

REVOLUTIONIZING CURRICULUM AND INSTRUCTION LEVERAGING ON ARTIFICIAL INTELLIGENCE IN COLLEGES OF EDUCATION IN NIGERIA

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Abstract

The curriculum and instructional methods in many Nigerian Colleges of Education (CoEs) remain outdated, failing to equip prospective teachers with the competencies required for the 21st-century classroom. This paper investigates the transformative potential of Artificial Intelligence (AI) to revolutionize teacher education in Nigeria. Using a qualitative literature review method, this study analyzes secondary data to explore how AI can address these systemic challenges. Key findings indicate that AI technologies, such as adaptive learning systems and intelligent tutoring systems, can facilitate personalized learning, automate administrative tasks, and provide data-driven insights for pedagogical improvement. However, significant challenges, including infrastructural deficits, a lack of requisite skills among educators, and ethical concerns, impede adoption. The study recommends a phased implementation strategy, massive investment in digital infrastructure and teacher training, curriculum redesign to include AI literacy, and the development of a national policy framework for AI in education. In conclusion, the strategic and ethical integration of AI is critical for modernizing curriculum and instruction in Nigerian CoEs, ensuring the preparation of a future-ready teaching workforce.

Keywords: Artificial Intelligence, Curriculum, Instruction, Colleges of Education, Teacher Training, Nigeria.

Introduction

A fundamental challenge facing Nigeria's educational system is the significant misalignment between the curriculum delivered in Colleges of Education (CoEs) and the evolving competencies required in modern classrooms. These institutions, responsible for training the nation's primary and junior secondary school teachers, often utilize outdated pedagogical approaches and curricular content that inadequately prepare graduates for 21st-century teaching demands (Iweuno, Orekha, Ojediran, Imohimi, & Adu-Twum, 2024). This deficiency perpetuates a cycle of educational underperformance, as teachers trained through obsolete methods struggle to impart contemporary skills to their students. This study investigates how Artificial Intelligence (AI) can serve as a catalytic force in bridging this gap, offering innovative solutions to revolutionize both curriculum design and instructional delivery in Nigerian CoEs.

The global educational landscape is undergoing a profound transformation driven by technological advancements, with AI positioned at the forefront of this change. Developed nations are increasingly integrating AI tools to create personalized learning experiences, automate administrative processes, and enhance educational outcomes through data-driven insights (Holmes, Bialik, & Fadel, 2019). The international trend demonstrates a clear movement towards educational models that leverage technology to cater to individual learner needs, moving beyond traditional one-size-fits-all approaches. This global shift establishes a compelling context for

exploring similar applications in developing economies, highlighting the risk of widening educational disparities if technological adoption is delayed.

Within Africa, the adoption of AI in education remains at a nascent stage, characterized by growing recognition of its potential alongside significant implementation challenges. While countries like Kenya and South Africa have initiated pilot programmes, widespread integration, particularly in teacher education, is hindered by infrastructural limitations and policy gaps (Hassan, 2023). The African context presents both a challenge and an opportunity—a chance to leapfrog traditional developmental hurdles through strategic technology integration. However, this potential remains largely untapped due to systemic constraints that require targeted intervention at institutional and governmental levels.

In Nigeria, the disconnect between policy ambition and practical implementation is particularly evident in teacher training institutions. Despite national discourses on educational technology, CoEs continue to operate with rigid curricula and lecture-based instructional methods that fail to model contemporary pedagogical practices (Roy & Paul, 2023). This study is therefore motivated by the urgent need to address this critical gap between potential and practice. By examining specific AI applications within the Nigerian context, this research aims to provide a framework for leveraging technology to enhance teacher education, ultimately contributing to the development of a more robust and responsive educational system.

Concept of Artificial Intelligence

Artificial Intelligence (AI) represents a branch of computer science dedicated to creating systems capable of performing tasks that typically require human cognitive functions such as learning, reasoning, problem-solving, and pattern recognition. Russell & Norvig (2016) provide a comprehensive definition, describing AI as "the study of agents that receive percepts from the environment and perform actions," with a focus on creating systems that act rationally. The field encompasses various approaches, typically categorized into Narrow AI, designed for specific tasks like language translation or image recognition, and the theoretical concept of General AI, which would possess broad, human-like cognitive abilities across diverse domains. The practical applications of AI extend across numerous fields, from healthcare diagnostics and financial modeling to transportation systems and educational technology, demonstrating its transformative potential in contemporary society.

Ouyang and Jiao (2021) conceptualize AI's role in education through three evolving paradigms: AI-directed, where systems act as tutors; AI-supported, involving collaboration between systems and learners; and AI-empowered, where technology enhances learner agency and autonomy. This framework suggests a progression toward more sophisticated integrations where AI augments rather than replaces human intelligence. Similarly, Chaudhry and Kazim et al, (2021) identify key application areas including workload reduction for educators, contextualized learning experiences, assessment transformation, and intelligent tutoring systems. They emphasize the importance of maintaining human oversight in AI-enabled educational environments. Further expanding this discussion, Guan, Mou, and Jiang et al, (2020) trace the historical evolution of AI in education, noting a significant shift from early intelligent tutoring systems toward contemporary applications in learning analytics and personalized educational pathways. From the researcher's perspective, these scholarly interactions highlight AI not as a replacement for human educators but as a

powerful augmentative tool that can enhance educational processes when integrated thoughtfully and ethically.

State of Curriculum and Instruction in Nigerian Colleges of Education

The curriculum in Nigerian Colleges of Education encompasses the structured plan for teacher preparation, including learning objectives, content, instructional methodologies, and assessment strategies designed to produce qualified educators for basic education levels. These institutions emerged historically in response to Nigeria's need for professionally trained teachers following the Universal Primary Education initiative of the 1970s, with a mandate to blend subject knowledge, pedagogical theory, and practical teaching experience. The relevance of CoEs remains paramount as they form the foundation of Nigeria's educational system, directly influencing the quality of teaching in primary and junior secondary schools nationwide. Their original objective focused on producing teachers equipped with both theoretical understanding and practical skills necessary for effective classroom instruction.

The current state of curriculum implementation and instructional delivery in many Nigerian CoEs presents significant concerns regarding their effectiveness in contemporary educational contexts. The curriculum has been criticized for its rigidity, theoretical emphasis, and misalignment with 21st-century skills, often failing to incorporate digital literacy, innovative pedagogy, and current educational research (Iweuno, et al., 2024). Instruction predominantly follows traditional lecture-based methods that prioritize knowledge transmission over critical engagement, while teaching practice components frequently suffer from inadequate supervision and resource constraints. This situation results in graduates who often lack the practical competencies and adaptive teaching skills required in modern, dynamic classroom environments.

Roy and Paul (2023) argue that the standardized approach prevalent in Nigerian teacher education fails to address diverse learning needs or foster pedagogical innovation, with limited technology integration further marginalizing both trainers and trainees. Abdelaziz (2023) emphasizes the curricular and administrative inflexibility that hinders responsive adaptation, advocating for curricula focused on developing "learning to learn" competencies rather than mere content transmission. From a global perspective, Holmes, et al, (2019) contend that curricula neglecting skills essential for AI-influenced environments risk becoming obsolete, stressing the importance of embedding creativity, collaboration, and critical thinking throughout teacher preparation programs. The researcher concurs that the current state represents a systemic failure requiring comprehensive reform rather than incremental adjustment, with AI integration offering a promising pathway toward meaningful transformation in teacher education practices.

AI Technologies for Curriculum and Instruction Revolution

The transformation of curriculum and instruction in Nigerian Colleges of Education can be significantly advanced through the strategic integration of specific AI technologies designed to enhance both teaching and learning processes. These technologies offer innovative approaches to address longstanding challenges in teacher education:

1. **Adaptive Learning Systems:** These platforms utilize machine learning algorithms to create personalized learning pathways for student-teachers. By continuously assessing individual performance and comprehension, these systems

adjust content difficulty and instructional sequencing in real-time, ensuring optimal challenge levels and addressing knowledge gaps effectively (Rahiman & Kodikal, et al, 2024).

2. **Intelligent Tutoring Systems (ITS):** Going beyond basic adaptation, ITS provide sophisticated, step-by-step guidance and feedback on complex tasks, simulating personalized tutoring support. These systems can demonstrate teaching techniques, evaluate lesson plans, and provide targeted feedback on pedagogical decisions, allowing student-teachers to practice and refine skills in supportive environments (Chaudhry & Kazim, et al, 2021).
3. **Automated Assessment and Feedback Tools:** AI-powered assessment systems can evaluate a range of students work from multiple-choice responses to written assignments, providing immediate, consistent feedback while freeing instructors from routine grading tasks. This automation enables lecturers to dedicate more time to higher-order instructional activities and individual student mentorship (Iweuno et al., 2024).
4. **AI-Enhanced Content Creation and Curation:** These tools assist educators in developing and updating curricular materials by identifying relevant resources, generating interactive content, and ensuring alignment with learning objectives. This capability helps maintain curriculum relevance and diversity while reducing preparation burdens on teaching staff.

The scholarly discourse surrounding these technologies reveals evolving perspectives on their implementation. Guan, Mou, and Jiang et al, (2020) document a historical shift in educational AI research from isolated intelligent tutoring systems toward integrated learning analytics approaches, emphasizing the value of data-driven instructional optimization. Building on this foundation, Ouyang and Jiao et al, (2021) advocate for applications that empower learners rather than simply directing them, viewing AI as a collaborative tool that enhances educational agency. Hassan (2023) further expands this conversation by highlighting the transformative potential when AI tools integrate with immersive technologies like virtual and augmented reality, creating rich, experiential learning environments previously unimaginable in teacher education contexts. From the researcher's viewpoint, these technologies represent interconnected components of an educational ecosystem that, when strategically implemented, can transform rigid, standardized teacher training into dynamic, personalized professional preparation.

Benefits of AI Technologies for Curriculum and Instruction Revolution

The integration of AI technologies into Nigerian Colleges of Education offers substantial benefits that could fundamentally enhance the quality and effectiveness of teacher preparation programmes. These advantages address core limitations in current educational practices while introducing new capabilities for professional development:

1. **Personalized Learning Pathways:** AI systems can tailor instructional content, pacing, and support to individual student-teacher needs, moving beyond the constraints of standardized curricula. This personalization ensures that trainees receive appropriate challenges and support based on their unique progress, knowledge gaps, and learning preferences (Roy & Paul, 2023).
2. **Data-Driven Instructional Improvement:** The capacity of AI to collect and analyze extensive data on learning patterns provides educators with actionable

insights into student comprehension, common difficulties, and effective teaching strategies. This evidence-based approach enables continuous refinement of both curriculum and instructional methods based on empirical feedback rather than intuition alone (Rahiman & Kodikal, et al, 2024).

3. **Enhanced Administrative Efficiency:** By automating routine tasks such as grading, attendance tracking, and resource management, AI reduces administrative burdens on educators, allowing them to focus on higher-value activities like mentoring, collaborative planning, and individualized student support (Chaudhry & Kazim, et al, 2021).
4. **Increased Access to Quality Resources:** AI-powered platforms can provide student-teachers with access to diverse, high-quality educational materials and global best practices, overcoming resource limitations often faced in Nigerian institutions. This exposure enhances the depth and breadth of professional preparation regardless of geographical location or institutional resources.

Research literature substantiates these potential benefits while exploring their broader implications. Hassan (2023) highlights the transformative impact of real-time feedback capabilities, which shift assessment from primarily summative evaluations toward ongoing formative processes that actively guide learning development. Ouyang and Jiao et al. (2021) emphasize how AI-supported environments foster greater learner agency, enabling student-teachers to take more ownership of their professional development through choice and self-direction. Iweuno, et al. (2024) further note that AI facilitation can support more inclusive and diversified curricula that better address varied learning needs and cultural contexts. The researcher contends that these benefits collectively represent not merely incremental improvements but a fundamental paradigm shift towards more responsive, efficient, and effective teacher education models that can better prepare educators for contemporary classroom challenges.

Challenges of Adopting AI Technologies for Curriculum and Instruction Revolution in Nigeria

Despite the promising potential of AI applications in teacher education, their successful implementation in Nigerian Colleges of Education faces substantial challenges that must be systematically addressed. These obstacles span technological, human, and systemic dimensions, creating a complex implementation landscape:

1. **Inadequate Technological Infrastructure:** The effective deployment of AI technologies requires reliable internet connectivity, stable electricity, and adequate digital devices—resources that remain scarce in many CoEs, particularly those in rural areas (Hassan, 2023). This infrastructural deficit represents the most immediate barrier to meaningful AI integration.
2. **Limited Educator Capacity and Readiness:** Many current teacher educators lack the digital literacy and technical confidence required to effectively integrate AI tools into their pedagogy. Without comprehensive professional development that addresses both technical skills and pedagogical adaptation, even advanced technologies may be underutilized or misapplied (Chaudhry & Kazim, et al, 2021).
3. **Ethical and Sociocultural Concerns:** AI implementation raises important questions regarding data privacy, algorithmic bias, and cultural relevance. Systems trained on datasets from other contexts may perpetuate biases or prove

misaligned with Nigerian educational values and needs, requiring careful oversight and localization efforts (Roy & Paul, 2023).

4. **Financial and Policy Constraints:** The costs associated with acquiring, maintaining, and updating AI technologies present significant barriers within constrained institutional budgets. Moreover, the absence of comprehensive national policies guiding educational AI use creates uncertainty regarding standards, ethics, and long-term sustainability (Zawacki-Richter, Marín, Bond, & Gouverneur, 2019).

Scholarly analysis confirms the interconnected nature of these challenges. Zawacki-Richter et al. (2019), in their systematic review, identify inadequate institutional strategy and teacher preparation as primary barriers globally, with these issues being particularly acute in resource-constrained contexts like Nigeria. Popenici and Kerr (2017) caution against technological solutionism that overlooks pedagogical and ethical dimensions, warning that poorly implemented AI could undermine educational relationships and values. Supporting this perspective, Rahiman and Kodikal et al, (2024) find that perceived risks and limited awareness significantly hinder faculty adoption, emphasizing the need for supportive institutional cultures and clear communication about technology purposes and benefits. The researcher's assessment aligns with these views, recognizing that overcoming these challenges requires coordinated efforts addressing infrastructure gaps, building human capital, establishing ethical frameworks, and developing sustainable implementation strategies tailored to Nigerian contexts.

Implementation Strategies for AI in Nigerian Colleges of Education

Successful integration of AI technologies into Nigerian Colleges of Education requires a deliberate, multi-faceted approach that addresses both technical and human dimensions of institutional change. A comprehensive implementation strategy should include the following key components:

1. **Development of National Policy Framework:** The Federal Ministry of Education, in collaboration with the National Commission for Colleges of Education (NCCE), should establish a comprehensive national policy for AI integration in teacher education. This framework should outline ethical guidelines, technical standards, implementation timelines, and funding mechanisms to ensure coordinated and sustainable adoption across institutions (UNESCO, 2021).
2. **Phased Implementation through Pilot Programmes:** Rather than attempting nationwide rollout simultaneously, a phased approach beginning with selected "Centers of Excellence" allows for testing, refinement, and capacity building. These pilot institutions would receive targeted resources to develop best practices that can be adapted and scaled across the CoE system based on demonstrated effectiveness (Hassan, 2023).
3. **Comprehensive Educator Professional Development:** Continuous professional development programmes must equip teacher educators with both technical skills to operate AI tools and pedagogical knowledge to integrate them effectively into curriculum delivery. This training should model active learning approaches and include ongoing support mechanisms to build confidence and competence (Chaudhry & Kazim, et al, 2021).
4. **Strategic Public-Private Partnerships:** Collaboration between government agencies, educational institutions, and technology companies can leverage

complementary resources, expertise, and innovation capacity. Such partnerships can improve access to technology, support localized content development, and create sustainable maintenance models (Holmes, Bialik, & Fadel, et al, 2019).

Research supports such multifaceted implementation approaches. Ouyang and Jiao et al, (2021) emphasize the importance of human-centered design in educational technology integration, aligning with the need for extensive professional development that empowers educators as active technology users. Hassan (2023) stresses the importance of addressing digital divides through targeted resource allocation, supporting the strategic selection of pilot institutions for maximum impact. The researcher concludes that a combination of top-down policy support and bottom-up, educator-centered implementation represents the most promising path toward sustainable AI integration in Nigerian teacher education institutions.

Conclusion

The integration of Artificial Intelligence presents a transformative opportunity to address longstanding challenges in Nigerian teacher education. By enabling personalized learning, enhancing instructional efficiency, and providing data-driven insights, AI technologies can significantly modernize curriculum and instruction in Colleges of Education. However, realizing this potential requires systematic addressing of infrastructural deficits, educator capacity gaps, and policy limitations. A strategic phased implementation approach that combines policy support, resource investment, and professional development is essential for sustainable integration. Ultimately, leveraging AI effectively can contribute substantially to preparing a teaching workforce equipped for 21st-century educational demands.

Recommendations

1. The Federal Ministry of Education should accelerate development and implementation of a national AI policy specifically addressing teacher education needs and standards.
2. Government should prioritize investments in digital infrastructure, including reliable electricity and internet connectivity, particularly in pilot institutions selected for initial implementation.
3. Teacher training institutions should establish continuous professional development programs focusing on both technical AI skills and pedagogical integration strategies for educator preparation.
4. Implementation should follow a phased approach, beginning with carefully selected pilot institutions to develop and refine effective models before scaling across the system.
5. National curriculum standards for teacher education should be revised to incorporate digital literacy, AI ethics, and technology integration as core graduate competencies.

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