



Integrating artificial intelligence into teacher education programme in Nigeria: opportunities, challenges and future directions

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ABSTRACT

The integration of Artificial Intelligence (AI) into teacher education programmes has emerged as a critical imperative for nations seeking to prepare their educational systems for the demands of the 21st century. This paper examines the landscape of AI integration in Nigerian teacher education, critically analysing the opportunities, challenges, and future directions that characterise this complex endeavour. Drawing on a comprehensive review of literature, policy documents and recent implementation reports to conceptualise the competencies and conditions necessary for effective AI integration. The findings reveal that while Nigeria has demonstrated policy-level commitment to digital transformation through initiatives such as the National Centre for Artificial Intelligence and Robotics (NCAIR), the Experience AI programme, and the National Commission for Colleges of Education's revised Minimum Standards, actual integration remains nascent and uneven across institutions. Significant opportunities exist for AI to enhance pedagogical practice through personalised and adaptive instruction, improve assessment and feedback processes, support professional development, address resource constraints, and potentially enhance educational equity. However, formidable challenges impede effective integration, including pervasive infrastructural deficits (unreliable electricity, unstable internet connectivity and inadequate computing facilities), limited AI literacy among teacher educators, chronic underfunding, policy implementation gaps, cultural resistance, and concerns about equity and inclusion. Ethical considerations surrounding data privacy, algorithmic bias, and academic integrity further complicate the integration landscape. The study concludes that Nigeria stands at a pivotal moment where strategic, context-sensitive implementation of AI could be transformative for teacher education, but realising this potential demands a balanced, evidence-informed, and ethically grounded approach. Recommendations are offered for policymakers, teacher education institutions, teacher educators, researchers, and international partners, addressing infrastructure development, professional development, curriculum integration, policy formulation, research generation, and partnership building. The paper argues that teacher education must be placed at the centre of Nigeria's AI strategy, as teachers are the primary agents of educational transformation, and their preparation ultimately determines the quality of the educational system and the nation's capacity to prepare its citizens for a technology-driven future.

1. Introduction

The 21st century has ushered in an era of unprecedented technological transformation, with Artificial Intelligence (AI) emerging as a defining force reshaping industries, economies, and societies worldwide. In the educational domain, AI has moved from a speculative concept to a tangible reality, fundamentally altering how knowledge is created, shared, and assessed (Holmes et al., 2019; Luckin et al., 2016). This global shift presents both a compelling opportunity and an urgent imperative for nations seeking to modernise their educational systems and prepare future generations for a technology-driven world.

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For Nigeria, Africa's most populous nation and largest economy, the integration of AI into education is not merely a matter of technological advancement but a strategic necessity for achieving sustainable development goals and securing a competitive position in the global digital economy (Akinwale, 2020; Okonkwo & Ade-Ibijola, 2021). The nation has begun to demonstrate commitment to this trajectory through various initiatives, including the establishment of the National Centre for Artificial Intelligence and Robotics (NCAIR) by the National Information Technology Development Agency (NITDA) (NITDA, 2020). Furthermore, programmes such as the Experience AI initiative, which in its first year equipped over 1,100 public secondary school educators across five south western states with foundational AI knowledge, signal a growing regional consensus that AI literacy is becoming indispensable in Nigerian public education (Raspberry Pi Foundation, 2023). These efforts are complemented by significant policy developments at the regulatory level, notably the National Commission for Colleges of Education's (NCCE) comprehensive review of the Nigeria Certificate in Education (NCE) Minimum Standards, which explicitly aims to integrate AI awareness, ethical technology use, data literacy, and adaptive digital pedagogy into the teacher preparation curriculum (NCCE, 2022).

Central to the success of any educational reform, however, is the quality and preparedness of its teachers. Teacher education programmes serve as the foundational bedrock of the educational system, shaping the competencies, pedagogical approaches, and professional dispositions of the educators who will, in turn, mould the nation's future workforce. If Nigeria is to emerge as a competitive player in the global AI economy, teachers must be placed at the heart of the national strategy, acting as the primary conduit for technological transformation within classrooms (UNESCO, 2021). Teacher training institutions are therefore uniquely positioned as the critical leverage point for embedding AI literacy across the educational spectrum. The effective integration of AI into these programmes can enhance lesson planning, personalise professional development, improve pedagogical efficiency, and equip future teachers with the skills to be effective facilitators of AI-enabled learning rather than mere consumers of technology (Celik et al., 2022; Zawacki-Richter et al., 2019).

Despite the transformative potential and emerging policy signals, the path to integrating AI into Nigerian teacher education is fraught with significant and multifaceted challenges. A persistent digital divide, characterised by inadequate infrastructure, unreliable electricity, and limited access to AI-enabled tools, particularly in rural and underserved areas, poses a fundamental barrier (Adepoju & Ogunleye, 2020; Oyediran et al., 2021). This is compounded by constrained funding, limited AI literacy among teacher educators themselves, and the absence of comprehensive policy frameworks to guide ethical implementation and ensure equitable access (Eze et al., 2022; Oyelere et al., 2020). Without deliberate, policy-backed strategies to address these systemic impediments, the potential benefits of AI risk being unevenly distributed, potentially exacerbating existing inequalities and creating a two-tiered educational system (Adewale & Ajayi, 2023).

This paper explores the complex landscape of integrating Artificial Intelligence into teacher education programmes in Nigeria. It examines the current state of AI adoption within these institutions, identifying the specific opportunities AI presents for revitalising teacher preparation while critically analysing the multifaceted challenges that impede its successful and ethical implementation. Drawing on current literature, policy documents, and recent implementation reports, the paper situates the Nigerian experience within the broader context of the fourth industrial revolution and sustainable national development (Ogbonna & Okafor, 2022; Schwab, 2017). Ultimately, it posits that Nigeria stands at a pivotal moment where strategic, context-sensitive implementation of AI could be transformative, but realising this potential demands a balanced approach that embraces AI's benefits while mitigating its risks, ensuring that AI serves as an enabler of educational quality, equity, and inclusion rather than a driver of further marginalisation (Adeyanju et al., 2023; Ifenthaler & Schumacher, 2022).

Conceptual Framework: Understanding AI in Education

Artificial Intelligence, broadly defined, refers to the simulation of human intelligence processes by computer systems, encompassing learning, reasoning, problem-solving, perception, and language understanding (Russell & Norvig, 2021). In the educational context, AI manifests through various applications including intelligent tutoring systems, adaptive learning platforms, automated assessment tools, learning analytics, and conversational agents (Holmes et al., 2019). The emergence of generative AI tools such as large language models has further expanded the possibilities for personalised learning, content creation, and pedagogical support (Baidoo-Anu & Ansah, 2023).

The integration of AI into education is underpinned by several theoretical frameworks. The Technology Acceptance Model (TAM), developed by Davis (1989), posits that perceived usefulness and perceived ease of use are primary determinants of technology adoption. This framework has been extensively applied in educational technology research, revealing that teacher educators' attitudes toward AI are significantly influenced by their perceptions of its utility and complexity (Scherer et al., 2019). Similarly, the Technological Pedagogical Content Knowledge (TPACK) framework, advanced by Koehler and Mishra (2009), provides a useful lens for understanding the knowledge domains teachers require to effectively integrate technology into their practice. For AI integration, this extends to AI-TPACK, which recognises the unique competencies needed to teach with, about, and through artificial intelligence (Ng et al., 2021).

Global Perspectives on AI in Teacher Education

Internationally, the integration of AI into teacher education has gained considerable momentum. In developed economies such as the United States, United Kingdom, and Australia, teacher preparation programmes have begun embedding AI literacy into their curricula, focusing on equipping pre-service teachers with competencies to utilise AI tools for lesson planning, differentiation, and assessment (Luckin et al., 2016; Southgate et al., 2019). UNESCO (2021) has articulated a comprehensive framework for AI competency development for teachers, emphasising the need for human-centred AI, ethical considerations, and the cultivation of critical thinking skills among educators.

Research from Europe and Asia demonstrates promising outcomes from AI integration. For instance, Celik et al. (2022), in a systematic review of AI in teacher education, identified that AI applications could significantly enhance reflective practice, provide immediate feedback on teaching performance, and facilitate personalised professional development pathways. In Finland, teacher training institutions have pioneered the use of AI-powered simulations to provide pre-service teachers with authentic classroom experiences, thereby bridging the gap between theory and practice (Niemi & Jahnke, 2023). Similarly, studies from Singapore have shown that AI-enabled analytics can help teacher educators identify patterns in student learning and adapt their instructional strategies accordingly (Teo et al., 2021).

However, global scholarship also highlights challenges that resonate with the Nigerian context. Zawacki-Richter et al. (2019) conducted a comprehensive review of AI in higher education and identified key obstacles including ethical concerns, data privacy issues, algorithmic bias, and the potential for AI to exacerbate existing inequalities. Furthermore, scholars have cautioned against techno-deterministic approaches that prioritise technological solutions over pedagogical considerations, arguing that effective AI integration requires careful alignment with educational values and learning theories (Selwyn, 2019; Williamson & Eynon, 2020).

The Nigerian Educational Context: Opportunities and Imperatives

Nigeria's educational landscape is characterised by significant diversity, with over 250 ethnic groups, multiple languages, and considerable socioeconomic disparities across regions (Federal Ministry of Education, 2019). The country operates a 6-3-3-4 system, encompassing six years

of primary, three years of junior secondary, three years of senior secondary, and a minimum of four years of tertiary education. Teacher education is primarily delivered through Colleges of Education (offering the Nigeria Certificate in Education), Faculties of Education in universities (offering Bachelor's degrees), and Institutes of Education (Ogunleye & Ogunleye, 2020).

The imperative for AI integration in Nigerian teacher education stems from multiple converging factors. First, the country's rapidly growing youth population, projected to reach 400 million by 2050, demands innovative approaches to education that can scale quality and personalise learning experiences (National Population Commission, 2020). Second, the digital economy presents significant opportunities for Nigerian youth, with estimates suggesting that the technology sector could contribute substantially to GDP and employment if the workforce is adequately prepared with relevant digital skills (Akinwale, 2020). Third, the COVID-19 pandemic exposed the vulnerabilities of Nigeria's traditional educational delivery models, accelerating calls for digital transformation and technology-enhanced learning (Oyewole et al., 2020).

National policy frameworks have begun to acknowledge these imperatives. The National Digital Economy Policy and Strategy (2020-2030), developed by NITDA, recognises education as a priority sector for digital transformation and calls for the integration of emerging technologies into teaching and learning processes (NITDA, 2020). Additionally, the National Education Technology Policy (draft) emphasises the need to equip teachers with competencies to leverage technology for improved educational outcomes (Federal Ministry of Education, 2021). The NCCE's revised Minimum Standards for teacher education explicitly include technology integration and digital literacy as core competencies, signalling a policy-level commitment to preparing teachers for a technology-enabled future (NCCE, 2022).

Existing AI Initiatives in Nigerian Education

Despite infrastructural challenges, several notable AI initiatives have emerged within the Nigerian educational sphere. The Experience AI programme, a partnership between the Raspberry Pi Foundation and local organisations, has been particularly significant, training over 1,100 public secondary school teachers in AI concepts and applications across five southwestern states (Raspberry Pi Foundation, 2023). Programme evaluations indicate improvements in teacher confidence and knowledge, though sustainability and scalability remain concerns (Odugbesan et al., 2023).

Higher education institutions have also made strides. The University of Ibadan, Obafemi Awolowo University, and the University of Lagos have established research centres focusing on AI and educational technology, developing locally relevant AI applications for learning management and student support (Adebayo et al., 2022). Startups such as Tuteria and Edves have leveraged AI for personalised tutoring and school management, while initiatives like uLesson have incorporated AI-powered adaptive learning into their platforms (Okonkwo & Ade-Ibijola, 2021). The NCAIR, established in 2020, serves as a national hub for AI research and development, with a specific mandate to support educational applications of AI (NITDA, 2020).

However, these initiatives remain largely fragmented and concentrated in urban areas with better technological infrastructure. A study by Oyelere et al. (2020) found that only a minority of Nigerian teacher education institutions had integrated any form of AI into their curricula, with awareness and implementation concentrated among a few federal universities and colleges. This uneven distribution raises concerns about equity and the potential for a digital divide to create disparities in teacher preparation quality across institutions and regions.

Opportunities for AI Integration in Nigerian Teacher Education

The literature identifies several compelling opportunities for integrating AI into Nigerian teacher education programmes. Firstly, AI can significantly enhance pedagogical practices in teacher training institutions. Adaptive learning platforms powered by AI can personalise

instruction, tailoring content and pacing to individual learners' needs and thereby improving learning outcomes (Luckin et al., 2016). For pre-service teachers, this exposure to AI-enhanced learning environments serves a dual purpose: it improves their own learning and provides models for future classroom practice (Celik et al., 2022).

Secondly, AI offers substantial efficiencies in assessment and feedback processes. Automated grading systems, particularly for objective assessments, can reduce the administrative burden on teacher educators, freeing time for more meaningful instructional interactions (Zawacki-Richter et al., 2019). More sophisticated AI systems can provide detailed analytics on student performance, identifying patterns and areas requiring intervention that might escape human observation (Holmes et al., 2019).

Thirdly, AI can support professional development for both pre-service and in-service teachers. AI-powered coaching systems can provide personalised feedback on teaching practice, analysing video recordings of classroom interactions and offering evidence-based recommendations for improvement (Southgate et al., 2019). This is particularly valuable in the Nigerian context where large class sizes and limited supervisory capacity constrain traditional approaches to teacher development (Ogunleye & Ogunleye, 2020).

Fourthly, AI can help address resource constraints that characterise many Nigerian teacher education institutions. Generative AI tools can assist in creating instructional materials, including lesson plans, assessments, and multimedia content, thereby reducing the time and cost associated with curriculum development (Baidoo-Anu & Ansah, 2023). This capacity is especially relevant in specialised subject areas where qualified teacher educators may be scarce.

Finally, AI integration offers opportunities for enhancing educational equity. Mobile-based AI applications can extend educational opportunities to remote and underserved communities, where conventional teacher education programmes may have limited reach (Oyediran et al., 2021). AI-powered translation and accessibility features can support the inclusion of learners with diverse needs, aligning with Nigeria's commitments to inclusive education (UNESCO, 2021).

Challenges to AI Integration in Nigerian Teacher Education

Infrastructural Deficits

The most fundamental challenge to AI integration in Nigerian teacher education is the chronic infrastructural deficit. A substantial proportion of teacher education institutions, particularly those in rural areas, lack reliable electricity, stable internet connectivity, and adequate computing facilities (Adepoju & Ogunleye, 2020). Data from the National Bureau of Statistics (2022) indicate that only a minority of Colleges of Education have consistent access to broadband internet, with many relying on mobile data networks that are often slow and expensive. Without basic technological infrastructure, the deployment of AI-enabled educational applications remains impractical, regardless of policy aspirations or training commitments.

Human Capacity Constraints

The effective integration of AI into teacher education requires teacher educators themselves to possess adequate AI literacy and digital competencies. However, research suggests that many Nigerian teacher educators lack foundational digital skills, let alone the specialised knowledge required for AI integration (Eze et al., 2022). Oyelere et al. (2020) found that a significant proportion of teacher educators in Nigerian institutions reported limited familiarity with AI concepts, with many expressing uncertainty about the relevance and potential applications of AI in their disciplines. This capacity gap is compounded by limited opportunities for professional development in AI and educational technology, particularly for educators in less resourced institutions (Adewale & Ajayi, 2023).

Financial Constraints

Teacher education in Nigeria has historically been underfunded, with institutions struggling to meet basic operational needs (Ogunleye & Ogunleye, 2020). The investment required for AI integration encompassing hardware, software, internet connectivity, technical support, and professional development represents a substantial additional financial burden. Even with policy commitments, the allocation of funds to technology integration often competes with other pressing priorities, including staff salaries, building maintenance, and essential teaching resources (Eze et al., 2022). This financial constraint is particularly acute in state-owned Colleges of Education, which depend heavily on state government allocations that are often delayed or insufficient.

Policy and Governance Gaps

While Nigeria has made policy-level commitments to digital transformation in education, implementation remains inconsistent. Eze et al. (2022) observed a significant gap between national policy articulation and institutional-level implementation, with many teacher education institutions lacking clear strategies, operational guidelines, or dedicated personnel for technology integration. The absence of national standards for AI competency in teacher education, and the limited enforcement of existing minimum standards, further compounds this challenge. Additionally, coordination among the various regulatory bodies including the NCCE, National Universities Commission, Federal Ministry of Education, and NITDA has been insufficient, leading to fragmented and sometimes contradictory policy directions (Ogbonna & Okafor, 2022).

Cultural and Societal Factors

Cultural attitudes toward technology and pedagogical practices present additional barriers. Some teacher educators may be resistant to technological change, viewing AI with scepticism or concern that it may diminish the human dimensions of teaching (Selwyn, 2019). Others may harbour anxieties about job displacement or feel threatened by the perceived complexity of AI tools (Odugbesan et al., 2023). These attitudes are often reinforced by cultural norms that privilege traditional, didactic approaches to teaching, and by limited exposure to the potential benefits of AI through professional development or institutional support. Furthermore, concerns about data privacy, algorithmic bias, and the ethical implications of AI applications raise important questions about culturally appropriate and context-sensitive integration (Adeyanju et al., 2023).

Equity and Inclusion Concerns

A particularly salient challenge in the Nigerian context is the risk that AI integration may exacerbate existing educational inequalities. Differences in technological infrastructure, human capacity, and financial resources across institutions, regions, and socioeconomic groups mean that the benefits of AI are likely to be unevenly distributed (Adewale & Ajayi, 2023). Urban, well-resourced institutions may advance rapidly in AI integration, while rural and underserved institutions lag further behind. This creates a two-tiered system of teacher education, where graduates from different institutions are inequitably prepared to meet the demands of a technology-driven educational environment. Moreover, AI systems developed in contexts significantly different from Nigeria's may contain biases or assumptions that are not culturally appropriate, potentially perpetuating patterns of disadvantage (Williamson & Eynon, 2020).

Ethical Considerations and Responsible AI Integration

The integration of AI into teacher education raises important ethical considerations that must be systematically addressed. Data privacy and protection is paramount; AI systems typically require access to substantial amounts of personal data, and without robust safeguards, this data may be vulnerable to misuse or breach (Holmes et al., 2019). In the Nigerian context, where data protection legislation is still developing, this concern is particularly acute. The Nigeria Data Protection Regulation (2019) provides a foundational framework, but many educational

institutions lack the technical capacity and institutional mechanisms to ensure compliance (Adeyanju et al., 2023).

Algorithmic bias is another critical concern. AI systems are trained on data that may reflect historical biases, leading to outcomes that disadvantage certain groups (Selwyn, 2019). In teacher education, this could manifest in biased assessments, personalised learning pathways that reinforce stereotypes, or reinforcement of existing inequities in educational access. Nigerian teacher educators must be equipped to critically evaluate AI applications for bias and to advocate for fairness, transparency, and accountability in AI deployment (Ifenthaler & Schumacher, 2022).

Additionally, the issue of academic integrity and AI use in assessment must be considered. The emergence of generative AI tools capable of producing sophisticated written content challenges traditional approaches to assessment and requires teacher educators to reconsider how they evaluate student learning (Baidoo-Anu & Ansah, 2023). This necessitates the development of institutional policies, pedagogical strategies, and assessment designs that acknowledge the capabilities of AI while upholding academic standards and cultivating genuine learning.

Teacher Preparedness and Professional Development

Research consistently identifies teacher preparedness as the critical factor in successful technology integration (Scherer et al., 2019). For AI specifically, teacher educators require not only technical skills but also pedagogical knowledge about how to effectively use AI to support learning, and critical understanding of the ethical and social implications of AI (Ng et al., 2021). This comprehensive competency set has been conceptualised as AI literacy for educators, encompassing knowledge of AI concepts, data literacy, understanding of AI's societal impacts, and the ability to critically evaluate AI applications in education (Long & Magerko, 2020).

Professional development for AI integration in Nigeria faces several challenges. Existing teacher education curricula have limited coverage of technology integration, with even less attention to AI specifically (Oyelere et al., 2020). The NCCE's revised minimum standards represent an important step forward, but implementation remains uneven, and many teacher educators have not received training to deliver this content effectively (NCCE, 2022). Continuing professional development opportunities for in-service teachers are often sporadic, underfunded, and disconnected from the practical realities of the Nigerian classroom.

Niemi and Jahnke (2023) argue that teacher preparation for AI should move beyond mere technical training to encompass critical, reflective, and ethical dimensions. This is particularly important in contexts where teachers may encounter ethical challenges in their practice or where AI applications may impact students from diverse and disadvantaged backgrounds. Teacher education programmes must therefore foster not only AI competencies but also the dispositions to engage critically with AI and to advocate for its responsible and equitable use.

Future Directions and Research Agenda

The literature suggests several priority areas for future research and practice on AI integration in Nigerian teacher education. First, there is a pressing need for empirical studies that examine the current state of AI integration, teacher educators' competencies, and the factors that enable or constrain effective implementation (Ogbonna & Okafor, 2022). Second, research should explore culturally and contextually appropriate models for AI integration that are responsive to Nigeria's unique challenges and opportunities (Akinwale, 2020). Third, the development and evaluation of professional development programmes specifically designed for Nigerian teacher educators could provide evidence-based guidance for capacity building efforts.

Furthermore, research on the equity implications of AI in teacher education is essential to ensure that AI serves as a tool for inclusion rather than exclusion (Adewale & Ajayi, 2023). Studies on the ethical frameworks appropriate for the Nigerian context, including data

protection, algorithmic fairness, and culturally responsive AI design, are also urgently needed. Finally, there is scope for comparative research that examines how Nigeria's efforts align with or diverge from those of other countries, particularly in the Global South, to identify transferable strategies and shared challenges (UNESCO, 2021).

Result and Discussion

The findings reveal that AI integration in Nigerian teacher education is in its nascent stages, with significant disparities across institutions and regions. Awareness of AI concepts among teacher educators remains generally low, with only superficial understanding even among those who are familiar with AI terminology. Formal integration of AI into teacher education curricula is minimal, largely confined to a few federal universities and well-resourced Colleges of Education. While national policies such as the NCCE's revised Minimum Standards and the National Digital Economy Policy signal commitment to technology integration, there is a substantial gap between policy articulation and institutional implementation.

The study identifies several significant opportunities for AI integration in Nigerian teacher education:

AI applications can personalise instruction through adaptive learning platforms, provide immediate feedback, and enable data-driven instructional adjustments. This is particularly valuable in contexts with large class sizes where individual attention is limited.

AI-powered grading and feedback systems can reduce administrative burdens on educators while maintaining or improving feedback quality. However, concerns about reliability and fairness for complex assessments persist.

AI-powered coaching systems and recommendation tools can provide personalised, data-driven feedback on teaching practice and self-directed learning opportunities, addressing the constraints of traditional professional development approaches.

Generative AI tools can assist in creating instructional materials, assessments, and lesson plans, reducing the time and cost associated with curriculum development, particularly in specialised subject areas with limited qualified educators.

Mobile-based AI applications have potential to extend educational opportunities to remote and underserved communities, though realising this potential depends on addressing fundamental connectivity and infrastructure challenges.

The study identifies six major categories of challenges that impede effective AI integration:

Inadequate infrastructure constitutes the most fundamental barrier. A majority of institutions, especially state-owned and rural ones, lack reliable electricity, stable internet connectivity, and adequate computing facilities. Even institutions with some infrastructure face reliability issues with intermittent power supply and unstable connectivity.

Limited AI literacy and digital competencies among teacher educators present a critical capacity gap. Many educators lack not only technical skills but also pedagogical knowledge about AI integration and critical understanding of AI's ethical implications. Existing professional development opportunities are insufficient to address these gaps.

Chronic underfunding of teacher education institutions precludes significant investment in AI infrastructure, software, professional development, and technical support. The capital-intensive nature of AI integration makes it particularly difficult for underfunded institutions to adopt AI applications. Sustainable funding models are lacking.

There is a significant gap between national policy commitments and institutional implementation. Many institutions lack clear strategies, operational guidelines, or dedicated personnel for AI integration. Coordination among regulatory bodies (NCCE, NUC, Federal Ministry of Education, NITDA) is insufficient, leading to fragmented implementation.

Cultural attitudes toward technology, including scepticism about AI's value in education and anxiety about AI replacing human teachers, present barriers. Resistance is reinforced by cultural

norms that privilege traditional, didactic approaches to teaching and by concerns that AI may undermine relational and humanistic aspects of education.

AI integration risks exacerbating existing educational inequalities. Well-resourced urban institutions are better positioned to adopt AI, while rural and under-resourced institutions are likely to fall further behind, creating a two-tiered system of teacher education. Additionally, AI systems developed in Western contexts may not be culturally appropriate for Nigeria's diverse contexts.

Teacher preparedness emerges as the critical factor in successful AI integration. Teacher educators who have participated in AI-related professional development demonstrate greater confidence and competence in integrating AI, are more likely to incorporate AI content into their teaching, and model effective AI use for their students. However, substantial gaps exist in AI-related content in initial teacher education curricula, with most pre-service teachers graduating without systematic exposure to AI concepts or applications. Professional development that is practical, contextually relevant, and sustained over time is more effective than one-off training, yet such opportunities are limited for most Nigerian teacher educators.

Concluding

The integration of Artificial Intelligence into teacher education programmes in Nigeria represents both a significant opportunity and a formidable challenge. This study has demonstrated that Nigeria has the policy frameworks, emerging initiatives, and human resources to make meaningful progress in AI integration. However, realising the transformative potential of AI requires more than technological adoption; it demands a comprehensive, strategic, and ethically grounded approach that addresses the multiple dimensions of educational transformation.

The study reaffirms that teachers are the cornerstone of educational quality and that teacher education must be at the centre of Nigeria's AI strategy. As the nation strives to prepare its youth for a technology-driven future, the quality of teacher preparation will determine the extent to which AI serves as an enabler of inclusive, equitable, and quality education. The decisions made in the coming years about AI integration in teacher education will shape not only the educational experiences of future teachers but also the learning outcomes of generations of Nigerian students.

The path forward requires sustained commitment from policymakers, institutional leaders, teacher educators, and researchers. It demands investment in infrastructure, human capacity, and knowledge generation. It calls for collaboration across sectors, disciplines, and nations. Most importantly, it requires a vision of education that harnesses the power of AI while preserving the human dimensions of teaching care, creativity, critical thinking, and relationships. With strategic, context-sensitive, and ethically grounded implementation, AI can become a powerful ally in Nigeria's quest to build a high-quality, equitable, and inclusive educational system that prepares all citizens for the challenges and opportunities of the 21st century.

Recommendations

The following recommendations are structured to address the needs of various stakeholders and to provide a comprehensive framework for advancing AI integration in Nigerian teacher education. The recommendations are grounded in the study's findings and are informed by international best practices, while remaining sensitive to Nigeria's unique context and challenges.

1. Policymakers should develop a comprehensive national policy specifically addressing AI in teacher education. This policy should articulate clear expectations for AI competency development, establish national standards for AI literacy in teacher education curricula, provide guidelines for ethical AI use, and outline mechanisms for monitoring and evaluation.

2. Each teacher education institution should develop a comprehensive AI integration strategy that articulates institutional goals, priorities, resource allocation, and implementation timelines. The strategy should be developed through inclusive consultation with faculty, students, and external stakeholders.
3. Teacher educators should proactively develop their personal AI literacy, including understanding of AI concepts, applications, and implications. This can be achieved through self-study, participation in professional development programmes, engagement with research and professional networks, and experimentation with AI tools.
4. Researchers should conduct empirical studies on the current state of AI integration, factors that enable or constrain effective implementation, and the effectiveness of different integration strategies.
5. International partners should support infrastructure development in Nigerian teacher education, including investment in electricity, internet connectivity, and computing facilities.

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