

EQUIPPING PRE-SERVICE TEACHERS FOR AI-BASED CLASSROOMS IN NIGERIA

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Article History	Abstract
Original Research Article	<p><i>This paper aims to explore the preparation of pre-service teachers for AI-integrated classrooms in Nigeria. It investigates the notion of Pre-Service Teacher, the definition of Artificial Intelligence, the emergence of AI in Nigerian Education, the Visual Era, AI-Enhanced Classrooms, Essential Elements of an AI-Enhanced Classroom, the Educational Adaptation of AI-Enhanced Classrooms for Future Careers, Implementing AI in Teaching and Learning, Critical Areas to Address for Preparing Pre-Service Teachers for AI-Enhanced Classrooms in Nigeria, and the Challenges Faced in Equipping Pre-Service Teachers for AI-Enhanced Classrooms in Nigeria. The paper concludes that the incorporation of Artificial Intelligence (AI) into education is not merely a concept for the future but a current reality, especially within the framework of inclusive classrooms. This research, employing the Unified Theory of Acceptance and Use of Technology (UTAUT) model, has yielded significant insights into the behavioral intentions of Nigerian pre-service teachers concerning the adoption and application of AI tools for educational engagement in inclusive environments. In light of this conclusion, the paper suggests the following recommendations: Investing in technological infrastructure: Ensuring reliable internet connectivity, suitable hardware (computers, tablets), and necessary software licenses in teacher training institutions and future classrooms, as well as developing accessible AI tools: Making certain that AI tools are created with accessibility features to accommodate various learning needs and abilities</i></p> <p>Keywords: Pre-Service Teachers, Artificial Intelligence and AI-Based Classrooms.</p>
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Introduction

Artificial intelligence (AI) is rapidly emerging as a vital component in education, transforming the methods utilized by educators and the competencies required for successful job performance. Recent research indicates that by the academic years 2024-2025, approximately 60% of teachers will routinely incorporate AI tools into their classrooms. These tools assist educators in saving time by optimizing tasks such as lesson planning, grading, and organizing class activities. Furthermore, they improve student engagement in the learning process (Malek Ash et al., 2025). In addition to the aforementioned benefits, AI fosters more personalized learning experiences, automates assessments, and equips teachers with current information regarding student progress (Cukurova et al., 2023).

The swift advancement and extensive adoption of artificial intelligence (AI) technology in the 21st century have resulted in unparalleled changes in both personal and professional dimensions of life. AI is increasingly woven into everyday activities, altering how individuals engage with their surroundings (Dai, et al, 2020). Artificial intelligence (AI) is transforming education by offering innovative solutions that enhance both teaching and learning experiences. AI technologies possess the capability to tackle a range of educational challenges, including personalized instruction, effective assessment, and enhanced accessibility. For teachers and educators in Nigeria, comprehending and embracing these AI applications is essential for modernizing the educational

system and equipping future generations for a technology-driven world (Muhammad, 2025).

As stated by Udosen (2012) in the work of Elujekwute (2022), a teacher is characterized as a person who facilitates learning by motivating a learner or sparking their interest in education. He further emphasizes that a teacher has a significant responsibility in ensuring that the learner acquires the necessary skills, absorbs essential information, cultivates appropriate habits, embraces concepts, and maintains ethical standards. In contrast, a pre-service teacher (PST) is defined as an individual undergoing training to become a certified educator but has not yet taken on a teaching role in their own classroom (Li & Guo, 2024).

Soon, pre-service teachers will be in charge of training students who will work in a field where knowing how to use AI is very important. So, it's very important for new instructors to know how to use AI technologies to make lesson plans that are both novel and useful, to customize and diversify education to match the needs of different students, and to make administrative jobs easier and more efficient. When new teachers are sure of their AI skills, they can better show pupils how to use AI responsibly and get them ready for jobs in the future. There is some guidance on how to make the most of AI in education and reduce the risks (Miao & Holmes, 2023), but many teachers still don't know enough about AI tools and what they mean for their students to use them in their lessons or to teach them how to use AI (Ng et al., 2023). If students do not become AI literate, they may be left behind in the rapidly changing digital world (Casal-Otero et al., 2023).

This issue holds particular importance for pre-service teachers, who are required to develop a comprehensive understanding of artificial intelligence (AI), encompassing both its benefits and potential risks. They must also acquire the necessary digital skills to effectively incorporate AI into their future teaching methodologies while simultaneously enhancing their students' digital competencies (Casal-Otero et al., 2023; Chounta et al., 2022; Ng et al., 2023). Digital competence is considered a fundamental prerequisite for comprehending AI (Wang et al., 2023), and familiarity with AI is closely associated with attitudes towards it (Ayanwale, Frimpong, et al., 2024).

In Nigeria, pre-service teachers typically demonstrate a positive attitude towards the integration of AI in educational settings, viewing it as a beneficial tool to improve teaching and learning by making the process more engaging and interactive. However, despite this positive perspective, there are significant gaps in their preparedness, skills, and the essential infrastructure required for effective AI integration. Equipping pre-service teachers for AI-enhanced classrooms in Nigeria requires addressing several key issues, including: the definition of Pre-Service Teacher,

the definition of Artificial Intelligence, the emergence of AI in Nigerian Education, Key Areas to Address for Preparing Pre-Service Teachers for AI-Enhanced Classrooms in Nigeria, the Advantages of AI, and the Challenges of Preparing Pre-Service Teachers for AI-Enhanced Classrooms in Nigeria.

Concept of Pre-Service Teacher

A pre-service teacher (PST) is defined as an individual who is involved in the educational and training process aimed at achieving certification as a teacher, but has not yet taken on a teaching role in their own classroom (Li, & Guo, 2024). Amissah and Mereku (2002) describe Pre-Service Teacher education as a structured method for recruiting, preparing, assessing, certifying, and registering individuals who will function at appropriate levels within a nation's educational system as professionals tasked with facilitating the learning experiences and various socialization activities of students or learners.

Generally, pre-service teacher education programs include a combination of theoretical learning and practical training. Students typically enroll in these programs after obtaining a previous academic degree in a field of their choice, or they may choose a concurrent program that integrates education courses with their undergraduate studies (Van 2011). Key components of these programs include practicum placements, where pre-service teachers observe and teach in school settings under the guidance of experienced educators, as well as academic coursework that covers educational philosophy, theory, pedagogy, and current research (Allen, & Wright, 2014).

Concept of Artificial Intelligence

The notion of Artificial Intelligence (AI) was initially put forth by John McCarthy, who is often acknowledged as the progenitor of AI, in 1955 when he and his associates formulated a proposal for the 1956 Dartmouth Summer Research Project on Artificial Intelligence. In this document, they characterized AI as systems that "... employ language, generate abstractions and concepts, address challenges typically associated with human intelligence, and improve their own functionalities" (McCarthy et al., 2006). Since that period, AI has developed into a distinct field within computer science. Over the course of its evolution, research and progress in AI have diversified, with insights and debates arising from specialists across various fields, such as anthropology, biology, philosophy, psychology, and linguistics (Luckin et al., 2016). This variety of perspectives is one factor contributing to the difficulty in establishing a unified definition of AI, as different scholars have presented their own interpretations.

Typically, research in artificial intelligence centers on the development of intelligent machines (Nilsson, 2011), and as highlighted in various other definitions (Luckin et al., 2016), the concept of intelligence in this context relates to human intelligence. Essentially, AI technologies act as representations of human cognition and behavior. Consequently, within the realm of education, especially in the domain of language instruction and acquisition, AI can serve as a language teacher (Bailin, 1987; Matthews, 1993). Artificial intelligence, commonly referred to as AI, denotes technology that allows machines to learn and understand logic in a manner akin to humans. This technology is thought to aid in alleviating the intricacies of human existence (Fitria, 2021a). AI functions by amalgamating various data sources, engaging in iterative processing, and employing intelligent algorithms, which allows the software to autonomously learn from patterns or features present in the data. Moreover, AI can be described as a vast area of research.

The Advent of AI in Nigerian Education

The Visual Era: The use of technology and artificial intelligence (AI) into Nigeria's educational system signifies a profound shift in the country's methodology of instruction and learning. The advancement of educational technology in Nigeria began in the early 20th century, starting with the visual age (Ogbonnia, 2017). During this phase, basic teaching tools including charts, maps, and models are used, and lesson plans are made. The focus was on making teaching tools that didn't cost a lot of money, especially in Teacher Training Colleges. This basic step set the stage for the next step in Nigeria's educational technology development.

The Radio Media Era and Beyond: After the visual era, Nigeria moved into the radio media age in education from the early 1940s to the 1950s (Udomisor, 2013). This period saw the rise of communication media, starting with the opening of a Radio Receiving Station in Lagos in 1932. The radio media era made educational programming better and made it easier for people to get learning materials and tools. During this time, the main goal was to train teachers by using audio-visual materials to improve their teaching methods. Progress and Working Together: The gains gained during the radio media era set the stage for more improvement. The United Nations Educational Scientific Cultural Organization (UNESCO) funded projects at the Institutes of Education, University of Ibadan, in 1962 that were very important for the growth of EdTech (Ogwu et al., 2023). The creation of an audio-visual section at the Institute brought in new methods and techniques, making it possible to use programmed learning tactics. Computer science also became an important field in education, slowly changing the way schools work.

Robotics and AI: The increasing incorporation of robots and artificial intelligence (AI) into educational frameworks has markedly expedited the shift towards technology-enhanced learning settings. In Nigeria, this change has been shown by important projects that show how new technologies can help new ways of teaching. In 2015, for instance, a Nigerian student named Bobai Ephraim Kato made a robot that could solve hard tasks using artificial intelligence. This success showed how AI-powered tools may help students improve their analytical thinking, creativity, and advanced problem-solving skills. Further progress has been demonstrated through institutional initiatives, exemplified by the creation of remote laboratory facilities at Obafemi Awolowo University, which have broadened opportunities for practical experimentation and experiential learning beyond the limitations of traditional classroom environments. Even with these technological advances, the search for new ways to teach must still be based on fairness and inclusiveness. One of the biggest problems is making sure that students from different socioeconomic and geographic origins have equal access to technology-enabled learning materials. Integrating robotics and AI into Nigeria's schools is both an opportunity and a responsibility. It's an opportunity to go beyond the limits of traditional education and open up new ways to learn. It's also a responsibility to make sure that technological progress doesn't make existing inequalities worse (Cleopas, 2023). To find this balance, we need to carefully combine new technology with the human-centered parts of good education. Nigeria can build a modern education system that prepares students for the challenges and opportunities of a world that is becoming more digital by investing in digital infrastructure, improving the tech skills of teachers and students, and removing barriers to access.

AI Based Classrooms

The integration of Artificial Intelligence (AI) in educational environments is rapidly transforming teaching methodologies, offering both significant benefits and notable challenges. This shift necessitates a focus on three critical skills for both learners and educators: AI literacy, prompt engineering, and critical thinking. Proficiency in these skills is essential for adeptly and ethically navigating the evolving landscape of AI-enhanced education (Yang, & Chen, 2020.). The concept of an AI-integrated classroom is multifaceted, encompassing a variety of applications and technologies. Classrooms that incorporate Artificial Intelligence (AI) are characterized as environments augmented by AI technologies aimed at enhancing teaching, learning, and classroom management.

This integration aspires to improve multiple aspects of education by leveraging AI's capabilities in data analysis, personalization, and automation (Chen, Liang, & Liang.

2020). At its core, an AI-integrated classroom signifies an educational environment where artificial intelligence tools and systems are utilized to customize learning experiences, automate administrative tasks, provide intelligent tutoring, and offer data-driven insights to both students and educators. AI-integrated classrooms exhibit several unique characteristics that differentiate them from conventional educational settings. These features stem from the core functions of AI, which include the analysis of large volumes of student data, the delivery of personalized learning experiences, and the automation of repetitive tasks (Partridge & Piccoli. 2018).

Key Components of an AI-Based Classroom

According to Partridge & Piccoli. 2018), Yang, & Chen (2020) and Chen, Liang, & Liang (2020) an AI based classroom is characterised by

1. Customized Learning Experiences: Artificial Intelligence possesses the ability to evaluate student data, encompassing learning preferences, pace, strengths, and weaknesses, to formulate personalized learning pathways. This facilitates adaptive content delivery, individualized assignments, and tailored feedback, thereby moving away from a uniform approach.
2. Enhanced Tutoring Systems (ETS): AI-driven tutoring systems, known as Enhanced Tutoring Systems (ETS), are becoming more popular in schools around the world. They have shown promising results in helping students study better. These systems are great for personalized education because they give each student the help they need based on their own skills and shortcomings. This method aims to boost student engagement and retention by changing the information in real time to meet the needs of the learner (Anderson & Kerr, 2022).
3. Smart Tutoring Solutions: AI-based tutors are adept at delivering instant feedback, resolving inquiries, and guiding students through complex problems. These systems can replicate human-like interactions, rendering learning more engaging and accessible, particularly for students with varied educational needs or those in need of prompt assistance.
4. AI-Enhanced Evaluation and Feedback: More and more, artificial intelligence is being used to improve the way tests are given and to give both students and teachers quick, data-driven feedback. AI-based grading tools are often used around the world to grade multiple-choice examinations, give instant feedback, and even grade short-answer or essay submissions using natural language

processing (NLP) approaches (Deeva et al., 2021; Luckin et al., 2016). These systems promise more uniformity, less time spent grading, and useful information about how students are doing over time.

5. Development and Organization of Educational Content: Artificial Intelligence can support educators in the creation and structuring of educational resources, including the generation of quizzes, summaries, and comprehensive lesson plans. Tools such as Perplexity enhance knowledge retrieval by linking information to external sources, while platforms like HelloHistory.ai animate historical figures, providing engaging learning experiences. This capability allows educators to allocate more time to direct student interactions and to nurture pedagogical creativity.
6. Administrative and Evaluation Support: AI can streamline routine administrative functions, such as grading, attendance monitoring, and scheduling, thereby alleviating the workload for teachers. In terms of assessment, AI can evaluate student performance data to uncover trends, forecast learning outcomes, and offer insights for instructional modifications.
7. Enhanced Accessibility and Inclusivity: AI technologies can address the needs of students with special requirements by providing tailored resources, including text-to-speech, speech-to-text, and visual aids, thereby enhancing the accessibility and inclusivity of education. This approach can help remove obstacles to learning for students who may find traditional classroom environments challenging.

Benefits and Limitations of AI in Learning Environments

Artificial Intelligence offers considerable benefits in educational environments, including customized learning experiences, increased efficiency, prompt feedback, and targeted interventions. A comprehensive meta-review conducted in 2024, which analyzed 96 literature reviews, revealed that the most commonly cited advantages were personalized learning (16.7%), enhanced instructional quality (16.1%), and improved feedback and assessment systems (15%). Additionally, AI fosters higher levels of student engagement, critical thinking, and the ability to meet diverse learning needs (Chang et al., 2024).

The advancement of 21st-century talents is one of the most important effects of this technological integration. In today's environment, you need skills like critical thinking, problem-solving, communication, and digital literacy (Kitching, 2015). Classrooms that use technology are like incubators for developing these talents. Students are taught

to think critically as they use technology to solve real-world problems, look at several sources of information, and navigate complicated digital landscapes (Nelson, 2025).

Educational technology makes it easier for people to work together, which improves communication and teamwork. This is in line with how people work together in today's global workforce. The teacher's job has also changed to include being a facilitator and mentor. Teachers help students navigate the massive amount of information available to them by teaching them how to sort through large amounts of data and choose trustworthy sources (EdTechCop, 2025). They encourage curiosity, spark questions, and help people develop a growth mindset that sees problems as chances to learn. This change is in line with global trends in education that focus on student-centered learning and teaching students skills that will help them learn for the rest of their lives.

Also, using AI in education has helped teachers make learning more personalized for each student by letting them choose what they want to learn and how they want to learn it. AI-powered adaptive learning systems look at how well students are doing and suggest individualized content and tests. This technology-enabled customisation not only helps students learn better, but it also encourages them to take care of their own learning by setting objectives and keeping track of their progress.

Putting AI into Action in Teaching and Learning

According to Yang and Chen (2020) and Chen, Liang, and Liang (2020), the program AI for Tomorrow's Teachers utilizes engaging videos, interactive activities, and carefully curated content to navigate pre-service teachers through five distinct sections:

1. **AI As We Understand It:** This section assists pre-service educators in understanding the complexities of AI usage, its significance, and its potential consequences for the future of students.
2. **AI Competencies:** This segment emphasizes prompt engineering, image generation, the detection of bias and misinformation, along with various strategies that pre-service educators can implement to utilize AI for their own educational growth.
3. **Educating with AI:** This section investigates how AI can improve lesson planning, activity creation, and assessment design.
4. **Ethical AI Utilization:** This part aids in understanding copyright regulations, safeguarding student data, and applying ethical principles in AI applications.
5. **Instruction on AI:** This section provides strategies for employing AI to teach digital citizenship and

critical thinking, highlighting active, relationship-centered applications of AI in educational environments.

Key areas to address for equipping pre-service teachers for AI-based classrooms

According to Partridge & Piccoli (2018), Yang & Chen (2020), and Chen, Liang, & Liang (2020), the primary areas that need to be addressed to prepare pre-service teachers for AI-based classrooms in Nigeria include:

1. **Curriculum Reform and Training:** The current teacher training programs in Nigeria often do not adequately prepare pre-service teachers for the digital challenges of the 21st century. There is an urgent need to revise these programs to include mandatory courses on digital literacy, artificial intelligence skills, programming, and the effective use of emerging technologies in educational contexts. This should involve practical training in designing AI-enhanced learning experiences, adapting AI resources, and employing AI tools for instruction, assessment, and collaboration.
2. **Infrastructure Development:** A major barrier to the integration of AI in Nigerian educational institutions is the insufficient technological infrastructure. This includes limited access to high-speed internet, AI-capable devices, and a reliable electricity supply. Investment in these areas is crucial to provide pre-service teachers with the necessary tools and environments to effectively practice and integrate AI.
3. **Building Confidence and Reducing Anxiety:** While pre-service teachers may have a positive attitude towards AI, a lack of confidence in their ability to use these tools and anxiety about the unknown can hinder adoption. Teacher education programs should focus on building confidence through experiential learning, practical training, and supportive educational environments. Addressing concerns about technological skills and the potential impact of AI on traditional teaching roles can help alleviate anxiety.
4. **Cultivating Positive Attitudes and Social Impact:** The conviction that AI can greatly improve teaching efficacy acts as a strong incentive. Educational leaders and policymakers need to effectively convey the benefits of AI in inclusive education and demonstrate its practical applications. Creating a nurturing social environment where the integration of AI is encouraged and modeled by experienced educators can also positively influence the intentions of pre-service teachers.

5. Promoting Ethical Understanding and AI Competence: It is crucial for pre-service teachers to have a comprehensive understanding of the ethical implications related to AI, including issues such as bias, data privacy, and responsible use. This includes education on AI literacy, which involves understanding how AI operates, its possibilities, and its limitations.

Challenges of equipping pre-service teachers for AI-based classrooms in Nigeria,

The integration of technology and artificial intelligence (AI) into Nigeria's educational framework presents a variety of ethical challenges and potential barriers that necessitate comprehensive analysis. Critical concerns such as privacy, data security, digital literacy, and cultural impacts arise as prominent issues.

1. Concerns about ethics and data privacy Using AI in schools means collecting and analyzing a lot of student data, which raises questions about privacy, security, and informed consent. In Nigeria, these problems are made worse by the fact that data privacy rules are not followed or enforced well. Even though the Nigeria Data Protection Regulation (NDPR) was put into effect in 2019, it is still not being used enough in schools (National Information Technology Development Agency NITDA, 2019).
2. Insufficient Infrastructure and Digital Disparity For AI to work well in schools, Nigeria has to have reliable internet connectivity, electricity, and digital devices and resources. These things are not equally available across the country. The Nigerian Communications Commission (2023) says that only roughly 45% of the population has access to broadband internet. The areas that need it the most are rural and underserved areas. This digital inequality continues to slow down the rollout of cloud-based AI systems and online learning platforms, which only makes the gaps in education worse.
3. Teacher Readiness and Resistance One big problem with using AI in Nigerian schools is that teachers aren't ready for it yet. Many teachers don't have the technical abilities or teaching experience they need to use AI tools in the classroom effectively. Omodan and Ige (2021) found that most teachers don't know how to use AI well for teaching and testing, even though they know it may help students learn better.
4. Cost and Sustainability: The significant costs related to the acquisition, implementation, and maintenance of AI technologies present a

substantial challenge, particularly for public educational institutions and economically disadvantaged communities in Nigeria. Although international organizations such as UNICEF and UNESCO have supported certain AI-based educational initiatives in Nigeria, their capacity for growth is constrained by insufficient governmental backing and collaboration from the private sector (UNESCO, 2022).

Conclusion and Recommendations

The incorporation of Artificial Intelligence (AI) into education has transitioned from a theoretical notion to a concrete reality, especially in inclusive classroom environments. This research, employing the Unified Theory of Acceptance and Use of Technology (UTAUT) framework, has yielded significant insights into the behavioral intentions of Nigerian pre-service teachers concerning the adoption and utilization of AI tools for educational engagement in inclusive settings. The results show how several factors affect this adoption in a complicated way. They show both things that help and things that get in the way that must be dealt with to get future teachers ready for AI-enhanced learning environments. The study determined that effort expectancy positively and directly affects pre-service teachers' intention to utilize AI for inclusive education, but performance expectancy, social influence, and facilitating environments now have a negative yet direct effect. While technical self-efficacy does not directly alter behavioral intention, it significantly and positively mediates the effects of performance anticipation and social influence. This thorough understanding is necessary for creating specific plans to attract people to use AI.

Based on the above conclusion, the paper recommends the following:

1. Investing in technological infrastructure: Guaranteeing reliable internet access, appropriate hardware (including computers and tablets), and essential software licenses within teacher training institutions and future classrooms
2. Developing accessible AI tools: Ensuring that AI tools are designed with accessibility features to meet a diverse range of learning needs and abilities.
3. Providing ongoing technical support: Offering readily available technical assistance and troubleshooting for pre-service teachers as they integrate AI into their teaching practices.
4. Structured and scaffolded training: Gradually introducing individuals to AI concepts and tools,

starting with basic functionalities and progressing to more complex applications.

5. Address AI Anxiety and Promote AI Readiness: Research on pre-service teachers' experiences with AI learning suggests that anxiety related to AI negatively impacts engagement, while a readiness to engage with AI fosters positive outcomes.

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