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Research Article

Artificial Intelligence in Higher Education in Nigeria: Challenges and Way Forward

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Abstract

This study explores the application of Artificial Intelligence (AI) in higher education in Nigeria, examining its potential benefits, prevailing challenges, and the strategic way forward. In the wake of global technological advancement, AI has emerged as a transformative tool in the education sector, offering innovative solutions for personalized learning, administrative efficiency, predictive analytics, virtual instruction, academic research support, and campus security. Nigerian universities, however, continue to lag in AI adoption due to numerous systemic and structural barriers. The challenges identified include inadequate digital infrastructure, shortage of skilled personnel, high cost of implementation, resistance to change among staff, ethical and privacy concerns, and the absence of a comprehensive national policy framework. To address these challenges, the study proposes a multifaceted strategy, including increased investment in ICT infrastructure, capacity building for staff and students, creation of institutional and national AI policies, public-private partnerships, and a strong focus on ethical AI deployment. Emphasis is placed on inclusive change management, transparent data governance, and phased implementation models tailored to local realities. The study concludes that while challenges are significant, a well-coordinated and strategic approach can position Nigerian higher education institutions to fully leverage AI as a driver of educational transformation, innovation, and global competitiveness.

Keywords: Artificial Intelligence, Higher Education, Educational Technology and Institutional Challenges.

Introduction

The advent of the Fourth Industrial Revolution has brought with it the accelerated integration of emerging technologies such as Artificial Intelligence (AI) into various sectors of human activity, including education. Globally, AI is redefining how knowledge is delivered, accessed, and managed. In higher education, AI is not only transforming traditional pedagogical practices but also enhancing administrative efficiency, research capacity, and learner engagement (Luckin, 2016; Holmes, 2019). As institutions of learning embrace digital transformation, Artificial Intelligence is becoming a key enabler of personalized learning, intelligent tutoring, automated grading, academic advising, and predictive analytics (UNESCO, 2021; Selwyn, 2019). Madu, and Musa (2024) defined artificial intelligence as the simulation/imitation of human beings by machines such as computer system. Mamela in Eiriemiokhale and Sulyman (2023) defined AI as the advancement of computer systems capable of performing tasks that would ordinarily need human intellect, such as decision making, object detection, solving complex issues, and so on.

In the context of developing nations like Nigeria, the potential for AI to bridge gaps in access, quality, and relevance of education cannot be overemphasized. Nigeria, with its rapidly expanding population of youth and a growing need for higher education access, is at a strategic position to benefit from the innovations driven by AI (Adebayo & Salako, 2021; Olayemi & Omotayo, 2022). The use of AI-powered tools such as chatbots, adaptive learning platforms, and data analytics can help address challenges of overcrowded classrooms, shortage of academic staff, and poor service delivery in Nigerian universities (Onyeaso & Eze, 2022). Furthermore, AI has the capacity to democratize education by enabling remote learning, supporting students with special needs, and enhancing teacher effectiveness (Mhlanga & Moloi, 2020).

Despite the significant promise of AI in higher education, the reality in Nigeria presents a complex landscape of infrastructural deficits, policy gaps, limited technical expertise, and resistance to change (Ogunlade & Usman, 2022; Olanrewaju, 2021). Nigerian universities, though increasingly aware of digital learning tools, are yet to fully harness the power of AI due to these constraints. For example, many institutions lack the foundational ICT infrastructure necessary for deploying intelligent systems, while others are constrained by inadequate funding, unreliable power supply, and poor internet connectivity (Idowu & Yusuf, 2020). Additionally, concerns about data privacy, ethical use, and the dearth of AI-skilled personnel further limit the adoption and sustainability of such innovations (Ifinedo, 2023).

Globally, there has been an increased policy focus on leveraging AI for educational advancement. UNESCO (2021) has called for the integration of AI in education policies to ensure that all countries benefit equitably from these technologies. In response, nations such as China, the United States, and some countries in Africa like Rwanda and South Africa are developing frameworks to promote responsible and inclusive AI integration in higher education (Wang & Cheng, 2020; Benaim & Lalloo, 2021; World Bank, 2020). Nigeria, however, has yet to establish a national strategy specifically focused on AI in education, leaving most higher institutions without a clear roadmap for implementation (Olumide & Ojo, 2022).

Furthermore, the COVID-19 pandemic exposed deep vulnerabilities in Nigeria's educational system and highlighted the urgent need for scalable, technology-driven solutions. During the pandemic, many Nigerian universities struggled to maintain learning continuity due to poor digital infrastructure and lack of preparedness for online education (Ogunode., 2021). In contrast, institutions with some level of AI integration managed better transitions through the use of learning management systems and virtual classrooms powered by intelligent algorithms (Okoye & Ezema, 2020; Adeoye, 2020). This experience underscored the relevance of AI not just as a luxury, but as a necessity in building resilient and future-ready educational systems.

In light of the above, there is a pressing need to examine the current state of AI application in Nigerian higher education, identify the major challenges impeding progress, and explore viable pathways to scale up adoption. This includes not only infrastructural and technical considerations but also the development of human capital, ethical frameworks, and strategic partnerships. A holistic approach that aligns national policy with institutional strategies and global trends is imperative to drive sustainable integration of AI in Nigeria's higher education landscape (Oke & Olatunji, 2023; Chaka, 2020).

Applications of Artificial Intelligence in Higher Education in Nigeria

Artificial Intelligence (AI) holds immense potential to transform the landscape of higher education in Nigeria by enhancing teaching, learning, research, and administrative processes. With increasing demands for quality education and the need to address systemic inefficiencies, Nigerian universities and colleges stand to gain significantly from adopting AI-driven technologies. The following subsections outline key applications of AI in the Nigerian higher education context.

1. **Smart Tutoring Systems**: AI-based tutoring systems are revolutionizing how students interact with course materials and instructors. These systems utilize machine learning algorithms to assess students' prior knowledge, monitor progress in real time, and adapt instructional content accordingly. By offering customized feedback and guidance, AI-powered tutoring systems can help bridge learning gaps, especially in large classrooms where personalized attention is difficult to provide. In Nigeria, where student-to-teacher ratios remain high often exceeding 1:100 in many public universities smart tutoring systems can serve as invaluable academic assistants. For example, platforms such as Squirrel AI and Carnegie Learning, which have been deployed in other countries, could be localized and adapted to the Nigerian context (Benaim & Lalloo, 2021). Such systems can also be programmed to offer multi-language support and address challenges in under-resourced regions, thus promoting inclusive learning.

2. Administrative Efficiency: AI is capable of enhancing operational efficiency by automating routine administrative tasks, thereby saving time and reducing human error. In Nigerian universities, common administrative activities such as processing applications, handling course registrations, scheduling examinations, and responding to student queries can be handled more effectively with AI-powered solutions. Chatbots, for instance, can provide 24/7 responses to frequently asked questions, reducing the workload of administrative staff. Natural Language Processing (NLP) models integrated into university websites or portals can interact with students, handle inquiries about admissions, course availability, deadlines, and even resolve complaints (Okoye & Ezema, 2020). Additionally, Robotic Process Automation (RPA) can be used for automating the generation of transcripts, certificates, and payroll systems, which are often bogged down by bureaucratic inefficiencies in Nigerian institutions.

3. Predictive Analytics: Another significant application of AI in higher education is in the area of predictive analytics. AI systems can analyze large volumes of student data to identify trends and predict future behaviors, such as the likelihood of academic success or dropout risk. This allows for early interventions that can support students at risk of failure or disengagement. In Nigeria, where retention and graduation rates are concerning in many universities, predictive analytics could be a game-changer. For instance, by analyzing attendance patterns, grades, and engagement with course materials, AI can alert academic advisors or faculty members about students who may need additional support. Predictive tools can also aid in strategic planning, such as forecasting enrollment numbers, optimizing resource allocation, and improving curriculum design (Adebayo & Salako, 2021).

4. Virtual Learning and Remote Classrooms: The COVID-19 pandemic exposed significant weaknesses in Nigeria's capacity for remote learning. AI can enhance the virtual

learning experience by facilitating adaptive learning platforms, intelligent virtual assistants, and automated grading systems. These tools support individualized learning pathways, allowing students to learn at their own pace and receive immediate feedback. For instance, AI-driven platforms like Coursera, Edmodo, and Khan Academy utilize algorithms that recommend resources based on learners' needs. Nigerian universities can integrate similar AI solutions into their Learning Management Systems (LMS) to improve student engagement and outcomes. Moreover, AI can provide subtitles, translations, and content summarization—essential tools for distance learners, especially those in rural and underserved areas (UNESCO, 2021). The integration of AI in virtual learning also supports educators. With AI-generated analytics, lecturers can assess which students are actively engaging with course content and tailor their support accordingly. These systems can flag knowledge gaps and provide suggestions on how to address them.

5. **Research and Academic Support:** Academic research is the backbone of higher education, and AI can significantly accelerate and enhance the research process. AI-powered tools such as natural language processing, machine learning, and semantic search engines can assist researchers in discovering relevant literature, analyzing data, and visualizing complex results. AI can also detect patterns and generate hypotheses, helping researchers in multidisciplinary fields to develop more robust models. In Nigerian universities where access to current research resources and laboratory equipment is often limited, AI tools can fill critical gaps. For example, platforms like Zotero, EndNote, Grammarly, and Turnitin, which use AI for citation management, grammar correction, and plagiarism detection, are already in use. These tools not only improve the quality of academic writing but also uphold academic integrity (Oke & Olatunji, 2023). Additionally, AI applications in language processing can aid postgraduate students and researchers whose academic writing may be limited by proficiency in English. AI-assisted writing support systems can help in improving clarity, coherence, and academic tone in thesis and journal submissions.
6. **Security and Surveillance:** As security becomes a growing concern in Nigerian higher institutions due to threats such as examination malpractice, cultism, and in some cases terrorism AI has found increasing application in enhancing campus safety. AI-powered facial recognition systems, smart cameras, and real-time monitoring software can be employed to control access to examination halls, dormitories, and sensitive facilities. Institutions like Covenant University and the University of Lagos have begun experimenting with advanced surveillance systems to prevent unauthorized access and curb exam-related fraud. These AI tools can detect suspicious behavior, identify individuals on watchlists, and alert security personnel instantly (Ogunlade & Usman, 2022). Furthermore, AI can play a role in maintaining academic integrity. During online examinations, AI-driven proctoring software can monitor students through webcams, track screen activity, and flag anomalies in real time. While such tools raise important ethical questions regarding privacy, their careful implementation can help in preserving academic standards in virtual environments.

The integration of Artificial Intelligence in higher education in Nigeria presents vast opportunities to revolutionize the education sector. From enhancing personalized learning through smart tutoring systems to improving administrative operations, strengthening research, and securing academic environments, AI holds transformative potential. However, for these benefits to be fully realized, deliberate investment, policy reform, and capacity building will be necessary. As Nigeria seeks to improve the quality and accessibility of higher education, AI stands out as a vital instrument for change and sustainable development.

Challenges of Artificial Intelligence in Nigerian Higher Education

While the potential benefits of Artificial Intelligence (AI) in higher education are well recognized, the adoption and integration of these technologies in Nigeria face numerous challenges. These challenges are structural, technical, financial, and ethical in nature, posing serious impediments to the full-scale deployment of AI-driven solutions in universities and colleges. Understanding these barriers is critical for formulating strategies to overcome them.

1. **Inadequate Infrastructure:** One of the most critical impediments to the adoption of AI in Nigerian higher education is the lack of enabling infrastructure. The implementation of AI systems requires robust ICT infrastructure, including reliable internet connectivity, modern computing equipment, cloud computing platforms, and uninterrupted power supply. Unfortunately, many Nigerian universities, particularly those in rural or semi-urban areas, struggle with poor digital infrastructure (Ogunlade & Usman, 2022). Broadband penetration remains low, and access to high-speed internet is inconsistent, making it difficult to support real-time AI applications such as intelligent tutoring systems or cloud-based learning platforms.

   Moreover, most universities still operate with outdated hardware and software, which are incompatible with modern AI algorithms and systems. The lack of smart classrooms, data centers, and secure servers further exacerbates the problem. These infrastructural deficits not only slow down adoption but also reduce the effectiveness and scalability of AI innovations within the education sector.
2. **Limited Technical Expertise:** The successful deployment of AI tools requires a skilled workforce capable of designing, developing, and maintaining such systems. In Nigeria, the shortage of AI professionals such as data scientists, machine learning engineers, and AI ethicists—poses a major constraint. Many academic institutions do not offer specialized training in AI, and existing staff often lack the technical competencies to implement and manage AI projects (Adebayo & Salako, 2021). Furthermore, most educators and administrative personnel are not exposed to continuous professional development in emerging technologies. The lack of training programs or partnerships with tech companies means that university staff are not adequately equipped to leverage AI for teaching or administration. This skills gap limits innovation and prevents institutions from exploring the full spectrum of AI capabilities.
3. **High Cost of Implementation:** AI systems are capital-intensive, requiring substantial investment in both hardware and software. The costs associated with acquiring AI platforms, setting up infrastructure, training staff, licensing software, and conducting regular maintenance are often beyond the financial capacity of many Nigerian public universities. Given the chronic underfunding of the education sector in Nigeria, it becomes extremely difficult for institutions to allocate sufficient resources to AI deployment (Oke & Olatunji, 2023). For example, AI-powered Learning Management Systems (LMS) with adaptive learning capabilities cost significantly more than standard LMS. Similarly, AI-enabled surveillance and security systems are more expensive than traditional CCTV setups. Without targeted funding or budgetary prioritization, it is unlikely that institutions will be able to afford the long-term costs of AI adoption.
4. **Resistance to Change:** Beyond technical and financial constraints, human factors such as resistance to change also pose significant challenges. Many academic and administrative staff in Nigerian universities are accustomed to traditional methods of teaching, learning, and management. As such, they may be reluctant to embrace new technologies that they perceive as disruptive or complex (Okoye & Ezema, 2020). This resistance is often fueled by fear of job displacement, especially when AI is introduced to automate tasks such as grading, scheduling, or administrative support. In some cases,

there is also a cultural or generational divide where older faculty members feel alienated by new technological trends. This lack of enthusiasm for innovation hampers institutional transformation and slows the adoption of AI tools.

5. **Ethical and Privacy Concerns:** The implementation of AI in higher education raises important ethical and legal questions, particularly concerning data privacy, algorithmic bias, surveillance, and informed consent. In Nigeria, these issues are even more complex due to the absence of comprehensive data protection laws and guidelines for ethical AI use in education (UNESCO, 2021). For example, AI systems that track student behavior or academic performance may inadvertently infringe on students' privacy if data is collected or used without proper consent. Similarly, facial recognition technologies and AI proctoring tools used during online examinations can lead to concerns about surveillance and misuse of biometric data. Moreover, AI algorithms trained on biased datasets may produce unfair outcomes, particularly affecting marginalized or underrepresented student groups. These ethical issues must be addressed through well-defined regulatory frameworks and institutional policies that prioritize fairness, transparency, and accountability.
6. **Lack of Policy Framework:** Despite increasing interest in AI across Africa, Nigeria currently lacks a national policy specifically dedicated to the integration of AI in the education sector. The absence of a coherent policy framework means that individual institutions are left to chart their own course without guidance, support, or standardization. This often leads to fragmented efforts, duplication of initiatives, and inconsistent levels of adoption (Benaim & Lalloo, 2021). Furthermore, key agencies such as the National Universities Commission (NUC), the Federal Ministry of Education, and the National Information Technology Development Agency (NITDA) have yet to develop a coordinated strategy to mainstream AI in higher education. Without clear policy direction, it becomes difficult to attract investments, mobilize resources, or monitor progress in AI integration. This policy vacuum also hinders collaboration between academia, industry, and government.

Way Forward

To overcome the multifaceted challenges hindering the adoption and effective use of Artificial Intelligence in higher education institutions in Nigeria, strategic and pragmatic solutions must be implemented. These solutions should be tailored to address the infrastructural, technical, financial, cultural, ethical, and policy-related barriers identified. The following proposals provide a comprehensive pathway toward enhanced AI integration in Nigerian universities and colleges.

1. **Addressing Inadequate Infrastructure:** To overcome the infrastructural deficits plaguing higher education institutions, there is a pressing need for substantial investment in ICT infrastructure. Universities must prioritize the development of modern computer laboratories, campus-wide broadband connectivity, uninterrupted power supply, and access to cloud-based platforms. Government agencies should work in collaboration with private sector partners to fund the expansion of digital infrastructure across campuses. In addition, institutions should adopt scalable and cost-effective technologies, including open-source AI tools, which can operate efficiently within limited resource environments. Equipping academic environments with the technological foundation necessary for AI will set the stage for long-term digital transformation.
2. **Bridging the Gap in Technical Expertise:** The shortage of skilled AI professionals and educators in the Nigerian higher education system can be addressed through targeted capacity-building programs. Universities should organize regular workshops, training sessions, and certification programs focused on AI, machine learning, and data science

for academic and administrative staff. These programs should be practical, industry-driven, and integrated into professional development frameworks. Furthermore, institutions should consider establishing dedicated AI research centers and innovation hubs where staff and students can collaborate on technology-driven projects. Engaging diaspora experts, forming academic partnerships with global AI institutions, and incorporating AI into the curriculum of relevant disciplines can also foster the development of in-house expertise.

3. **Tackling the High Cost of Implementation:** Although AI technologies are typically resource-intensive, creative funding strategies can mitigate the financial burden on institutions. Universities should actively seek alternative funding through grants, research collaborations, and public-private partnerships. The establishment of technology endowment funds can provide long-term financial support for AI initiatives. Institutions may also negotiate subsidized access to AI platforms with technology vendors or adopt freemium software models that allow incremental scaling. Implementing AI in phases starting with high-impact, low-cost areas such as administrative automation or e-learning support can help institutions manage costs while demonstrating value to attract further investment.
4. **Overcoming Resistance to Change:** Resistance to change, particularly among academic and administrative personnel, can be addressed through inclusive change management strategies. Institutions must foster a culture of innovation by involving all stakeholders in the planning and implementation of AI initiatives. Awareness campaigns, success stories, and demonstration projects can help demystify AI and highlight its benefits to staff and students alike. Creating a supportive environment where educators feel empowered, rather than threatened, by technology is essential. Providing incentives for early adopters, recognizing innovation in teaching and administration, and integrating digital literacy into staff evaluation criteria can promote wider acceptance and engagement.
5. **Managing Ethical and Privacy Concerns:** Ethical concerns surrounding the use of AI in higher education must be addressed through the establishment of clear institutional guidelines on data governance, user consent, transparency, and fairness. Universities should develop comprehensive data protection policies that define the scope of data collection, usage, and storage related to AI systems. It is essential to establish ethics committees to oversee the implementation of AI tools and ensure compliance with best practices in privacy and equity. Educating both students and staff on the responsible use of AI technologies can foster trust and promote ethical behavior. Provisions should also be made to audit AI systems periodically to detect and rectify algorithmic bias or misuse.
6. **Developing a Robust Policy Framework:** The absence of a national AI policy tailored to the education sector necessitates the urgent development of a comprehensive strategic framework. Government bodies responsible for education and technology should collaborate to formulate guidelines that promote the responsible adoption of AI in Nigerian higher institutions. These policies should provide clarity on standards, priorities, ethical boundaries, and performance metrics. Universities should be supported in developing institutional AI strategies aligned with national goals, including digital transformation, inclusive education, and research development. A central coordinating body could be established to monitor implementation, share best practices, and facilitate resource-sharing across institutions.

Conclusion

The integration of Artificial Intelligence (AI) into higher education represents a transformative shift in the delivery, management, and experience of learning in the 21st century. For Nigeria, the adoption of AI offers a powerful tool for addressing many of

the long-standing challenges in the higher education system, including overcrowded classrooms, administrative inefficiencies, low research output, and limited access to quality education. AI technologies such as smart tutoring systems, predictive analytics, virtual classrooms, and intelligent administrative tools have the potential to significantly improve teaching and learning outcomes, streamline university operations, and enhance the overall academic experience.

However, the realization of these benefits is not without obstacles. As this study has revealed, higher education institutions in Nigeria face significant challenges in deploying AI, including poor digital infrastructure, lack of skilled personnel, high implementation costs, resistance to change, ethical and privacy concerns, and the absence of a comprehensive policy framework. These challenges not only hinder technological advancement but also deepen the digital divide between Nigerian universities and their global counterparts.

To move forward, deliberate and coordinated efforts are required from all stakeholders, including government agencies, university management, academic staff, industry partners, and students. Investment in infrastructure, human capacity development, inclusive policymaking, and awareness campaigns must be prioritized to facilitate a smooth and sustainable integration of AI technologies into the educational ecosystem. While the road to AI adoption in Nigerian higher education may be challenging, it is both necessary and inevitable. Institutions that embrace innovation and strategically position themselves to harness the power of AI will not only improve their educational delivery but will also become more competitive and relevant in the global knowledge economy. Therefore, the effective application of AI in Nigeria's higher education sector must be pursued with urgency, vision, and a commitment to excellence.

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