# APPLICATION OF AI IN TEACHING AND LEARNING VOCATIONAL AND TECHNICAL EDUCATION STUDENTS FOR NATIONAL DEVELOPMENT IN NIGERIA

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## Abstract

The integration of Artificial Intelligence (AI) in vocational and technical education (VTE) represents a transformative opportunity for Nigeria's educational landscape and national development agenda. This study examines the potential applications of AI technologies in teaching and learning within VTE institutions, with particular focus on their capacity to enhance student's skills acquisition, bridge the existing gap between educational outcomes and industry requirements, and contribute to sustainable national development. Through examination of global best practices and analysis of the Nigerian educational context, this study identifies significant benefits including enhanced learning outcomes, improved employability of graduates, and accelerated economic development through a more skilled workforce. The research context involves Nigeria Certificate in Education (NCE) students at Sa'adatu Rimi College of Education, Kumbotso, Kano, with a representative sample of 200 students providing insights into current technological readiness and future implementation possibilities. However, the study also acknowledges substantial challenges including infrastructure deficits, digital divide, funding constraints, and the need for comprehensive teacher training programs. The analysis concludes that strategic implementation of AI in VTE, supported by appropriate policy frameworks, infrastructure development, and stakeholder collaboration, can significantly advance Nigeria's educational goals, enhance human capital development and accelerate the country's transition toward a knowledge-based economy capable of competing in the global marketplace.

Key Words: Artificial Intelligence, Teaching, Learning, Education and National Development.

## Introduction

In the twenty-first century, Artificial Intelligence (AI) has emerged as a defining force of technological innovation, reshaping industries, economies and education worldwide. For Nigeria, a nation grappling with youth unemployment and underdeveloped technical capacity, integrating AI into Vocational and Technical Education (VTE) represents a crucial strategy for advancing human capital and national development (Adesina & Molloy, 2022). VTE, as defined by the National Policy on Education (FME, 2022), aims to equip learners with practical

skills and competencies necessary for productive participation in the workforce. Yet, despite policy emphasis, Nigeria's VTE sector continues to face significant limitations: outdated curricula, weak infrastructure, and inadequate teacher preparation that hinder its ability to produce industry-ready graduates (Ibrahim, 2020). Globally, nations such as Finland, Singapore, and South Korea have demonstrated that embedding AI in education can enhance learning personalization, improve assessment accuracy, and expand access to quality instruction (UNESCO, 2023).

Within the Nigerian context, the challenge is to harness AI's transformative capacity while addressing systemic issues that limit innovation. This study asserts that integrating AI in Nigeria's VTE is not merely a technological upgrade but a developmental necessity one that can bridge the gap between education and employment, promote economic diversification, and build a resilient knowledge-based society. Education remains the cornerstone of national development and vocational and technical education (VTE) serves as a key driver for workforce readiness, industrialization and innovation. With the rapid advancement of Artificial Intelligence (AI), educational systems worldwide are being transformed.

**Background to the Study**

The Nigerian national development plan (NDP) 2021-2025 is a multi-sectorial blueprint aimed at diversifying the economy. Building infrastructure, and fostering inclusive grow through robust educated workforce. It emphasizes technical and vocational education and training (TVET) as a corner stone for economic diversification job creation and poverty reduction by fostering practical skill acquisition. The National development plan focused on these aspect for better application of AI in vocational and technical education in Nigeria, thus, in areas like system reform, industry partnership, modernization, entrepreneurship, funding and teacher raining, hoping that these focus areas will improve the present status of VTE in the country.

The current state of teaching vocational and technical education (VTE) in relation to AI in Nigeria, is in an early fragmented and challenging transitional phase. While AI is recognized as a tool for curriculum enhancement and skill development it is integration into technical and vocational education and training (TVET) is hindered by poor digital infrastructure, limited instructors capacity and outdated curricula (Adesina & Molloy, 2022).

Artificial Intelligence refers to computer systems designed to perform tasks that typically require human intelligence, such as reasoning, learning and problem-solving. Globally, AI technologies are redefining instructional methods through adaptive learning systems, virtual labs, intelligent tutoring, and automated assessment. In Nigeria, a study conducted at Sa'adatu Rimi College of Education (2024) revealed that students possess moderate awareness but strong positive perceptions of AI's potential to enhance learning outcomes in vocational fields such as Business Education, Home Economics, Agricultural Education and Technical Education. However, the same study identified infrastructural barriers, limited institutional readiness, and insufficient policy frameworks for AI integration. Nationally, initiatives such as the Federal Ministry of Education's ICT-in-Education Policy (2019) and TETFund's Research and Innovation Framework (2023) encourage digital adoption but lack explicit AI strategies. Bridging this gap is vital for aligning Nigerian education with Sustainable Development Goal 4 (Quality Education) and Goal 9 (Industry, Innovation, and Infrastructure).

Vocational technical education VTE is a specialized form of education designed to provide student with practical skills, knowledge, and attitude necessary for employment in specific trades, occupations or industrial sectors. It focuses on "hands on" training and applied knowledge bridging the gap between classroom theory and workplace requirement.

The importance of VTE in Nigeria's socio-economic agenda cannot be overstated. According to the National Board for Technical Education (NBTE, 2022), VTE institutions are central to preparing the skilled workforce required for industrialization, technological advancement, and sustainable growth. However, systemic inefficiencies have constrained their potential impact. Traditional teaching approaches remain largely teacher-centered and fail to accommodate the diverse learning styles of students. Moreover, the lack of adequate funding and equipment has widened the skill gap between graduates and labor market requirements (Usman, 2022).

In Nigeria however, the integration of AI in VTE is still at a formative stage. This study takes the position that AI application in VTE can revolutionize teaching and learning processes, foster technological competence among students and accelerate Nigeria's drive toward economic diversification and digital transformation.

Objectives of the Study This study seeks to:

Study the potential application of Artificial Intelligence to enhancing teaching and learning processes in vocational and technical education.

Ascertain the benefits of AI application in teaching and learning of vocational and technical education for national development.

## LITERATURE REVIEW

The Nigerian national development plan (NDP) 2021-2025 is a multi-sectorial blueprint aimed at diversifying the economy. Building infrastructure and fostering inclusive grow through robust educated workforce. It emphasizes technical and vocational education and training (TVET) as a corner stone for economic diversification job creation and poverty reduction by fostering practical skill acquisition. The National development plan focused on these aspect for better application of AI in vocational and technical education in Nigeria, thus, in areas like system reform, industry partnership, modernization, entrepreneurship, funding and teacher raining, hoping that these focus areas will improve the present status of VTE in the country.

Key Focus Areas For Vocational and Technical Education (TVET):

System Reform: Rebuilding TVET as a mordent, industry-aligned system is a priority to meet the demands of a changing labour market

Industry Partnership: The plan focuses on enhancing collaboration between educational institutions and private industries to ensure curriculum relevance and practical skill acquisition.

Modernization and digitalization: It emphasizes infrastructure modernization, such as improved workshop equipment and integrating digital tools (ICT) in technical education.

Self-Reliance and Entrepreneurship: A major aim is to produce skilled personnel (craftsmen, technicians) who can create jobs thereby combating youth employment and reducing poverty.

Funding and Teacher Quality: The plan highlights the need to address low-quality teaching and improve funding for vocational schools to effectively train individuals in areas like agriculture, technology, and business.

### The State of Vocational and Technical Education in Nigeria

The current state of teaching vocational and technical education (VTE) in relation to AI in Nigeria, is in an early fragmented and challenging transitional phase. While AI is recognized as a tool for curriculum enhancement and skill development it is integration into technical and vocational education and training (TVET) is hindered by poor digital infrastructure, limited instructor's Capacity and outdated curricula .Technical education

in Nigeria is characterized by low, fragmented, adoption, struggling to bridge the gap between traditional instruction and industry demand. While interest is high, initiatives face significant barriers including poor digital infrastructure, lack of specialized trainers' outdated curricula, and limited funding. However, these are some key aspect hindering the VTET in Nigeria.

Slow adoption and infrastructure deficit: most VTE institutions are slow to adopt old, with many operating on outdated curricula and inadequate, non-functional, or non-existent digital infrastructure.

Digital divide and access: there is a pronouns gap access to old tools, particularly affecting rural areas and low income communities, with erratic electricity and internet connectivity hindering adoption.

Instructor's preparedness: there is a recognized shortage of educators with necessary pedagogical skills to teach or integrate all tools.

High potential vs. reality: while AI offers immense potential for personalizing learning, enhancing practical skills, optimizing curriculum, current implementation is fragmented, with little to know national standardization, Azizah, Hanafi, and Yusro (2025).

**How AI Application Improves Teaching of Vocational and Technical Education**

Artificial Intelligence (AI) has become one of the most transformative technologies in modern education, particularly in Vocational and Technical Education (VTE). Vocational and technical education focuses on practical skills, competency development, and workforce preparation. The integration of AI into teaching and learning processes has improved instructional delivery, personalized learning.

Assessment methods, and students' practical engagement. Researchers have emphasized that AI technologies such as intelligent tutoring systems, machine learning, virtual simulations, robotics, and generative AI tools are reshaping vocational education to meet the demands of Industry. Zawacki, et al. (2023).

According to Vocational Education scholars, AI supports adaptive and personalized learning in technical education. AI-powered learning systems can analyze students' strengths, weaknesses, and learning pace, thereby providing customized instructional materials and feedback. Rosyadi et al. (2023), observed that AI improves efficiency and effectiveness in vocational education by enabling personalized teaching approaches that suit learners' individual needs. This is particularly important in technical education where students possess varying levels of practical competence and learning abilities.

Another important contribution of AI in vocational and technical education is the use of intelligent tutoring systems and virtual simulations. AI-driven simulators provide learners with opportunities to practice technical tasks in safe and controlled virtual environments. These simulations are widely used in engineering, automobile technology, electrical installation, welding, and healthcare training. Azizah, Hanafi, and Yusro (2025) explained that AI-powered simulators improve students' practical understanding and enhance skill acquisition through repetitive and interactive practice. Virtual laboratories also reduce the cost of equipment maintenance and minimize risks associated with dangerous practical activities.

AI applications also enhance classroom instruction and teacher productivity. Generative AI tools such as ChatGPT assist teachers in lesson planning, preparation of instructional materials, question generation, grading, and providing feedback to students. These technologies reduce teachers' workload and allow instructors to focus more on practical demonstrations and learner support. Research on AI in education revealed that AI tools increase teaching efficiency and support educators in designing more engaging learning experiences.

Furthermore, AI improves students' engagement and motivation in vocational learning. Interactive AI systems, chatbots, and augmented learning platforms create learner-centered environments that encourage active

participation. Technical and vocational students are more motivated when learning involves real-life simulations, problem-solving activities, and interactive technologies. Studies have shown that AI-supported learning environments increase learners' confidence, attention, and participation in classroom and workshop activities.

In addition, AI contributes significantly to assessment and performance evaluation in vocational education. AI systems can monitor learners' progress, evaluate practical tasks, and provide immediate feedback. Predictive analytics help teachers identify struggling students and recommend intervention strategies early enough. Rajamanickam et al. (2026) noted that AI can analyze skills gaps and support competency-based assessment in technical and vocational training institutions. Such systems improve accuracy, fairness, and speed in evaluating students' performance.

AI also strengthens curriculum development and workforce preparation in vocational education. Modern industries require workers with digital, technical, and problem-solving skills. AI helps institutions align vocational curricula with labor market needs by analyzing industrial trends and identifying emerging skills. Through AI-driven data analysis, technical institutions can redesign courses to match the demands of Industry and the digital economy. This ensures that graduates are employable and technologically competent.

**Benefits for Application of AI in Teaching & Learning Vocational & Technical Education**

AI as a Catalyst for Improved Teaching and Learning Vocational & Technical Education Students for National Development.

AI can transform instructional delivery through intelligent tutoring systems, virtual simulations, and personalized learning experiences. Findings from the Sa'adatu Rimi College of Education study (2024) indicated that 89% of students agreed that AI could personalize learning, provide real-time feedback, and develop workplace-ready skills. Globally, UNESCO (2023) and OECD (2022) report that AI-driven learning tools enhance student engagement and reduce dropout rates by adapting content to individual learning needs. These benefits align with Nigeria's goal to produce competent, employable graduates in technical and vocational fields.

AI for Students and Workforce Development for National Growth

Vocational and technical education plays a pivotal role in developing skilled manpower for economic progress. Integrating AI prepares students for emerging careers in automation, robotics, digital fabrication, and smart manufacturing. Evidence shows that AI-based learning environments develop critical thinking, digital literacy, and problem-solving abilities essential for Nigeria's participation in the global knowledge economy. Thus, AI in VTE can support entrepreneurship, industrial innovation, and youth empowerment, contributing directly to Nigeria's Vision 2050 for inclusive economic growth.

Enhancing Student's Skills Acquisition through Adaptive Learning Systems

AI-powered adaptive learning platforms can tailor instruction to individual learner needs, addressing the limitations of one-size-fits-all pedagogy. Through data analytics and machine learning, these systems identify student strengths and weaknesses and adjust content delivery in real time (Zawacki-Richter et al., 2019). This personalized approach is especially valuable

in technical fields such as mechanical engineering, agriculture, and business education, where learners acquire diverse skill sets at different paces.

Promoting Student's Competency-Based Education through Intelligent Tutoring Systems

Intelligent Tutoring Systems (ITS) replicate the function of human tutors by providing real-time feedback, hints, and corrective guidance during practice sessions. In Nigerian technical institutions, where student-to-teacher ratios can exceed 60:1, ITS can supplement human instruction and ensure that learners

achieve mastery in practical competencies (Okolocha & Bako, 2020).

Bridging the Gap between Educational outcome and Industry Required Skills

AI enables data-driven curriculum alignment with labor market trends. Predictive analytics tools can monitor employment data and identify emerging skill demands in sectors such as renewable energy, ICT and manufacturing (World Economic Forum, 2023).

Strengthening Teacher Capacity and Instructional Efficiency

AI can assist educators by automating routine tasks such as grading and administrative scheduling, allowing instructors to focus on mentoring and innovation (Holmes et al., 2023).

Economic and Developmental Impact

AI integration in VTE contributes to broader economic objectives by increasing employability, productivity and innovation.

**Challenges:**

Despite these benefits, several challenges affect the integration of AI in vocational and technical education. Researchers identified issues such as inadequate infrastructure, lack of teacher training, high implementation costs, data privacy concerns, and overdependence on technology. Some institutions, especially in developing countries, struggle with poor internet connectivity and insufficient digital facilities needed for effective AI implementation. Ethical concerns regarding academic integrity and excessive reliance on AI tools have also been highlighted in recent studies. Also critics fear that AI may replace human teachers or widen educational inequality. However, studies by the World Bank (2022) and UNESCO (2023) show that AI functions as a supportive tool, not a replacement, by automating administrative tasks and freeing teachers for higher-level mentoring. Moreover, concerns about inequality and lack of policy integration on AI in Nigeria. Critics also argue that Nigeria's infrastructural deficits, low digital literacy and limited funding make AI integration premature (Mohammed & Hassan, 2020).

**Conclusion:**

In conclusion, literature has shown that AI applications significantly improve the teaching of vocational and technical education through personalized learning, intelligent tutoring systems, virtual simulations, automated assessment, curriculum enhancement, and increased learner engagement. AI prepares students with relevant practical and digital skills required in modern workplaces.

To express the opinion of the researchers, application of AI in teaching vocational technical education is at the introductory stage in Nigerian academic environment. There is a hope for good feature for the growth in application and appreciation of AI in vocational technical education in Nigeria. However, successful integration requires adequate infrastructure, teacher training, proper funding, and ethical guidelines to maximize the benefits of AI in vocational education.

The integration of Artificial Intelligence into Nigeria's vocational and technical education system represents a pivotal step toward achieving the country's vision of technological advancement, economic diversification and sustainable national development. By revolutionizing teaching and learning processes, AI can bridge the gap between academic training and industrial needs, empowering a new generation of skilled, adaptable and innovative workers. While infrastructural and ethical challenges persist, the potential benefits enhanced learning outcomes, influence entrepreneurs, improved employability and increased productivity underscore the urgency of action. To actualize this vision, Nigeria must adopt a multi-stakeholder approach that combines policy innovation,

institutional commitment and strategic investment. The transformation of VTE through AI is not an option it is an imperative for Nigeria's competitiveness in the digital age

**Recommendations:**

Based on the suggestions and findings on how AI applications improve the teaching of Vocational and Technical Education (VTE) in Nigeria, and to ensure effective application of AI in teaching and learning vocational and technical education for national development the following recommendations are made:

.Policy Integration: Policies should be developed by educational authorities to guide the ethical and responsible use of AI in teaching and learning activities. The Federal Ministry of Education and NUC should include AI competencies within the National Policy on Education and VTE curricula. Thus, through inclusive digital policies, government subsidies, and teacher training programs that ensure equitable access.

Capacity Building: Educational institutions should organize regular training and workshops for teachers on the effective use of AI applications in classroom instruction. Continuous professional development training for lecturers and instructors on AI-based pedagogy and digital literacy.

Infrastructure Development: Continuous maintenance and upgrading of technological facilities should be ensured to sustain effective AI integration in Vocational and Technical Education. Expand broadband internet, stable electricity and provision of smart classrooms in colleges of education.

4. Partnerships and Funding: Government should provide adequate funding for the integration of Artificial Intelligence (AI) tools in vocational and technical institutions to improve teaching and learning processes. Encourage collaboration between government, TETFund and private technology firms to develop AI-driven teaching tools.

5. AI Research and Innovation Centers: Researchers should conduct further studies on the long-term impact of AI applications on students' academic performance and employability in Vocational and Technical Education. Establish dedicated AI and robotics laboratories in VTE institutions to foster innovation and applied research.

Policies should be developed by educational authorities to guide the ethical and responsible use of AI in teaching and learning activities. Advocate and suggest for policies and institutional strategies that promote AI inclusion in teaching and learning VTE students as a means of achieving sustainable national development.

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