

Leveraging the transformative power of artificial intelligence for effective and sustainable curriculum development in Nigeria

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Abstract

The application of Artificial Intelligence (AI) in education has the potential to transform traditional curriculum development processes by offering innovative solutions to enhance learning outcomes. This paper explores the impact of AI on curriculum design, focusing on its potential to personalize learning experiences, streamline administrative tasks, and provide data-driven insights for continuous improvement. The utilization of AI technologies offers opportunities for educators to create adaptive curricula that cater to diverse student needs, fostering an inclusive and engaging learning environment. Additionally, the paper examines various AI applications in curriculum development, including intelligent tutoring systems, predictive analytics, and automated content creation. Nonetheless, despite its numerous benefits, the integration of AI into curriculum design presents several challenges. These include concerns over data privacy, ethical considerations regarding AI-generated content, the risk of reducing human oversight in curriculum decision-making, and the digital divide that limits access to AI-driven educational tools in under-resourced regions. Furthermore, the complexity of AI systems requires specialized expertise, posing challenges for educators with limited technical proficiency. To

address these challenges, this paper suggests implementing clear ethical guidelines for AI-driven curriculum development, enhancing teacher training programmes to equip educators with AI literacy, and fostering collaborations between educational institutions and technology developers to create user-friendly AI tools. Additionally, policies should be put in place to ensure equitable access to AI resources and preventing further educational disparities.

Keywords : Artificial intelligence, AI technologies, AI application, curriculum development,

Introduction

Curriculum development is a planned, purposeful, progressive, and systematic process aimed at creating positive improvements in the educational system. Whenever changes or developments occur around the world, school curricula are affected (Kranthi, 2017). Mitchell (2016), on the other hand, conceptualizes curriculum development as a process or a series of steps to create a complete curriculum. This curriculum is a continuous process and a living document that requires constant updating and review. Curriculum development plays a crucial role in shaping the educational experiences of students. Similarly, Glatthorn (2012) describes curriculum development as a systematic and intentional process of planning, implementing, and evaluating the

learning experiences offered to students within an educational program. It encompasses the content, structure, methods, and resources used to achieve desired learning outcomes for students at specific stages of development and within particular educational contexts.

A well-developed curriculum promotes equity and inclusivity, equips learners with essential knowledge, and prepares them for future challenges. Consequently, curriculum planners and teachers are striving to meet these challenges by incorporating technology for effective service delivery and the realization of educational goals (Dwivedi, Vishwakarma, & Pandey, 2021). From the above perspectives, one can deduce that curriculum development involves improving existing educational programs to meet pressing needs. It is also regarded as a continuous process, since knowledge is dynamic and societal needs and demands are constantly changing. Thus, curriculum development is an indispensable tool for fostering educational growth and national development.

In recent times, the world has witnessed rapid technological advancements, particularly with the integration of Artificial Intelligence (AI) across nearly all fields of human endeavor. This has made AI a powerful tool in education. Khlaif, Alzahrani, and Al-Azmi (2022) argue that AI can revolutionize curriculum development by providing data-driven insights, personalized learning paths, and adaptive assessments. This enables educators to tailor curricula to the specific needs and preferences of individual students, thereby enhancing learning outcomes and preparing them for the future. Therefore, this paper discusses the role of Artificial Intelligence (AI) in curriculum development.

Importance of Curriculum Development

Curriculum development holds immense importance in education. It serves as a roadmap for educators, guiding them in delivering effective instruction and achieving desired learning outcomes. A well-designed curriculum ensures that students receive a comprehensive education that covers essential

concepts and skills. It enables educators to provide a cohesive and structured learning experience, promoting engagement, motivation, and deep understanding. Moreover, curriculum development helps in aligning educational goals and standards, fostering continuity across different grade levels and institutions. By integrating AI into curriculum development, educational institutions can enhance their ability to create relevant and impactful learning experiences for students.

Curriculum development especially with the integration of AI tools presents enormous benefits that cut across students and society. It lays the foundation for individual and societal well-being. Analysing students' needs, the demands of society, and the values to be instill, we can develop a curriculum that empowers students to thrive in a rapidly changing world and contribute positively to the future. Al-Enezi, and Alshareeda, (2020) believe that a well-developed curriculum provides essential knowledge and skills, prepares students for future challenges, promotes engagement and motivation; and provides essential knowledge and skills to students. Similarly, Glatthorn, (2012) maintained that curriculum development is essential for the growth of a society as it promotes informed citizens, supports workforce development, reduces inequality and promotes social mobility and contributes to innovation and progress.

Artificial Intelligence

Artificial intelligence (AI) according to Fahimirad and Kotamjani (2018) is a computing system, which engaged human-like processes such as learning, adapting, synthesizing, self-correction and the use of data for complex processing tasks. Similarly, Franenfield (2020) conceptualize AI as the simulation or replication of human intelligence in machines. In addition, Ferguson (2020) viewed AI as broad field of automated decision-making devoid of human intervention. It covers a variety of topics, including neural networks and conditional logic

Use of AI for Curriculum development

The influence of Artificial Intelligence (AI) in education is increasingly becoming more compelling prominent. AI technologies can support educators in various aspects of teaching and learning, including curriculum development. AI systems can analyse vast amounts of educational data, identify patterns, and generate insights for curriculum design (Dwivedi, Vishwakarma, & Pandey, 2021). Similarly, Khlaif, Alzahrani, and Al-Azmi (2022) maintained that use of AI enables automation of certain tasks which gives teachers ample opportunity to introduce learner centric activities such as individualized instruction and mentoring. Additionally, AI can assist in developing adaptive learning paths, tailoring content based on student performance and preferences. Through its ability to process and interpret data, AI enhances the efficiency and effectiveness of curriculum development processes. Moreover, Pal (2023) in a study of Artificial Intelligence: reshaping the topography of pedagogic practices—a comparative study on curriculum construction, teaching modalities, and evaluation techniques; revealed that AI holds transformative potential in modifying the landscape of educational practices. The incorporation of AI in education can pave the way for more flexible curriculum design, personalized instruction, and sophisticated evaluation methods. These breakthroughs might give rise to more individualized, inclusive, and data-centric education systems, thus amplifying learning outcomes and widening access to high-quality education.

Integrating artificial intelligence (AI) into curriculum development can enhance educational experiences and better prepare students for the rapidly evolving technological landscape. The following are several ways through which AI can be utilized in curriculum development:

Jumpstarting Curriculum Design Using AI

AI can significantly streamline the initial stages of curriculum design by functioning as a smart assistant

for educators. It can generate course outlines, define learning objectives, suggest sequencing of topics, and create draft lesson plans based on curriculum standards or keywords (Blaik-Hourani et al., 2022; Cheng et. al., 2021; Novita, 2025). For instance, large language models like GPT can simulate expert-level brainstorming by offering structured content aligned with Bloom's taxonomy or other pedagogical frameworks. This jumpstart capability is especially useful in contexts where curriculum developers face time constraints or lack subject matter expertise in emerging fields.

Moreover, AI can pull from vast educational datasets to recommend globally-relevant content and integrate cross-disciplinary themes, ensuring curricula remain current. Tools like Content Technologies Inc. or platforms like Squirrel AI (used in China) already offer such capabilities, suggesting the approach is both feasible and scalable (Holmes et al., 2019). In low-resource settings, open-source AI tools could democratize curriculum innovation, allowing more teachers to participate meaningfully in design. Additionally, AI-driven curriculum platforms can support iterative design processes, where feedback is rapidly analyzed and used to refine course materials in real-time.

Personalisation of learning

AI can also enhance the personalization of education by adapting curriculum content to individual student needs. Through machine learning techniques, AI algorithms can analyse student data, such as learning preferences, strengths, and weaknesses, to develop customised learning pathways (An & Xie, 2020) this personalized approach, ensures that each student receives tailored instruction, maximizing their learning potential and engagement, this implies that each student progresses at their own pace (Al-Enezi, & Alshareeda, 2020).

Streamlining curriculum development process and data-driven decision-making

AI can play a crucial role in streamlining curriculum development processes by automating certain tasks

that would otherwise be time-consuming and resource-intensive. For instance, AI algorithms can analyse vast amounts of education-related data, including academic research, student performance metrics, and educational resources (Chen & Cheng, 2019), by processing this data, Liu and Li (2018) relate that AI can identify patterns and trends, enabling curriculum developers to make data-driven decisions when designing instructional materials and learning activities.

Creation of interactive and immersive learning experiences

In a study of educational data mining and learning analytics Khan and Yacef (2017) stressed that AI can contribute to the creation of more interactive and immersive learning experiences. For example, virtual reality (VR) and augmented reality (AR) technologies powered by AI algorithms can simulate real-world scenarios, enabling students to apply their knowledge in practical contexts. This hands-on approach enhances comprehension and retention, making learning more engaging and meaningful.

Identification of knowledge gaps

Bennett and Matonak (2023) opined that AI-powered algorithms can assist in identifying gaps or weaknesses in existing curricula. By analysing student performance data, AI can pinpoint areas where students may be struggling or where the curriculum may be lacking in effectiveness; this information to Khlaif, Alzahrani, and Al-Azmi (2022) allows educators to make targeted adjustments and improvements to the curriculum, ensures that it meets the needs of students and aligns with educational goals.

Automation of routine tasks

AI can automate many of the routine tasks involved in curriculum planning, such as scheduling, grading, data analysis and creating assessments. This can free up teachers' time so that they can focus on more high-level tasks, such as planning lessons and providing support to students, leading to increased efficiency

and effectiveness in curriculum development (Chen & Cheng, 2019).

Challenges of Using AI for Curriculum Development in Nigeria

While AI holds substantial promise, its practical implementation in Nigeria faces systemic and logistical challenges. Foremost is the digital divide: many schools, particularly in rural areas, suffer from limited or no access to stable electricity, internet connectivity, or functional ICT equipment. This makes deploying AI-based tools nearly impossible without foundational infrastructure investment.

Educator readiness is another major issue. Many Nigerian teachers lack the digital literacy or professional development needed to effectively leverage AI tools (Eguagie, 2025). Without adequate training and support, the risk of misuse or underuse of AI increases. Furthermore, financial constraints at both governmental and institutional levels limit procurement and maintenance of AI systems. Security and data privacy concerns also arise in a context where data protection laws are still evolving.

Cultural and institutional resistance to innovation, often rooted in skepticism about automation and change, further slow adoption. There is fear among some educators that AI might displace human input or undervalue traditional teaching methods (Novita, 2025; Yunusa & Yusuf, 2025). For AI integration to succeed, efforts must address infrastructure gaps, capacity building, ethical concerns, and policy reform.

Future direction on the use of AI in Curriculum Development

- i. The adoption of Artificial intelligence (AI) into curriculum development presents a bright future for the advancement of Education, especially in the era of rapid development. Nigeria, with its systemic challenges, stands to benefit more from this transformative advancement. Artificial intelligence systems like Generative AI, adaptive learning systems, data analytics are

evolving and have great potential in redefining curriculum design and instructional practices. Therefore, the future of AI in curriculum development must consider inclusivity, agility, and sustainability in order to be on the same page with Nigeria's peculiarities. Adopt AI utilisation: Curriculum planners should adopt and utilise AI tools that can enhance curriculum design. This includes intelligent tutoring systems, predictive analytics, and automated content creation tools.

- ii. **Focus on Personalization:** Utilize AI to create adaptive learning experiences that are tailored to individual learners' needs. This can help in addressing diverse learning styles and improving student engagement and outcomes.
- iii. **Data-driven decision-making:** There is a need to leverage AI tools for the analysis of educational data and gain insights into students' performance and curriculum effectiveness. This can inform continuous improvement and ensure that the curriculum remains relevant and effective.
- iv. **Professional Development:** Organise training of educators and curriculum planners to guide them on the effective integration of AI tools. This will ensure that they are equipped with the necessary skills to implement and manage AI-driven curriculum development.
- v. **Ethical Considerations:** Address the ethical implications of AI in education, such as data privacy, bias, and the digital divide. Establish guidelines and policies to ensure that AI is used responsibly and equitably.
- vi. **Collaborative Approach:** Foster collaboration between educators, AI experts, and policymakers to develop comprehensive strategies for AI adoption in curriculum development. This can help in creating a balanced and well-rounded approach.
- vii. **Pilot Programs and Case Studies:** Conduct a pilot program to test AI applications in curriculum development and gather data on their effectiveness. Share successful case studies with stakeholders to build a body of evidence supporting AI integration.

Conclusion

Artificial Intelligence offers powerful tools for modernizing curriculum development. From generating course outlines to identifying knowledge gaps, AI supports data-driven decisions, personalization, and efficiency. In Nigeria, integrating AI could transform education by making it more responsive, inclusive, and future-ready. However, several barriers persist. Infrastructure deficiencies, limited digital literacy among educators, and inadequate funding present major hurdles. Moreover, skepticism about AI replacing traditional teaching roles and concerns about data use pose challenges. To realize AI's full benefits, Nigeria must invest in digital infrastructure, train teachers, and adopt supportive policies. Strategic partnerships with tech providers and phased implementation can help bridge these gaps. While challenges exist, AI's role in improving curriculum relevance, accessibility, and impact is too significant to ignore. With thoughtful planning and inclusive strategies, Nigeria can harness AI to build an education system fit for the future.

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