tools assist students in organizing their study schedules, tracking progress, and identifying areas that require improvement. According to Ifenthaler and Yau (2020), learning analytics systems collect and analyze students' learning data to provide personalized recommendations that support effective study planning.

Furthermore, AI supports adaptive learning, which enables students to engage with content tailored to their individual needs. According to Holmes, Bialik, and Fadel (2019), AI-driven learning environments adjust instructional materials based on learners' performance, thereby improving engagement and retention. This personalization ensures that students focus on areas where they need the most support, making study planning more efficient and targeted. Time management is another critical aspect of study planning. AI-based applications help students allocate time effectively by generating study timetables, setting reminders, and prioritizing tasks. According to Broadbent and Poon (2015), effective time management strategies are strongly associated with academic success, particularly in self-directed learning environments. AI tools enhance these strategies by providing automated and data-driven planning support. In addition, AI facilitates goal setting and progress monitoring. Students can use AI systems to set academic goals, track their performance, and receive feedback on their progress. According to Schraw, Crippen, and Hartley (2006), goal setting and self-monitoring are essential components of metacognitive regulation, which plays a crucial role in successful learning. AI tools provide visual dashboards and performance analytics that enable students to monitor their achievements and adjust their study strategies accordingly. AI also enhances learning through intelligent recommendations and resource management. AI systems suggest relevant learning materials, such as articles, videos, and practice exercises, based on students' interests and performance. According to Khosravi, Kitto, and Knight (2019), personalized recommendations improve learning efficiency by guiding students toward appropriate resources and reducing cognitive overload. Moreover, AI supports collaborative learning and peer interaction, which are important aspects of the learning process. Through AI-enabled platforms, students can engage in group discussions, share resources, and receive peer feedback. According to Dillenbourg (1999), collaborative learning promotes deeper understanding and critical thinking by encouraging interaction and knowledge sharing among learners,

Problem-solving and skill development: are essential components of effective learning and professional preparation. Problem-solving refers to the cognitive process of identifying, analyzing, and resolving complex or unfamiliar challenges, while skill development involves acquiring and enhancing competencies necessary for academic, personal, or professional success. According to Jonassen (2011), problem-solving is a fundamental cognitive activity that requires critical thinking, reasoning, creativity, and decision-making. It involves understanding the problem, generating possible solutions, evaluating alternatives, and implementing the most effective solution. Problem-solving skills are crucial for students as they prepare to navigate real-world challenges in their personal and professional lives. Skill development, closely linked with problem-solving, emphasizes the acquisition of both cognitive skills (such as analytical thinking and reasoning) and practical skills (such as communication, collaboration, and technical competence). According to Pellegrino and Hilton (2012), skill development is a process through which learners gain knowledge, abilities, and attitudes necessary to perform tasks effectively and adaptively in varying

contexts. In contemporary education, Artificial Intelligence (AI) has become a powerful tool for enhancing problem-solving and skill development. AI-powered learning platforms provide interactive simulations, adaptive problem-solving exercises, and personalized feedback that help students develop higher-order thinking skills. According to Holmes, Bialik, and Fadel (2019), AI enables the creation of dynamic learning environments that challenge students with real-world scenarios and facilitate experiential learning. Problem-based learning (PBL) is a widely recognized instructional approach that promotes problem-solving and skill development. In PBL, students work collaboratively to address complex, ill-structured problems, fostering critical thinking, creativity, and teamwork skills. According to Savery (2015), PBL encourages active engagement, reflection, and knowledge application, which are essential for the development of transferable skills. Moreover, AI facilitates skill development through personalized learning analytics, which monitor students' progress and identify skill gaps. These systems provide targeted interventions and recommendations for improvement. According to Ifenthaler and Yau (2020), adaptive AI tools enable students to practice problem-solving in a scaffolded manner, receive immediate feedback, and progressively build competence. Collaborative problem-solving is another important aspect of skill development. According to Hesse et al. (2015), working in teams allows learners to pool knowledge, exchange perspectives, and develop interpersonal and communication skills while solving complex problems. AI tools can support collaborative problem-solving by enabling virtual teamwork, tracking contributions, and providing suggestions for effective collaboration (Luckin et al., 2016). Furthermore, integrating problem-solving with skill development promotes 21st-century competencies, such as critical thinking, digital literacy, creativity, and self-regulation. According to Trilling and Fadel (2009), these competencies are essential for success in the modern knowledge-based economy. AI-enhanced educational systems provide environments that simulate real-world challenges, allowing learners to apply knowledge in practical contexts and refine their skills iteratively.

Despite the growing importance of AI in education, there is concern that many pre-service teachers in universities, particularly in developing countries like Nigeria, may not be adequately prepared to harness these technologies. Factors such as inadequate infrastructure, lack of training, limited access to AI tools, and insufficient curriculum integration may hinder their awareness and utilization. It is against this backdrop that this study seeks to assess the level of Artificial Intelligence awareness and the utilization strategies among pre-service teachers in universities. The findings of this study will provide insights into existing gaps and inform policy decisions, curriculum development, and teacher training programmes.

Recent empirical studies have increasingly focused on the level of awareness of artificial intelligence (AI) among students in tertiary institutions. This growing interest is driven by the rapid integration of AI technologies into education and the recognition that awareness plays a critical role in determining adoption, utilization, and learning outcomes. Dergunova et al. (2022) conducted a study to examine students' awareness of artificial intelligence in higher education institutions. Using a descriptive survey design, the researchers found that while students had basic awareness of AI concepts, their understanding was largely superficial. Most respondents were familiar with the term "artificial intelligence" but lacked knowledge of its practical applications in academic contexts. The study concluded that although awareness exists, it is not sufficiently deep to support effective utilization of AI tools in learning environments.

Similarly, Ofem et al. (2024) investigated students' awareness and perceptions of AI in academic research using a structural equation modeling approach. The findings revealed that students exhibited moderate awareness of AI technologies, which significantly

influenced their perception and eventual use of AI tools. The study also identified gender and programme type as moderating variables, suggesting that awareness levels vary across different student demographics. This study underscores the importance of awareness as a determinant of AI adoption in higher education. In another study, El-Shara et al. (2025) explored university students' awareness and attitudes toward AI applications in learning through a descriptive survey. The results indicated that although students demonstrated moderate awareness of AI tools, their actual usage was relatively low. The study attributed this gap to insufficient practical training and limited institutional support. Furthermore, the researchers noted that awareness positively influenced students' attitudes toward AI, implying that increased awareness could lead to greater acceptance and utilization.

Focusing on the Nigerian context, Nwodu (2025) examined awareness and perception of AI among undergraduate students. The study revealed a relatively low level of awareness, with a significant proportion of students lacking exposure to AI technologies. The findings highlighted infrastructural deficiencies, poor digital literacy, and limited access to technological resources as major barriers to awareness. This study is particularly relevant to developing regions, where technological disparities may hinder students' ability to engage with emerging innovations. Hamzat and Ansah (2025) further investigated AI awareness and readiness among undergraduate students in Nigerian universities. Using a survey research design, the study found that students possessed moderate awareness of AI but demonstrated low readiness for its practical application. The researchers identified lack of training, inadequate curriculum integration, and insufficient institutional support as key factors limiting students' engagement with AI technologies. The study emphasized the need for structured educational interventions to enhance both awareness and readiness. Kanipriyan (2025) conducted a study among research scholars to assess their awareness and perception of AI in academic work. The findings indicated that awareness levels varied significantly depending on academic discipline and exposure to digital technologies. While students in science-related fields exhibited higher awareness, those in social sciences showed limited understanding of AI applications. This disparity suggests that awareness is influenced by academic background and access to relevant learning opportunities.

In a mixed-method study, Pawar et al. (2025) examined students' awareness and usage of AI tools such as ChatGPT and Grammarly. The study found that while many students were aware of these tools, their use was often limited to basic functions. Additionally, students expressed concerns about ethical issues, including academic dishonesty and overdependence on AI. These findings indicate that awareness alone is not sufficient; students also require guidance on ethical and effective use of AI technologies. Zhang et al. (2026) investigated the relationship between AI awareness and students' career development in higher education. The study employed a quantitative approach and found that awareness of AI significantly enhanced students' self-efficacy and employability confidence. The researchers concluded that AI awareness is not only important for academic purposes but also plays a crucial role in preparing students for the labor market.

Furthermore, a large-scale cross-sectional study published in BMC Medical Education (2025) assessed AI awareness among medical students. The findings revealed moderate awareness levels, with many students recognizing the importance of AI in healthcare. However, the study also identified significant gaps in curriculum integration, suggesting that formal education systems have not fully incorporated AI into teaching and learning processes. Across these studies, a consistent pattern emerges. Most students demonstrate low to moderate awareness of artificial intelligence, with awareness levels influenced by factors such as digital literacy, access to technology, academic discipline, and institutional support.

While awareness is generally associated with positive attitudes toward AI, it does not necessarily translate into effective utilization. This gap between awareness and application highlights the need for targeted educational strategies, including training programs, curriculum integration, and improved access to technological resources.

Statement of the Problem

Artificial Intelligence is increasingly becoming an essential component of modern education systems. However, despite its growing relevance, there is evidence suggesting that many pre-service teachers lack adequate awareness and practical knowledge of AI technologies. This lack of awareness may limit their ability to effectively integrate AI into teaching and learning processes. Furthermore, even among those who are aware of AI, the utilization strategies employed are often inadequate or ineffective. Some pre-service teachers may not possess the necessary skills, training, or institutional support required to apply AI tools in educational settings. This creates a gap between technological advancement and its practical application in classrooms. In Nigerian universities, where teacher education is expected to prepare future educators for digital classrooms, the extent to which pre-service teachers are aware of and utilize AI remains unclear. Without proper assessment, it becomes difficult to identify deficiencies and implement appropriate interventions. Therefore, the problem of this study is to determine the level of AI awareness among pre-service teachers and examine the strategies they employ in utilizing AI for educational purposes.

Purpose of the Study

The main purpose of this study is to assess the level of Artificial Intelligence awareness and utilization strategies among pre-service teachers in universities. Specifically, the study seeks to:

i. Identify the artificial intelligence tools used. among mathematics students in tertiary Institutions in Imo State
ii. Determine the level of Artificial intelligence awareness among mathematics students in tertiary Institutions in Imo State
iii. Examine the utilization strategies of artificial intelligence among mathematics students in Tertiary Institutions in Imo State.

Research Questions

The following research questions will guide the study:

1. What are the artificial intelligence tools used among mathematics students in tertiary institutions in Imo State?
2. What is the level of Artificial Intelligence awareness among pre-service teachers in universities?
3. What are the utilization strategies of artificial intelligence among mathematics students in tertiary institutions in Imo State?

Methods

The study adopted the descriptive research survey design. It is a quantitative research design that aims to describe the differences between groups in a population without manipulating the independent variable. According to Nkwocha (2014), it is design that seeks to compare and contrast between two or more nations, cultures, societies, and Institutions. Also, Ejifugha (2016) stated that a comparative survey research design is the act of comparing two or more things with a view to discovering something about one or the entire thing being compared. The population of the study consisted of all the 123 mathematics students in tertiary Institutions in Imo State. The sample of 80 mathematics students using purposive sampling

technique. This involves urban (163 mathematics teachers) and rural (217 mathematics). The instrument used for data collection is a structured questionnaire titled: Artificial Intelligence Awareness and Utilization Strategies Questionnaire (AIAUSQ). The AIAUSQ has three sections. Section A contained items designed to elicit demographic information from the respondents. It includes items such as gender, age, institution type (University, Polytechnic and college of Education) and level of study. Section B measures Artificial Intelligence Awareness and Utilization Scale (AIAUS), it has four dimensions namely (a) Cognitive Awareness (knowledge level): it involves knowing about the existence of a concepts. (b) Comprehension Awareness (Understanding Level): At this stage the students understand how the concepts work and its relevance, (c) Application Awareness (Usage Level): this involves the ability to use the knowledge in practical situations and (d) Attitudinal Awareness (feelings and perceptions): this reflects students' feelings, perception and disposition towards the concepts. The AIAUSQ was measured on a 4-point scale format of Strongly Agree, Agree, Disagree and Strongly Disagree, which were assigned numerical values, 4, 3, 2, and 1. The respondents were requested to tick the options that best suit their opinion on each item. The maximum score is 15 while the minimum score is 0. Boxes were provided in front of each question where respondent will tick his or her choice out of the option and all the question were closed ended questions. The face and content validity was done by one expert in Mathematics Education and one expert in Educational Technology, Faculty of Education, Alvan Ikoku Federal University of Education Owerri. Boxes were provided in front of each question where respondents will tick his or her choice out of the option and all the questions were closed ended questions. To establish the instrument reliability, Pilot study was done by administering the questionnaire to the respondents which is not part of the study but have similar characteristics and the data collected was analyzed using Cronbach alpha reliability Statistics with reliability co-efficient of 0.88. The researchers collected introduction letter from the school and meet with the respondents to explain the objectives of the study and to seek their consent. The questionnaires was in closed ended form in which the researchers and two assistants took the questionnaires to the respondents on two different working days, they administered the questionnaires after ethical approval has been obtained from the HODS of the department authority and informed consent has been signed by respondents, the instrument were collected back immediately for compilation and analysis, the questions have response categories pertaining to the topic of study and it was given to the respondents. The data were collected and analyzed means and standard deviation (SD) to answer the research questions.

Results

Research Question 1. What are the artificial intelligence tools used among mathematics students in tertiary Institutions in Imo state?

Table 1. Mean and standard deviation on identifying the artificial intelligence tools used. among mathematics students in tertiary Institutions in Imo state.

S/n	Artificial intelligence tools	Mean	SD	REMARKS
1	Chat GPT	3.32	2,2	Utilized
2	Wolfram Alpha	2.00	1.1	Not utilized
3	Photomath	2.35	1.4	Not utilized
4	Microsoft maths solver	2.12	1.0	Not utilized
5	GeoGebra	2.00	1.1	Not utilized
6	Symbolab	1.54	0.7	Not utilized
7	MATLAB	3.00	2.3	Utilized
8	Maple	2.11	1.0	Not utilized
9	Grammarly and QuilBot	3.00	2.3	Utilized
10	Khan Academy AI learning	2.65	1.5	Utilized

The results in table 1 indicated that ChatGPT recorded the highest mean score (Mean = 3.32), indicating that it is Similarly, MATLAB (Mean = 3.00), Grammarly and QuillBot (Mean = 3.00), and Khan Academy AI learning tools (Mean = 2.65) were also identified as utilized tools. However, other specialized mathematics AI tools such as Wolfram Alpha, Photomath, GeoGebra, Symbolab, Maple, and Microsoft Math Solver recorded low mean scores, indicating low utilization among students.

Research Question 2: What is the level of Artificial Intelligence awareness among pre-service teachers in tertiary Institutions?

Mean and Standard deviation on level of Artificial Intelligence awareness among pre-service teachers in universities

S/n	Level Of Artificial Intelligence Awareness	MEAN	SD	Remarks
11	Cognitive Awareness (knowledge level)	3.41	2.12	High awareness
12	Comprehension Awareness (Understanding Level):	3.00	2.32	High awareness
13	Application Awareness (Usage Level):	3.40	2.13	High awareness
14	Attitudinal Awareness (feelings and perceptions)	3.40	2.13	High awareness

The results showed a high level of AI awareness among pre-service teachers across all dimensions examined. Cognitive awareness recorded a mean of 3.41, comprehension awareness had a mean of 3.00, while application awareness and attitudinal awareness both recorded mean scores of 3.40.

Research Question 3; What are the utilization strategies of artificial intelligence among mathematics students in tertiary institutions in Imo State?

Mean and standard deviation on utilization strategies of artificial intelligence among mathematics Students in Tertiary Institutions in Imo State.

S/N	Items	Mean	SD	Remarks
15	Personalized Learning	3.34	1.5	Utilized
16	Intelligent Tutoring Systems	2.00	0.7	Unutilized
17	Academic Writing and Research Support	2.00	0.7	Unutilized
18	Automated Assessment and Feedback	2.34	1.0	Unutilized
19	Study Planning and Learning Analytics	3.42	1.4	Utilized
20	Collaborative Learning and Interaction	2.56	1.1	Utilized
21	Accessibility and Inclusive Learning	2.50	1.3	Utilized
22	Accessibility and Inclusive Learning	2.00	0.7	Unutilized
23	Assessment and feedback:	2.13	0.8	Unutilized
25	Problem-solving and skill development	2.52	1.3	Utilized

The findings indicated that personalized learning (Mean = 3.34) and study planning and learning analytics (Mean = 3.42) were the most utilized AI strategies among pre-service teachers in mathematics.

Discussion

The findings revealed that ChatGPT recorded the highest mean score, indicating that it is widely utilized among mathematics students in tertiary institutions in Imo State. Similarly, MATLAB, Grammarly and QuillBot , and Khan Academy AI learning tools were also identified as utilized tools. However, other specialized mathematics AI tools such as Wolfram Alpha, Photomath, GeoGebra, Symbolab, Maple, and Microsoft Math Solver recorded low mean scores, indicating low utilization among students. This finding suggests that students are more familiar with general-purpose AI tools that support writing, explanations, and basic computational assistance than with advanced mathematical AI applications. The popularity of ChatGPT may be attributed to its accessibility, conversational interface, and ability to simplify mathematical explanations. This finding aligns with the study of Kasneci et al. who observed that AI conversational tools are increasingly being adopted by university students for learning support and problem solving. Similarly, Zawacki-Richter et al. reported that AI technologies are becoming important learning companions in higher education. The low utilization of specialized mathematical software may be due to inadequate awareness, poor digital skills, lack of institutional training, or limited access to technological infrastructure. This supports the findings of Aldowah et al. who stated that insufficient technological exposure limits students' adoption of educational AI systems.

Also, the results showed a high level of AI awareness among pre-service teachers across all dimensions examined. Cognitive awareness recorded, comprehension awareness, while application awareness and attitudinal awareness both recorded high scores. These findings indicate that respondents possess substantial knowledge, understanding, practical awareness, and positive perceptions of AI technologies. The high awareness level may be linked to increased exposure to digital technologies, internet resources, and the growing integration of AI discussions into educational settings. The findings imply that pre-service teachers recognize the relevance of AI in improving teaching and learning processes. This finding agrees with Holmes et al. who noted that awareness of AI among students and teachers has increased significantly due to digital transformation in education. Furthermore, the positive attitudinal awareness suggests that students are willing to embrace AI

technologies for academic purposes. This supports the work of Luckin who emphasized that positive perceptions toward AI encourage its acceptance and effective classroom application.

Finally, the findings indicated that personalized learning and study planning and learning analytics were the most utilized AI strategies among mathematics students. This suggests that students use AI tools mainly to support individualized learning, organize study activities, and monitor academic progress. However, other important AI utilization strategies such as intelligent tutoring systems, academic writing and research support, automated assessment and feedback, collaborative learning, accessibility and inclusive learning, and problem-solving strategies recorded relatively lower mean scores. This indicates that students are yet to fully maximize the broader educational opportunities provided by AI technologies. The high utilization of personalized learning confirms the argument of Chen et al. that AI enables adaptive and learner-centered instruction which improves students' academic engagement. Likewise, the use of AI for study planning aligns with the findings of Baker and Inventado (n.d) who stated that AI-driven analytics assist students in monitoring and improving learning outcomes. The relatively low utilization of intelligent tutoring systems and automated feedback tools may result from limited institutional support, inadequate ICT facilities, or insufficient training on educational technologies. This finding agrees with Selwyn who observed that educational institutions in developing countries often face challenges in effectively implementing AI-supported learning systems.

Conclusion

The study concluded that mathematics students in tertiary institutions in Imo State utilize a few common AI tools, especially ChatGPT, MATLAB, Grammarly/QuillBot, and Khan Academy AI learning platforms, while many specialized mathematics AI tools remain underutilized. The findings further revealed that pre-service teachers possess a high level of awareness regarding artificial intelligence, including cognitive, comprehension, application, and attitudinal awareness.

Additionally, the study established that personalized learning and study planning are the major AI utilization strategies adopted by students, although several other educational AI strategies are not adequately utilized. Overall, artificial intelligence has significant potential to improve mathematics learning and teaching in tertiary institutions if adequate awareness, training, and technological support are provided.

Recommendations

1. Tertiary institutions in Imo State should organize regular workshops, seminars, and training programmes to improve students' and lecturers' knowledge of specialized AI mathematical tools such as Wolfram Alpha, GeoGebra, Symbolab, and Maple.
2. Educational authorities should integrate AI education into teacher-training curricula to ensure that pre-service teachers acquire practical skills in the use of AI technologies for teaching and learning mathematics.
3. Institutions should provide adequate ICT infrastructure, internet access, and digital learning facilities to support effective utilization of AI tools in mathematics education.
4. Mathematics lecturers should encourage students to adopt AI-driven personalized learning and intelligent tutoring systems to improve problem-solving abilities and academic performance.
5. Government and institutional administrators should develop policies and support systems that promote ethical and effective use of artificial intelligence in tertiary education.

References

Black, P., & Wiliam, D. (2018). Classroom assessment and pedagogy. Assessment in Education: *Principles, Policy & Practice, 25(6), 551–575*.https://doi.org/10.1080/0969594X.2018.1441807

BMC Medical Education. (2025). Medical undergraduate students' awareness and perspectives on artificial intelligence. BMC Medical Education. https://doi.org/10.1186/s12909-025-07223-6

Broadbent, J., & Poon, W. L. (2015). Self-regulated learning strategies and academic achievement in online higher education learning environments. Internet and Higher Education, 27, 1–13.https://doi.org/10.1016/j.iheduc.2015.04.007

Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2024). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Assessment & Evaluation in Higher Education, 49(1), 1–14*.https://doi.org/10.1080/02602938.2023.2180890

Dergunova, Y., Aubakirova, R. Z., Yelmuratova, B. Z., Gulmira, T. M., Yuzikovna, P. N., & Antikeyeva, S. (2022). Artificial intelligence awareness levels of students. International Journal of Emerging Technologies in Learning, 17(18), 26–37. https://doi.org/10.3991/ijet.v17i18.32195

Dillenbourg, P. (1999). What do you mean by collaborative learning? In P. Dillenbourg (Ed.), Collaborative-learning: Cognitive and computational approaches (pp. 1–19). Elsevier.https://doi.org/10.1016/B978-008043073-4/50001-4

Dwivedi, Y. K., Kshetri, N., Hughes, L., et al. (2023). "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative AI for research. *International Journal of Information Management, 71,(10)26- 42*.https://doi.org/10.1016/j.ijinfomgt.2023.102642

El-Shara, I. A., Saeed, A. S., & Arouri, Y. M. (2025). University students' awareness and attitudes toward the use of artificial intelligence applications in learning. International Journal of Information and Education Technology, 15(3), 539–548. https://doi.org/10.18178/ijiet.2025.15.3.2264

Farhood, H., Nyden, M., Beheshti, A., & Muller, S. (2025). Artificial intelligence-based personalized learning in education: A systematic literature review. Discover Artificial Intelligence, 5, Article 331. https://doi.org/10.1007/s44163-025-00598

Hamzat, A. A., & Ansah, S. D. (2025). Artificial intelligence awareness and readiness among undergraduate students in Kwara State universities, Nigeria. Journal of Educational Management and Instruction, 5(2), 335–349. https://doi.org/10.22515/jemin.v5i2.11988

Hariyanto, H., Kristianingsih, F. X. D., & Maharani, R. (2025). Artificial intelligence in adaptive education: A systematic review of techniques for personalized learning. Discover Education, 4, Article 458. https://doi.org/10.1007/s44217-025-00908-6

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77(1), 81–112*.https://doi.org/10.3102/003465430298487.

Hesse, F., Care, E., Buder, J., Sassenberg, K., & Griffin, P. (2015). A framework for teaching and assessing complex problem-solving skills.https://doi.org/10.1007/978-3-319-13133-8

Hidayat, M., & Anggreini, D. (2025). The effectiveness of artificial intelligence-based tutoring systems in personalized learning. *Education Studies and Teaching Journal (EDUTECH), 2(1), 512–529.*https://doi.org/10.62207/pdm6w811

Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial intelligence in education: Promises and implications for teaching and learning. Center for Curriculum Redesign.https://doi.org/10.13140/RG.2.2.26599.98728

Hyland, K. (2019). Second language writing (2nd ed.). Cambridge University Press.https://doi.org/10.1017/9781108635547

Ifenthaler, D., & Yau, J. Y. K. (2020). Utilizing learning analytics for study success. Educational Technology Research and Development, 68(1), 1–18.https://doi.org/10.1007/s11423-020-09788-y

Jonassen, D. H. (2011). Learning to solve problems: A handbook for designing problem-solving learning environments (2nd ed.). https://doi.org/10.4324/9780203852160

Kanipriyan, K. (2025). Awareness and perception of the use of artificial intelligence for learning among social science research scholars. Vidya: A Journal of Gujarat University. https://doi.org/10.47413/6s4kk139

Kasneci, E., Sessler, K., Küchemann, S., et al. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. Learning and Individual Differences, 103, 102274.https://doi.org/10.1016/j.lindif.2023.102274

Khosravi, H., Kitto, K., & Knight, S. (2019). Personalized learning analytics. Journal of Learning Analytics, 6(3), 1–15.https://doi.org/10.18608/jla.2019.63.1

Khosravi, H., Kitto, K., & Knight, S. (2019). Personalized learning analytics. Journal of Learning Analytics, 6(3), 1–15.https://doi.org/10.18608/jla.2019.63.1

Li, Z., Diao, Y., & Li, H. (2023). Artificial intelligence in academic writing: A tool for enhancing student performance. Education and Information Technologies, 28(10), 13045–13062.https://doi.org/10.1007/s10639-023-11787-2

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An argument for AI in education. Pearson Education.https://doi.org/10.13140/RG.2.2.27274.49605

Naayini, P. (2025). AI and the future of education: Advancing personalized learning and intelligent tutoring systems. *Frontiers in Educational Innovation and Research, 1(1), 29–39*. https://doi.org/10.62762/FEIR.2025.332098

Nwodu, G. E. (2025). Awareness and perception of the use of artificial intelligence for learning among select communication undergraduates in Nigeria. African Journal of Social Sciences and Humanities Research, 8(1), 113–130. https://doi.org/10.52589/AJSSHR-QKE2A0EG

Ofem, U., Arikpo, A. M., Ovat, S. V., & Nwogwugwu, C. E. (2024). Artificial intelligence in academic research: A multi-group analysis of students' awareness and perceptions. Journal of Applied Learning & Teaching, 7(1). https://doi.org/10.37074/jalt.2024.7.1.9

Onyebuchi, N. C., Ayeni, B. O., Al Hamad, N. M., Osawaru, B., & Adewusi, O. E. (2024). AI in education: A review of personalized learning and educational technology. *GSC Advanced Research and Reviews, 18(2), 261–271*. https://doi.org/10.30574/gscarr.2024.18.2.0062

Park, C. (2022). Academic integrity and plagiarism: The role of AI in higher education. *Journal of Academic Ethics, 20(2), 123–139*.https://doi.org/10.1007/s10805-021-09410-4

Pawar, P., Chodnekar, G. M., & Agarwal, T. (2025). Artificial intelligence in academia: An empirical study of usage and student perceptions. International Journal for Research in Applied Science and Engineering Technology. https://doi.org/10.22214/ijraset.2025.76355

Pellegrino, J. W., & Hilton, M. L. (2012). Education for life and work: Developing transferable knowledge and skills in the 21st century. National Academies Press.https://doi.org/10.17226/13398

Peng, J., & Li, Y. (2025). Frontiers of artificial intelligence for personalized learning in higher education*: A systematic review of leading articles. Applied Sciences, 15(18),31-45*10096. https://doi.org/10.3390/app151810096

Savery, J. R. (2015). Overview of problem-based learning: Definitions and distinctions. Interdisciplinary Journal of Problem-Based Learning, 1(1), 9–20.https://doi.org/10.7771/1541-5015.1002.

Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting self-regulation in science education. Research in Science Education, 36(1–2), 111–139.https://doi.org/10.1007/s11165-005-3917-8

Shute, V. J., & Rahimi, S. (2021). Review of computer-based assessment for learning. Educational Measurement: Issues and Practice, 40(1), 5–24.https://doi.org/10.1111/emip.12374

Trilling, B., & Fadel, C. (2009). 21st century skills: Learning for life in our times. Jossey-Bass.https://doi.org/10.1002/pfi.20111

Tyagi, N. (2025). AI in education: Personalized learning through intelligent tutors. *International Journal of Advanced Research in Computer Science and Technology, 8(2),*12-21. https://doi.org/10.15662/IJARCST.2025.0802003

Yarlagadda, K. C. (2025). AI in education: Personalized learning and intelligent tutoring systems. *European Journal of Computer Science and Information Technology, 13(32), 15–27*. https://doi.org/10.37745/ejcsit.2013/vol13n321527

Zhang, J., Yang, S., & Yazid, Z. (2026). AI awareness and career education in Chinese higher education: Serial mediation effects on self-efficacy and employability. British Journal of Guidance & Counselling. https://doi.org/10.1080/03069885.2026.2622429

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. Theory Into Practice, 41(2), 64–70.https://doi.org/10.1207/s15430421tip4102_2