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Integration of Artificial Intelligence in Curriculum Development: Opportunities and Challenges for Rivers State

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Abstract

This study explores the Integration of Artificial Intelligence (AI) into Rivers State educational system, examining its potential to revolutionize curriculum development and address longstanding challenges in the education sector. As global advancements in AI reshape teaching and learning practices, Rivers State faces unique infrastructural and financial obstacles that hinder the full adoption of AI-driven educational technologies. This research highlights their transformative impact on personalized learning, real-time feedback, and administrative efficiency. The study also evaluates the efforts of the Rivers State government, including the establishment of the National Agency for Research in Robotics and Artificial Intelligence (NARRAI), to foster AI innovation in education. While recognizing the significant hurdles, this research emphasizes the critical need for strategic investment in infrastructure, teacher training, and curriculum innovation to bridge the gap between current capabilities and future demands. The findings underscore the importance of a multifaceted approach, combining government initiatives, academic involvement, and private sector collaboration, to create a scalable, inclusive educational system that prepares Nigerian students for an AI-driven future.

Keywords: Artificial intelligence, Curriculum Development, Innovation, Multifaceted, Robotics

Introduction

In ancient times, traditional classrooms were the main place for student education, using the same teaching methods and consistent guidance from teachers. However, having all students learn at the same time made it hard to meet individual learning needs (Sampayo-Vargas, Cope & Byrne, 2013). Recently, rapid technological advancements have led to many new digital tools and services. The fast development of computer technology has significantly changed the learning environment, with more educational resources becoming computerized.

These technologies improve learning experiences, help develop skills, and promote classroom collaboration, showing the transformative impact of technological progress. It's now possible

to quickly access expert knowledge through intelligent tutoring systems that replicate teachers' expertise to offer personalized help (Pai, Kuo, Liao & Liu, 2021).

Artificial Intelligence (AI) is a powerful force that can reshape social interactions, especially in education. AI-driven teaching and learning solutions are being tested to prepare students for an AI-driven future (Pedro, Subosa, Rivas & Ververde, 2019). The use of AI in education aims to enhance knowledge acquisition, leading to more online learning. This necessitates a paradigm shift in national curricula, formalizing a new educational normal characterized by innovative approaches. This research explores the convergence of curriculum innovation and the integration of artificial intelligence (AI) in Nigeria's educational landscape, recognizing the pivotal role of curriculum in shaping the vision for education.

Curriculum, as the foundation of educational systems, is critical to promoting innovation. As a result, there is a growing realization that curriculum innovation is essential for bridging the gap between obsolete educational techniques and the changing demands of current learners. Incorporating AI into curriculum development is a crucial step towards overcoming space limits in education. AI is a cutting-edge technology that mimics human intellect through machine learning, neural networks, and natural language processing. Artificial intelligence has the potential to transform educational experiences. While AI is still in its early stages in underdeveloped nations like Nigeria, it has already demonstrated potential for personalized learning, real-time feedback, and early detection of learning impediments. The study highlights the importance of AI in aligning educational practices with the demands of the fast-expanding digital age.

In Nigeria and many developing countries are faced with challenges in fully benefiting from AI due to infrastructural limitations and limited internet access. Developing nations struggle with operational and technological challenges, making it hard to integrate AI-backed learning despite its recognized benefits. Financial constraints worsen the situation, hindering the establishment of necessary infrastructure and internet access. In Nigeria, where millions apply for admission, universities cannot accommodate the influx due to technological deficiencies (Adesulu, 2018). Institutions offering distance learning face challenges in providing robust AI e-learning platforms, manual processes are still common due to technological limitations. In advanced countries, AI is at the forefront and widely adopted by well-funded universities. While Nigeria has reputable academic institutions, the lack of financial support hinders their ability to keep up with the latest AI advancements. As a result, scholars in the field of AI show

less commitment to their work. Despite the availability of online learning resources in many institutions, only a few actively develop AI capabilities (Liverpool, Marut, Ndam & Oti, 2009; Robinson, 2018; Adejo & Misau, 2021; Enang, 2022). As observed with online learning, students face computer literacy challenges, making it hard for them to engage with technology-based education. This issue stems from the failure of institutions to innovate teaching and learning methods.

However, the pandemic catalyzed a paradigm shift, with a remarkable 86 percent of educators advocating for the integral role of technology in education (Madhurjya, 2022). This shift underscores the urgency of reconsidering traditional approaches to education and embracing the transformative potential of AI. As the conversation around the convergence of AI and education gains momentum, it is critical to recognize the multifaceted nature of AI's effect, which presents both challenges and opportunities

Integrating AI-enabled learning into universities requires educating teacher educators and providing professional development and support. However, current workshops and training have proven inadequate. AI-based learning could address the challenge of limited physical space on university campuses (Ndzibah & Ofori, 2017). Incorporating AI into curriculum development is a crucial step towards overcoming space limits in education. AI is a cutting-edge technology that mimics human intellect through machine learning, neural networks, and natural language processing. Artificial intelligence has the potential to transform educational experiences. While AI is still in its early stages in Nigeria, it has already demonstrated potential for personalised learning, real-time feedback, and early detection of learning impediments. The study highlights the importance of AI in aligning educational practices with the demands of the fast-expanding digital age.

Scholars and researchers have extensively explored the applications of AI in education, highlighting its multifaceted impact. Among the major AI technologies instrumental in reshaping educational practices are machine vision, expert systems, machine learning, natural language processing, deep learning, and robotics.

1. Machine Vision (MV): Machine vision is commonly referred to as computer vision, is a key technique in artificial intelligence. Richter, Mann, Bond and Gouverneur (2019) describes machine vision as a capability that empowers software to recognize patterns, make predictions, and adapt discovered patterns to unforeseen situations. Operating with high speed, precision,

and accuracy, machine vision replicates human visual perception, utilizing cameras and computers for functions such as recognition, tracking, object measurement, and image processing. This technology finds applications in video surveillance, facial recognition, biometric face scanning, autonomous driving, medical image analysis, and archaeology (Chen, 2019).

In the educational context, machine vision proves invaluable for tasks like attendance recording, monitoring students' facial expressions, and detecting signs of confusion in learners. However, the incorporation of machine vision into education holds immense promise for improving attendance tracking, enhancing classroom dynamics through facial expression monitoring, and providing targeted support for students facing challenges in comprehension.

2. Natural Language Processing (NLP): Natural Language Processing (NLP) stands at the intersection of AI and linguistic communication, focusing on emulating human natural language patterns. This technology facilitates interaction with intelligent systems using natural languages, both written and spoken. Kolodny (2017) emphasizes the integration of NLP into various applications, such as talking calculators, enabling oral dictation of numbers and signs. Furthermore, NLP broadens access to information for individuals with visual impairments, hearing difficulties, and motor challenges, fostering independent conversations. Common services like Google Translate and chatbots exemplify the practical applications of NLP, providing multilingual access to information. The incorporation of Natural Language Processing into educational contexts offers avenues for enhanced language learning, spelling and grammatical corrections, and multilingual support. AI-driven writing assistants based on NLP and Machine Learning present opportunities to augment the writing process, providing corrective feedback and recommendations for improvement.

3. Machine Learning (ML): Machine learning (ML) stands as the forefront of Artificial Intelligence, encompassing the design, training, and deployment of models to applications, processes, and other machines. Chen (2019) delineates ML's core components, including algorithms, Application Programming Interfaces (APIs), development and training toolkits, data, and computing power. Goksel and Bozkurt (2019) emphasize ML's dynamic application, utilizing existing data for predictive analysis. In education, ML plays a pivotal role in optimizing course material selection through content providers, employing feedback and scoring systems for assignment grading, plagiarism detection, and student progress assessment. Integration with Natural Language Processing enhances applications like text-to-speech and

language translation, exemplified by Google Translate. ML transforms information retrieval by automating suggestions and recommendations based on geographic location, search history, and user preferences, providing students and lecturers' access to a wealth of internet knowledge. The integration of Machine Learning into educational practices not only streamlines administrative tasks but also enhances the learning experience, offering personalized content recommendations and revolutionizing information retrieval for academic purposes.

4. Expert System (ES): Expert systems (ES) represent a pivotal facet of Artificial Intelligence (AI), embodying the capacity of computer software to replicate human expertise within a specific domain, facilitating problem-solving through a meticulously organized knowledge base. Nwigbo and Madhu (2016) underscore the utilization of expert systems in education, particularly within the Intelligent Tutoring System (ITS). These systems function as adept tutors, delivering personalized learning experiences by considering students' prior knowledge and abilities. Notably, AI-driven career coaches embedded with expert systems provide individualized advice to students, incorporating historical data, experiences, location preferences, skills, and career requirements (Khare, Steward & Khare, 2018). The integration of expert systems into educational frameworks holds significant implications for personalized learning and career guidance. By replicating human expertise, these systems contribute to a tailored and adaptive educational experience, aligning with the diverse needs and aspirations of students.

5. Deep Learning (DL): Deep Learning (DL), synonymous with deep neural networks, represents a sophisticated facet of machine learning primarily utilized in pattern recognition and classification applications with substantial datasets. Chen (2019) highlights DL's capacity to enable virtual assistants to detect and comprehend speech, images, sound, and videos. In the realm of education, DL significantly augments online learning efficiency, as adaptive educational software tailors content to meet individual student needs. This fosters personalized learning experiences, providing avenues for students to receive additional assistance from tutors, thereby enriching the overall learning process. The incorporation of Deep Learning into online learning platforms presents a transformative potential, offering personalized learning experiences and reinforcing the role of technology in addressing individual learning needs.

6. Robotics: Robotics, encompassing the design, construction, operation, and application of robots, represents a multifaceted science and technology domain. The Robot Institute of America's definition underscores the reprogrammable, multifunctional nature of robots,

capable of executing various tasks through programmed motions. Odoh (2018) emphasizes that robots are equipped with sensory capabilities akin to human environmental perception. In the educational context, robots offer synchronous lessons to absent students, exemplified by Avatarion's technology connected to Microsoft Azure IoT Hub. This facilitates full video and audio connections for students in hospitals or homes, allowing them to actively participate in the learning process through a tablet-controlled robot. This innovative approach bridges the gap for physically absent students, transforming traditional learning dynamics. The integration of robotics into education holds significant implications for inclusivity, enabling absent students to engage actively in the learning process. This technological advancement fosters a more accessible and participatory educational environment.

AI in Curriculum Development

Artificial Intelligence (AI) plays a pivotal role in revolutionizing curriculum development, primarily leveraging Machine Learning and Text Mining methods (Somasundaram, Latha & Saravana, 2020). Somasundaram et al. (2020) proposes an innovative educational program model grounded in AI back-propagation concepts, tailoring curriculum elements (prerequisites, content, expected outcomes) to meet labour market demands. While the model exhibits promise, its focus remains confined to the realm of Internet of Things (IoT).

Despite steps in personalized educational systems (Rojas-López & Gracia-Penalvo, 2022), scalability remains a significant challenge. Current approaches focus on key content domains and may compromise on the quality of educational content due to scalability issues (Zhang, James & Yang, 2020). There is an urgent need for a scalable and dynamic curriculum development approach that caters to individual learner needs, encompasses relevant knowledge areas, integrates high-quality educational content, and requires minimal maintenance efforts (Zhang et al., 2020). The integration of AI into curriculum development heralds a new era of personalized education, aligning with individual learner needs and labour market demands. However, addressing scalability issues is imperative for sustained success, ensuring that educational systems can adapt dynamically to evolving requirements while maintaining high standards of content quality and relevance.

Artificial Intelligence (AI) has become a focal point in Nigeria's educational landscape, exemplified by the establishment of the National Agency for Research in Robotics and Artificial Intelligence (NARRAI) in 2018. The government, recognizing the transformative potential of AI, entrusted NARRAI with the coordination and oversight of all AI and robotics

research endeavours. Minister of Science and Technology, Dr. Ogbonnaya Onu, emphasized NARRAI's commitment to collaboration with international research bodies, partnership with tertiary institutions, and the facilitation of Nigeria's proficiency in leveraging AI technologies for economic growth (Ladeinde, 2019). This strategic initiative reflects the government's proactive stance in integrating AI into the national curriculum.

Efforts of AI Integration in the Nigerian Government

In alignment with its commitment to advancing AI, the Nigerian government has taken substantial steps, as illustrated by the formation of NARRAI. Bobai Ephraim Kato's accomplishment in developing a functional AI robot for his final year project further exemplifies the individual initiatives within the country. Kato's creation, capable of puzzle-solving, underscores the potential for AI to contribute meaningfully to problem-solving in education (Ogbonnia, 2017).

Initiatives like ScholarX, a Nigerian social impact start-up, are pivotal in addressing educational disparities. ScholarX focuses on providing access to quality education for young Africans from low-income backgrounds through scholarships, crowd funding, and e-learning initiatives (Nsehe, 2019). The AI innovation from the Obafemi Awolowo University iLab team, particularly the Remote Lab developed by Ishola Babatunde Isaac, showcases the practical integration of AI in educational settings. This system allows students to control laboratory equipment remotely, overcoming constraints of time and space for experimentation in Nigerian universities (Ogbonnia, 2017).

Furthermore, global technology giant Google's establishment of an AI research hub at the University of Lagos in June 2018 highlights the international recognition of Nigeria's potential in AI research and development (Hussain, 2018). These collective efforts, both at the governmental and individual levels, demonstrate a comprehensive approach to integrating AI into the fabric of Nigerian education, with far-reaching implications for curriculum development. The active involvement of the Nigerian government and innovative individuals in fostering AI initiatives signals a paradigm shift in curriculum development. The establishment of NARRAI and various AI applications in education imply a commitment to enhancing learning experiences, promoting problem-solving skills, and preparing students for a technologically advanced future. The synergy between government initiatives and grassroots innovations holds the promise of, a curriculum that aligns with the evolving demands of the digital age.

Conclusion

Curriculum changes are prompted by evolving societal needs, cultural shifts, and responses to economic, social, and political dynamics. Technological advancements, such as the integration of artificial intelligence (AI), play a pivotal role in reshaping curriculum implementation within tertiary education. This paper has explored the multifaceted contributions of AI in Nigerian tertiary institutions. The integration of Artificial Intelligence (AI) into Nigeria's educational system presents both significant opportunities and considerable challenges. As AI technologies continue to revolutionize global education, Nigeria must strategically address infrastructural and financial constraints to fully benefit from this transformation. The establishment of the National Agency for Research in Robotics and Artificial Intelligence (NARRAI) and various AI-driven initiatives reflect the country's commitment to embedding AI within its curriculum development framework. However, for these efforts to bear fruit, sustained investment in infrastructure, teacher education, and curriculum innovation is essential.

Embracing AI offers the potential to personalize learning, optimize educational resources, and equip students with the skills needed for a rapidly evolving digital landscape. The road ahead demands a concerted effort to bridge the gap between current capabilities and the future demands of education, ensuring that Nigeria's learners are prepared to thrive in an AI-driven world. This will require a multifaceted approach, combining government initiatives, academic involvement, and private sector support to create a robust, scalable, and inclusive educational system. Ultimately, the successful integration of AI into Nigeria's educational landscape could serve as a model for other developing nations, highlighting the transformative power of technology in shaping the future of education.

Suggestions

Based on the findings of this study, the following recommendations are suggested:

1. Government and relevant authorities in education to create comprehensive training programs for educators to improve their understanding and application of AI in the classroom. These programs should focus on both the technical aspects of AI and pedagogical strategies for effectively incorporating AI tools into teaching and learning processes.
2. Opportunities for collaboration between the government, academic institutions, and private sector tech companies. Public-private partnerships could provide the necessary

- infrastructure, funding, and expertise to accelerate the integration of AI in education, particularly in under-resourced areas.
3. Government through appropriate agencies should provide professional training and freedom, granting teachers the opportunity to pursue relevant courses during school hours, to support their competence and enhance their contribution to curriculum development. Employee of educators and school leaders should foster collaborative learning experiences among teachers, utilizing mentorship programs and group activities, to enhance relatedness, promote a sense of belonging and community among educators, and increase their motivation and engagement in curriculum planning.
 4. There is need for continuously evaluate the effectiveness of autonomy-supportive strategies and professional development initiatives in fostering teachers' motivation and engagement and adapt approaches based on feedback and outcomes to ensure sustained commitment to curriculum development efforts.

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