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The Role of AI in Transforming Teacher Education in Nigeria: Opportunities and Challenges

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Abstract:
This study looks at how artificial intelligence (AI) might change teacher education in Nigeria by boosting administrative effectiveness, improving assessment and classroom practices, strengthening professional development, and personalizing teacher learning. It maps opportunities (adaptive learning tools, automated feedback, content generation, data-driven decision-making) and challenges (digital infrastructure gaps, teacher readiness, ethical risks, policy and regulatory lacunae) based on policy documents, international guidance, and recent empirical studies. In order to generate practical suggestions for legislators, teacher educators, and development partners, the study employs a qualitative synthesis of secondary literature and policy analysis. Important suggestions include incorporating AI literacy into teacher preparation, testing professional development initiatives powered by AI, bolstering digital infrastructure and data governance, and implementing moral standards in line with national and UNESCO policies. The study concludes that AI can be a catalytic force in teacher education in Nigeria but only if investments align with capacity building, inclusivity, and robust governance.

Keywords: *artificial intelligence, educational technology, education sector, Nigeria, teacher education*

1. Introduction

Education is not an exception to how artificial intelligence (AI) is changing industries around the world. AI in teacher education promises to provide tools for automated assessment, scalable mentoring, personalized professional learning, and rich data that can guide curriculum and classroom instruction (Alkhatlan & Kalita, 2018). AI has both revolutionary promise and particular implementation obstacles for Nigeria, a nation

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with a sizable teaching workforce, notable regional heterogeneity in educational quality, and aspirational policy goals for enhancing learning results (Data Science Nigeria, 2021). International organizations and policy frameworks are emphasizing more and more that the use of AI in education should be governed by the values of ethics, transparency, and equity and should be used to augment human capabilities rather than replace them (GSMA, 2022). These priorities are established by UNESCO's work on AI and education, which promotes human-centered strategies that safeguard inclusivity while utilizing AI's potential (Nigerian Data Science, 2023).

Through strategy documents and initiatives by organizations like the National Information Technology Development Agency (NITDA) and the National Centre for Artificial Intelligence and Robotics (NCAIR), Nigeria has started to articulate its national ambitions for AI development and public-good applications, including education. AI-driven training and education systems are specifically listed as priority areas for investment and capacity building in the 2024 National AI Strategy (Usman et al. 2025).

This paper aims to respond to the following question: What specific opportunities does AI offer Nigerian teacher education, and what pedagogical, ethical, and structural obstacles need to be overcome to make those chances a reality? In order to offer suggestions for legislators, teacher-training programs, and donor organizations, the analysis of national policy papers, and recent empirical investigations of teacher preparedness and digital infrastructure synthesizes the body of current research.

2. Methodology

Using a qualitative, interpretive methodology, this study synthesizes recent empirical data, policy papers, and secondary literature that are pertinent to AI and teacher education in Nigeria.

- Document analysis: For specific references to AI, teacher development, and governance, important policy papers (such as Nigeria's National AI Strategy), international guidelines like UNESCO reports, and national education policies (such as the National Policy on Education's provisions for teacher training) were analyzed.
- Literature review: To find recurrent possibilities and obstacles, peer-reviewed research, working papers, and practitioner reports on AI in education particularly those pertaining to sub-Saharan Africa or Nigeria were examined.
- Analytic framing: The results were arranged according to four domains: (a) teacher preparation and professional learning, (b) classroom practice and pedagogy, (c) data analytics and assessment, and (d) governance, ethics, and infrastructure.

2. Literature review

2.1. AI and teacher professional development: global findings

The impact of artificial intelligence (AI) on professional development and teacher education around the world is becoming more widely acknowledged. According to recent studies, AI-powered resources can support teachers' professional development by offering flexible, individualized, and ongoing chances to improve their skills. Alkhatlan and Kalita (2018) claim that AI applications like learning analytics, automated feedback engines, and intelligent tutoring systems have completely changed how teachers interact with pedagogy and content. A more adaptable and competency-based approach to professional development is promoted by these technologies, which make it possible for instructors to obtain specific abilities through modular learning using micro-credentialing systems.

AI technologies are being integrated by educational institutions worldwide to improve pedagogical innovation and instructor effectiveness. For instance, AI-powered analytics tools are used in Finland and Singapore, two nations renowned for having robust frameworks for teacher development, to pinpoint areas for pedagogical improvement,

instructional gaps, and learning patterns (Edinoh, 2024). Similar to this, AI-enabled virtual coaching systems in China and the US analyze classroom videos using computer vision and natural language processing to provide teachers with real-time formative feedback on student participation, engagement tactics, and instructional delivery (Zawacki-Richter et al., 2019). These programs broaden the scope of coaching and mentoring, particularly in situations where there is limited access to qualified mentors.

Furthermore, the literature highlights how AI and human expertise work hand in hand. While AI may effectively automate routine administrative and evaluative duties, such lesson preparation, grading, and data analysis, it cannot take the place of the reflective, ethical, and relational aspects of teaching, according to UNESCO (2025) and the OECD (2023). AI need to work as a "pedagogical amplifier" that strengthens educators' ability to make decisions and promotes research-based teaching methods. This is consistent with the Intelligence Augmentation (IA) approach developed by Luckin et al. (2016), which holds that technology should enhance human intellect rather than replace it.

Global equity in teacher preparation is another possible benefit of AI-enabled professional development. Teachers in rural or low-resource areas can receive the same level of support as their counterparts in urban or developed areas by using adaptive feedback systems and scalable virtual learning environments (Holmes et al., 2022; Eliza et al. 2024). National education policy and curriculum revisions can benefit from the use of AI for teacher analytics, such as finding common pedagogical issues across populations. To avoid bias and guarantee inclusivity, researchers warn that strong data governance, moral standards, and contextual localization are necessary for successful adoption (Williamson & Piattoeva, 2022).

2.2. AI in Africa and Nigeria: emerging evidence

In Africa, and especially in Nigeria, the incorporation of artificial intelligence (AI) into teacher education is a developing phenomena that exhibits both incredible promise and enduring structural constraints. According to current African studies, artificial intelligence (AI) is a key facilitator of educational change that can improve classroom management, teacher professional development, and pedagogical innovation (Adebayo, 2024; UNESCO, 2025). However, because of differences in access, digital literacy, and infrastructure development throughout the continent, this potential is not equally realized. EduTech Nigeria (2023) asserts that by providing real-time statistics and individualised learning experiences, these tools can promote continuous learning and speed up capacity building. However, the scalability and sustainability of such ideas have been hindered by infrastructural deficiencies, which range from limited internet connectivity and unstable electricity to insufficient access to digital devices. As a result, the use of AI in education is still mostly limited to private schools, urban areas, and donor-funded experimental initiatives, with public and rural schools still lagging far behind.

According to research from the African Union's Continental Education Strategy (CESA 2025), one of the biggest obstacles to integrating AI is instructors' varying levels of digital preparation. Although the importance of AI in education is becoming more widely recognized, a sizable percentage of Nigerian instructors lack the technical know-how and pedagogical confidence to use AI technologies successfully, according to the 2025 UNESCO Report on Nigerian instructors' Readiness for AI. The report also identifies institutional and generational divides: in contrast to older teachers and those working in under-resourced environments, who exhibit reluctance due to lack of exposure or fear of technological redundancy, younger educators especially those trained in ICT-integrated teacher colleges and urban universities are more likely to experiment with AI applications for lesson planning, assessment, and resource creation. The inclusion of AI competencies in teacher education programs is promoted by initiatives like the Nigeria AI Strategy Framework (2024) and the National Digital Learning Policy

(2023). To assist AI-driven instructional design, a number of universities are experimenting with digital pedagogical innovation centres, such as the Federal University of Technology, Owerri, Ahmadu Bello University, Zaria, and the University of Ibadan. Regional partnerships, like the African Centre for AI in Education (ACAIED), support indigenous AI research, policy discussions, and capacity building throughout West African teacher training ecosystems (Afolabi & Musa, 2024).

However, the research continuously highlights the necessity of ethical supervision and contextual adaptability. Researchers like Adeoye (2023) and Owusu (2024) warn that AI technologies created in Western or Asian contexts could not be compatible with sociocultural reality, linguistic variety, or local curriculum requirements. There is still a chance of "technological colonialism," in which imported AI systems strengthen dependency rather than empowerment, if localized datasets, collaborative design, and culturally sensitive teaching are not used. Therefore, in addition to technical investment, a conscious approach to indigenize innovation, encourage teacher agency, and link technology with national development aspirations is needed to integrate AI into teacher education in Nigeria.

2.3. Policy and ethical frameworks

A strong ethical and policy framework is required for the integration of artificial intelligence (AI) into education, especially in teacher development, to guarantee that technology advancements are consistent with social justice, human values, and educational integrity. The core principles of human-centered design, equity, transparency, and accountability are highlighted in UNESCO's worldwide recommendations on AI in education (UNESCO, 2025). These frameworks support AI systems that uphold privacy, steer clear of bias, and support educators' professional agency rather than diminish it. Crucially, UNESCO emphasizes that in order for educators and decision-makers to comprehend, assess, and use AI tools in educational settings in an ethical manner, they need ongoing capacity-building initiatives. This aligns with the broader worldwide trend toward AI literacy not only for learners but also for educators as ethical mediators of digital transformation.

Several African governments are starting to formulate strategic responses to the increasing impact of artificial intelligence in education at the continental and state levels. In this sense, Nigeria's National Artificial Intelligence Strategy (2024) is a historic endeavour. The strategy outlines plans for digital infrastructure, AI literacy programs, and experimental AI projects in educational settings, citing education and AI-driven training systems as a key pillar for national development (Adams, 2025). Additionally, it highlights localized datasets that represent Nigeria's linguistic and cultural variety as well as the growth of indigenous AI expertise. Despite the strategy's broad breadth, there has been little implementation of it in actual teacher development programs. The majority of AI projects are still in the pilot or conceptual stage, according to Aboderin (2025), with little money, coordination, or monitoring systems to guarantee long-term systemic influence.

Beyond technological design, concerns of fairness, access, and autonomy are among the ethical aspects of AI in education. According to academics like Sefotho (2024) and Adewumi (2023), AI systems run the potential of escalating current disparities by favoring wealthy schools and teachers while excluding members of marginalized populations if intentional policy controls are not in place. In a similar vein, worries about algorithmic bias, data privacy, and the commercialization of educational data underscore how urgently open governance and public accountability are needed. Despite their evolution, Nigeria's present data protection rules are still not adequately suited to the educational sector, which could lead to vulnerabilities in the way that teacher and student data is gathered, maintained, and examined (Obi & Daramola, 2024).

Additionally, integrating AI ethically necessitates balancing local norms, such as cultural and religious ethics, with scientific

advances. Policy design needs to be inclusive in a pluralistic culture like Nigeria, taking into account community involvement in decision-making and societal norms. According to Afolabi (2024), incorporating ethical AI literacy into teacher education programs could develop teachers who are critical assessors of the social and moral ramifications of AI technologies rather than just users. This would ensure that AI continues to be a tool for human flourishing rather than a replacement for it by bolstering teachers' professional ethics, digital citizenship, and reflective pedagogy.

2.4. Barriers identified in the literature

The literature continuously identifies a number of interconnected structural, institutional, and ethical barriers that impede effective implementation in sub-Saharan Africa, and especially in Nigeria, despite the growing enthusiasm for Artificial Intelligence (AI) in transforming education and teacher professional development. According to UNESCO (2025), EduTech Nigeria (2023), and a number of local empirical studies (Aboderin, 2025; Adewumi, 2023), these difficulties show that implementing technology innovation in education requires contextual preparation, equitable access, and systemic change in addition to adoption. The common barriers include:

2.4.1. Infrastructure gaps

One of the biggest obstacles to the use of AI in education is a lack of infrastructure. Numerous teacher training colleges in Nigeria and Africa still function in settings with unstable electrical supplies, spotty broadband connectivity, and restricted access to electronic devices. The adoption of AI-driven tools that rely on reliable internet access and a steady power source is severely hampered by these infrastructure flaws. Inequality in digital infrastructure continues to be a major contributing cause to the widening educational gap between urban and rural areas, as the World Bank (2024) has noted. AI's transformational potential in teacher education will remain limited to a tiny percentage of well-resourced schools and universities in the absence of intentional governmental reforms and consistent investment in technology infrastructure.

2.4.2. Teacher preparedness

Another significant obstacle is teacher readiness and digital competency. According to empirical data, a large number of Nigerian educators lack the practical training, AI literacy, and self-assurance necessary to interact with emerging technologies (UNESCO, 2025). Opportunities for in-service training that are especially centred on AI pedagogical tools are either scarce, infrequent, or restricted to projects supported by donors. Because they see AI as a threat to their job security rather than as a tool for professional development, educators frequently approach it with skepticism or concern. According to Afolabi and Musa (2024), digital pedagogy, AI ethics, and practical exposure to technology innovation must all be specifically covered in teacher education curriculum for AI integration to be successful. Professional development programs should, therefore, focus continual capacity building, reflective teaching, and collaborative learning within digital ecosystems.

2.4.3. Governance and data protection

The situation is made more difficult by issues with data privacy and governance. Nigeria's cyber security, AI ethics, and data privacy legislative frameworks are still in their infancy and frequently lack explicit enforcement mechanisms in the country's educational system (Obi & Daramola, 2024). Teachers and students are at risk from surveillance, algorithmic prejudice, and data breaches when there are weak regulations controlling the gathering, storing, and use of educational data. Additionally, governance fragmentation slows implementation and produces policy incoherence when duties for educational technology are divided among several ministries and organizations. Researchers like Williamson and Piattoeva (2022) warn that the application of AI in education could unintentionally strengthen administrative control rather than pedagogical

empowerment in the absence of transparent governance mechanisms.

2.4.4. Equity risks

Finally, there is a widespread concern about the hazards associated with equity and inclusion. Existing disparities in teacher preparation and educational quality could be made worse by the digital divide between public and private institutions as well as between rural and urban locations. According to Edinoh (2024), AI advancements typically thrive in settings with sufficient resources, leaving underprivileged communities behind and widening socioeconomic gaps. The deployment of AI without accompanying equality procedures could lead to a new kind of "technological elitism" in Nigeria, where rural schools frequently lack even the most basic ICT infrastructure. Targeted initiatives are needed to address this, including inclusive infrastructure planning, subsidized internet access for public institutions, and gender-sensitive digital policies that guarantee female instructors are not excluded from technological empowerment.

3. Discussion

3.1. Synthesizing evidence for Nigeria

One key finding unites the literature and policy documents: while AI can enhance teacher education, it cannot replace strong pedagogical institutions and human mentoring. The most promising near-term applications in Nigeria include those that provide AI-assisted content localization, automated formative feedback that frees mentors to concentrate on pedagogical coaching, and adaptive CPD platforms for human teachers and trainers.

However, concomitant investments in infrastructure, teacher digital and AI literacy, and governance procedures that safeguard data and maintain openness will be necessary to achieve equal impact. The 2024 National AI Strategy lays the groundwork by recognizing education as a strategic AI area. However, putting that strategy into practice calls for funding, pilot projects, and institutional agreements that connect AI projects with professional councils, teacher colleges, and education ministries.

A realistic path forward involves phased, evidence-driven pilots focused on priority areas (e.g., primary mathematics pedagogy, early-grade reading) combined with national capacity building for teacher educators in AI pedagogy and ethics.

3.2. Opportunities

Nigerian teacher education could undergo a major transformation due to artificial intelligence (AI), which could solve persistent problems with equity, accessibility, and quality. AI-driven innovations present revolutionary opportunities as Nigeria continues to face issues like poor teacher training, uneven pedagogical quality, and a lack of professional support in rural areas (Eke, 2024). While being acquainted of the distinct socioeconomic realities of the Nigerian educational system, these prospects are in line with worldwide trends in educational technology. Key areas where AI can transform teacher education for national growth are outlined in the following subsections.

3.2.1. Personalized professional learning

In order to provide individualized learning routes, AI-based systems can analyze the abilities, learning histories, and instructional needs of individual teachers. These systems can recognize certain pedagogical gaps using machine learning algorithms, modify content accordingly, and provide micro-courses, modular training, or simulations that are customized for each teacher's situation (Fitria, 2021). Self-paced, need-based professional development is encouraged by this adaptable paradigm, which is especially important in Nigeria, where urban and rural areas have quite different levels of teacher training.

An AI-powered professional learning platform, for example, may analyze a teacher's proficiency in assessment literacy and provide pertinent interactive lessons, films, or tests. The technology would change one-size-fits-all professional development into differentiated, data-driven learning by continuously assessing progress and improving its recommendations

(Muhammad, A.A., Ardo, Aliyu, Muhammad, I.A., & Jika, 2025).

This personalization helps sustain teacher motivation, fosters reflective practice, and ensures continuous competence enhancement aligned with the National Policy on Teacher Education.

3.2.2. Scalable virtual coaching and mentoring

There is frequently a lack of competent mentors and supervisors for teacher education programs in Nigeria, particularly in rural and underdeveloped areas. AI-driven virtual coaching solutions can close this gap by providing large-scale, real-time feedback and guidance. Instantaneous pedagogical feedback generation, lesson plan evaluation, and classroom recording analysis are all possible with intelligent tutoring systems and conversational agents like chatbots built into mobile learning apps (Musa & Abdulkadir, 2025).

An AI tool may evaluate a teacher candidate's usage of questioning tactics, classroom management strategies, and engagement levels, for instance, if the trainee uploaded a video of a class. The platform might then use a database of best practices to provide specific recommendations for enhancement. Even educators in remote areas can gain from professional input thanks to this virtual mentorship concept, which democratizes access to high-quality advice. Furthermore, AI can match mentors and mentees across institutions based on expertise and developmental needs, creating a collaborative professional network beyond geographical boundaries.

3.2.3. Automated assessment and formative feedback

The manual grading and feedback procedure is one of the biggest administrative headaches in teacher education. By automatically scoring objective exam items and analyzing written responses using rubric-based analytics, artificial intelligence (AI) technologies in particular, Natural Language Processing (NLP) and machine learning models can simplify assessment (Muhammad, Yakub, Mikail, & Ibrahim, 2025). In addition to cutting down on turnaround time, this improves evaluation fairness and uniformity.

These technologies allow teacher educators to concentrate more on mentoring and interpretation activities, like giving qualitative comments on classroom management and instructional philosophy. Furthermore, real-time tracking of teacher candidates' progress through AI-driven formative assessment tools allows for prompt interventions when learning challenges are identified (Muhammad, Yakub, Mikail, & Ibrahim, 2025). For example, if a trainee routinely does poorly in curriculum design modules, an AI dashboard may notify a supervisor so that focused support can be provided. Such data-informed feedback loops enhance the responsiveness and effectiveness of teacher preparation programs.

3.2.4. Data-driven curriculum design

Analytics driven by AI have the potential to revolutionize the development and ongoing enhancement of teacher education programs. Large datasets from teacher training platforms, including class performance, engagement metrics, and student outcomes, can be aggregated and analyzed by AI systems to determine which teaching strategies or subject areas have the greatest influence (Wilson et al. 2020). Policymakers and teacher education institutions can adapt curricula to meet changing societal demands and real-world classroom realities thanks to this body of evidence.

Curriculum review committees in Nigeria, where curriculum implementation frequently fails to match classroom issues, should be guided by data-driven insights to give priority to emerging abilities like digital pedagogy, inclusive education, and sustainable learning practices (Adam et al. 2025, Afifi et al., 2024). Additionally, decision-makers can assess alternative models prior to adoption by using AI technologies to simulate the results of suggested curriculum modifications. This process ensures that curriculum design becomes empirical, adaptive, and responsive to 21st-century teaching demands.

3.2.5. Content creation and localization

Contextualized learning materials are essential for effective teacher education in Nigeria because of the country's language variety and resource inequalities. Large language models and multimodal systems are examples of generative AI technologies that may automate the creation of lesson plans, teaching aids, and digital content that adhere to the curriculum standards set forth by the Nigerian Educational Research and Development Council (NERDC) (Edinoh, 2024).

AI can, for instance, translate instructional materials into regional tongues like Hausa, Yoruba, and Igbo or modify examples to better represent cultural realities that Nigerian students are accustomed to. These systems can also produce interactive simulations, visual aids, or locally relevant reading materials that can be used by both educators and students. AI greatly lowers expenses and time by automating content creation, increasing access to high-quality educational resources in both public and commercial institutions. The result is an inclusive and culturally relevant teacher education ecosystem that supports national goals of equitable education and sustainable human development.

All of these possibilities point to AI as a potential game-changer for Nigeria's teacher training program. AI has the potential to improve teacher professional development in terms of both quality and reach through data analytics, automated assessment, scalable mentorship, personalization, and localized content production. But to take advantage of these chances, a purposeful framework that includes capacity building for teacher educators, infrastructure preparedness, and ethical oversight is needed. This makes AI more than just a technical advancement; it becomes a strategic ally in attaining SDG 4 quality education and bolstering Nigeria's educational future.

3.3. Challenges and risks

3.3.1. Infrastructure and access:

Many Nigerian schools, particularly those in rural regions, lack computing devices, dependable electricity, and broadband connectivity. The scope of AI-enabled teacher education is restricted by these infrastructure gaps, which also run the danger of making inequality worse.

3.3.2. Teacher capacity and readiness

Empirical research indicates varying degrees of teacher readiness. AI tools may be underutilized or abused in classrooms if teachers lack fundamental digital skills or AI literacy. To increase competence and confidence, professional growth approaches must be systematic.

3.3.3. Risks to ethics and education

AI models may provide false results (sometimes known as "hallucinations"), include biases from training data, or promote superficial automation of instructional duties. Algorithmic openness, teacher and student data privacy, and misuse prevention are ethical considerations. UNESCO cautions that in order to prevent harm, AI usage in education must be human-centered and regulated.

3.3.4. Policy and regulatory gaps

Nigeria's policy commitments, such as the National AI Strategy, are a good start, but their implementation calls for cooperation between three ministries: Education, ICT, and Power, as well as regulatory investments in areas like teacher credentialing, data protection, and procurement standards. Pilots may be halted or initiatives may become divided due to weak implementation capacity.

3.3.5. Equity and cultural relevance

AI systems created in other contexts could not be linguistically or culturally suitable for Nigerian classrooms if they are not purposefully designed. Private Edtech solutions run the risk of benefiting more affluent schools, which would increase

inequality (UNESCO, 2021; UNESCO, 2024; Adams, 2025).

3.4. Recomendations

Based on the synthesis above, the following recommendations are proposed:

3.4.1. National AI + teacher education roadmap

To incorporate AI into teacher education, the Federal Ministry of Education should create a roadmap that is in line with the National AI Strategy. This roadmap should include specific deadlines, sources of funding, and accountable organizations.

3.4.2. Integrate AI Literacy into pre-service and in-service training

Courses on educational AI tools, digital pedagogy, and data ethics should be part of teacher training programs at universities and schools of education. Provide in-service teachers with tiers of continuing professional development that include professional body-recognized micro-credentials.

3.4.3. Fund regionally representative pilots

To produce context-specific evidence, start pilots in both urban and rural areas that concentrate on certain pedagogical issues (such as formative assessment in reading and maths). Analyze cost-effectiveness, equitable effects, teacher adoption, and learning results.

3.4.4. Targeted infrastructure investments

Give teacher training facilities and school clusters priority when it comes to electricity and connectivity upgrades, and where practical, use low-bandwidth AI solutions.

3.4.5. Adopt ethical guidelines for AI in education

Include data protection and transparency standards in contracts for deployment and procurement, and adopt or modify UNESCO's human-centered AI guidelines for education.

3.4.6. Encourage local content creation

Offer funding to regional edtech companies and collaborate with academic institutions to create locally relevant learning materials and AI tools that are culturally appropriate.

4. Conclusion

Nigeria has the chance to modernize and expand teacher education with AI, which would improve professional learning's adaptability, timeliness, and reflection of classroom reality. However, AI runs the risk of becoming just another unequally distributed technology trend in the absence of intentional policy, infrastructure expenditures, and capacity building. Nigeria needs to take coordinated action across ministries, teacher education institutions, and development partners in order to fully benefit from AI. This activity should be informed by ethical principles and data from carefully planned pilots. When used properly, AI can enhance learning outcomes, support teachers' professional judgement, and advance the larger objective of inclusive, high-quality education in accordance with SDG 4.

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