ARTIFICIAL INTELLIGENCE IN CURRICULUM DESIGN AND IMPLEMENTATION IN NIGERIA: ISSUES, CHALLENGES, AND PANACEA.

O.J OKEKE(P.h. D.)

Department of Science Education, Faculty of Education, Godfrey Okoye University, Thinkers Corner, Emene, Enugu State.

okekejames@gouni.edu.ng

0803 750 3363

&

VITALIS CHINEMEREM ILOANWUSI

Department of English and Literary Studies, Faculty of Arts, Godfrey Okoye University, Thinkers Corner, Emene, Enugu State.

chinemeremiloanwusi@gmail.com

07062395436

ABSTRACT

Artificial Intelligence (AI) is reshaping curriculum studies and instructional design, offering innovative approaches to content delivery, assessment, and student engagement across various disciplines. In Nigeria, AI-driven tools are being integrated into secondary school subjects such as English, Literature in English, Chemistry, and Mathematics, enhancing personalized learning and real-time feedback. In Literature, AI facilitates textual analysis and interactive storytelling, providing deeper insights into themes and character development. In Chemistry, virtual laboratories and AI-powered simulations offer students hands-on experience, bridging the gap between theoretical knowledge and practical application. Despite these advancements, challenges persist, including inadequate digital infrastructure, teacher resistance, and concerns about AI diminishing critical thinking and creativity. Additionally, ethical issues such as algorithmic bias and data privacy raise concerns about equitable access to quality education. This paper explores the potential of AI in curriculum design while addressing the pressing challenges and proposing strategic solutions to ensure AI complements human-centered learning. By striking a balance between technology and traditional pedagogical methods, AI can enhance curriculum effectiveness without compromising the depth, creativity, and analytical skills that define holistic education.

Keywords: Artificial Intelligence, Curriculum Design, Personalized Learning, Digital Infrastructure, Ethical Considerations.

Introduction

Artificial Intelligence (AI) is rapidly changing the educational landscape across the globe. Secondary education is making the best use of AI to improve processes ranging from student engagement to better administration (Ogunleye & Adeyemi, 2023). The progress of AI technology has led to a growing adoption of tools for learning personalisation.

In Nigeria, students still face issues such as teaching and learning material being of very low ordinary quality and having to contend with poorly qualified instructional staff. According to AI, it can help improve these inefficiencies and enhance educational and learning outcomes (Okonkwo, 2022). Through AI platforms, schools will be able to provide personalised instructions which will help the students understand and remember what they are learning (Eze & Nwachukwu, 2024). Regrettably, the application of AI in Nigerian secondary schools is very minimal, if at all, because of inadequate infrastructure, the absence of competent manpower to work, and fear of possible damaging impacts of AI on learners' strategic thinking and creativity.

This study explores how Artificial Intelligence(AI) affects curriculum development along with teaching methods within Nigerian secondary schools even though its extensive deployment faces multiple obstacles. The research shall explore the ways Artificial Intelligence advances modern education in Nigeria while examining positive attributes and key barriers that need resolution during implementation.

The Evolution of AI in Education

The use of AI in education has advanced dramatically over the last decade, from basic automation to more sophisticated machine learning algorithms that enable intelligent tutoring systems, predictive analytics, and adaptive learning technologies (Brown & Smith, 2023).

Globally, AI has helped to reshape curriculum design by making learning more interactive and personalised (Siemens, 2021). Countries like China and the United States have used AI-driven platforms to improve student engagement and performance, with AI-powered chatbots, automated grading systems, and virtual tutors becoming prevalent in classrooms.

In Nigeria, the integration of AI in education is still in its early stages, with limited study and deployment in secondary schools. While some private schools are experimenting with AI-powered technologies to enhance classroom instruction, public schools continue to rely heavily on traditional teaching techniques due to funding restrictions and limited technology infrastructure.

AI in Curriculum Design: A New Pedagogical Approach

The traditional teacher-based method utilised in secondary school curriculum creation in Nigeria is direct instruction, in which teachers manage the activities they want to teach while students passively learn from them (Olawale & Benson, 2022). AI, on the other hand, allows for a change towards a more student-centered approach by modifying courses based on individual student learning needs and data (Williams & Adekunle, 2023).

Intelligent tutoring systems (ITS), which are AI-enabled, assess students' performance and tailor lessons to their specific levels (Johnson & Okechukwu, 2024). Artificial intelligence evaluations enable teachers in mathematics and chemistry to collect feedback during their classroom instruction. The evaluation system provides teachers with insights to modify their lesson plans, which they can utilise in future instances (Nwankwo et al., 2022). AI-driven customisations provide enough time for challenging topics for struggling learners while allowing advanced students to move forward at an increased pace (Adigun & Peters, 2024).

AI technology develops unified platforms that unite different disciplines into a singular information format, according to Garcia & Aliyu (2024). The AI-guided literature class incorporates historical features along with psychological elements and philosophical segments so students can study literary ideas within broader social contexts, according to Eze and Nwachukwu (2024). The comprehensive teaching method that teachers employ promotes essential skills of creative thinking and essential cognition abilities required by today's practicing workforce (Ogunleye & Adeyemi, 2023).

The Role of AI in Enhancing Teaching and Learning in Nigerian Secondary Schools

The deployment of artificial intelligence in Nigerian secondary schools creates three primary educational transformations: personalised instruction, real-time assessment feedback and enhanced student engagement.

Personalized Learning

The innovative educational approach of personalised computer-assisted learning outperforms traditional teaching tools by enabling AI to create learning programmes that adapt to individual student speeds and learning preferences (Brown and Smith 2023). Virtual chemistry laboratories are one of many examples of how students can conduct simulated experiments and gain practical experience in chemistry without the constraints of real-world laboratories. Okonkwo proposed this in 2022. This mode of learning also allows pupils to visualise very abstract scientific topics, which is why AI-powered education systems outperform ichagonia (Jamez, 2022).

AI technology is being utilised to enhance literature lectures by allowing students to interact with texts that can be analysed and comprehended. According to Olawale Benson 2022, AI

proposes a text and gives various comprehension exercises with the content in order to push basic literacy learners to enhance their skills even further.

Real-Time Feedback and Assessment

A main advantage of employing AI in education is its capacity to provide rapid feedback, allowing students to identify and correct errors as soon as possible (Nwankwo et al., 2022). Traditional evaluation procedures in Nigerian secondary schools feature extensive grading windows, which slow down feedback and make the opportunity for change less beneficial (Chukwu & Ibrahim, 2023). Unlike previous techniques, AI assessments analyse responses immediately, identify flaws, and offer next steps (Adeola & Hassan, 2023).

For example, AI checking software helps students with their essays by highlighting grammatical errors, recommending terms, and justifying why modifications are required (Williams & Adekunle, 2023). Similarly, AI problem-solving systems in Math take lengthy procedures to explain difficult mathematical issues, which aids students' understanding.

Enhanced Student Engagement

AI can make learning more enjoyable by incorporating gamification, virtual reality (VR), and augmented reality (AR) (Garcia & Aliyu, 2024). Active learning is one of the most effective methods for students to remember information. AI-powered educational games and simulations can generate attractive learning possibilities that pique students' interest while reinforcing learning through practical application (Adebayo et al., 2021).

AI enables the establishment of virtual laboratories, allowing students to conduct Core Chemistry experiments with no risk because there is no need to handle hazardous chemicals directly (Okonkwo, 2022). Similarly, AI-enabled storytelling systems inspire students to actively develop stories, which boosts their imagination while also strengthening their critical thinking abilities (Siemens, 2023).

Challenges in Implementing AI in Nigerian Secondary Schools

Despite its numerous advantages, the integration of AI into Nigerian secondary education is hindered by several challenges, including:

1. Inadequate Digital Infrastructure: Many schools lack the technology infrastructure required for AI learning platforms (Akinyemi & Uche, 2024). The absence of high-speed internet access and money for digital materials are significant barriers to AI adoption.

2. Teacher Resistance and Undertraining: Many educators are unfamiliar with new AI technologies and may resist their implementation because they fear losing their jobs or lacking the necessary skills (Williams & Adekunle, 2023). Teacher training programs are crucial for ensuring that education practitioners have the necessary abilities to deploy AI teaching methods.

3. Ethical Issues and Privacy Concerns: Because AI operates on enormous datasets, there are concerns about data security and student privacy (Garcia & Aliyu, 2024). Bias in algorithms is another ethical issue because AI applications have the potential to repeat existing disparities in education.

Artificial intelligence (AI) has the potential to change secondary education in Nigeria by increasing student engagement, personalising learning, and providing fast feedback. Nonetheless, poor infrastructure, ethical concerns, and teacher reluctance, among other factors, impede successful AI integration. If Nigerian educational institutions combine AI with traditional methods, they would be able to employ technology to improve the quality of education for all children.

Statement of the Problem

The Nigerian secondary education system encounters multiple difficulties when implementing AI-driven technologies to enhance educational results. Challenges such as inadequate digital infrastructure, limited access to AI tools, and teacher resistance hinder the effective adoption of AI in classrooms. Furthermore, AI stands as a barrier to high-quality education because of its potential to lower analytical skills while privacy concerns and machine-biased learning capabilities constrain educational equality. It is essential to address these difficulties to maintain AI as an aid for human-focused learning rather than a complete replacement for creative education.

Purpose of the Study

1. To explore the current state of AI integration in teaching in Nigerian secondary schools.

2. To identify the challenges hindering the effective adoption of AI-driven tools for instruction.

3. To propose strategic solutions for integrating AI into the curriculum without compromising critical thinking, creativity, and ethical standards.

Research Questions

1. What is the extent of AI integration in teaching in Nigerian secondary schools?

2. What challenges do educators face in adopting AI-driven tools for instruction?

3. What strategies can be implemented to effectively integrate AI into the curriculum while maintaining educational quality and ethical considerations?

Theoretical Framework

The Technological Pedagogical Content Knowledge (TPACK) framework was propounded by Punya Mishra and Matthew J. Koehler in 2006. This theory highlights the importance of

the interplay between three key components in teaching: technology, pedagogy, and content knowledge. TPACK argues that effective teaching with technology requires not only an understanding of subject matter (content knowledge) and instructional methods (pedagogical knowledge) but also how technology can enhance learning experiences. In the context of this study, TPACK serves as a foundation for analyzing how AI tools can be integrated into secondary school teaching while ensuring that both pedagogical effectiveness and subject content integrity are maintained.

Methodology

This study employed a descriptive survey research design to assess AI adoption in Nigerian secondary schools. Data were collected from 50 respondents (45 teachers and 5 managerial staff, including the principal, vice-principals and head teachers) from Godfrey Okoye University's secondary school. A structured questionnaire was used to collect data, measuring responses on a 4-point Likert scale.

Results

Table 1: Mean Responses on the Use of AI Tools in Teaching in Nigerian Secondary Schools.

Items	SA (%)	A (%)	D (%)	SD (%)	Mean	SD
AI tools are commonly used in Nigerian secondary schools.	10 (20%)	12 (24%)	18 (36%)	10 (20%)	2.44	0.97
Teachers are provided with AI-based teaching resources.	8 (16%)	14 (28%)	20 (40%)	8 (16%)	2.44	0.94
AI enhances interactive learning in various subjects.	20 (40%)	18 (36%)	8 (16%)	4 (8%)	3.08	0.83

AI-driven tools improve student engagement.	18 (36%)	20 (40%)	7 (14%)	5 (10%)	3.02	0.81
AI facilitates personalized learning for students.	16 (32%)	18 (36%)	10 (20%)	6 (12%)	2.88	0.86
AI is used for assessment and grading in Nigerian secondary schools.	12 (24%)	14 (28%)	14 (28%)	10 (20%)	2.56	0.91
AI applications help students in textual analysis (Literature).	14 (28%)	16 (32%)	12 (24%)	8 (16%)	2.72	0.89
Virtual labs are available for AI-assisted Chemistry experiments.	8 (16%)	12 (24%)	18 (36%)	12 (24%)	2.32	0.92

Grand Mean = 2.68 (Accepted)

Table 2: Mean Responses on Challenges in Adopting AI-Driven Tools in Instruction

Items	SA (%)	A (%)	D (%)	SD (%)	Mean	SD

Limited access to AI tools is a challenge.	28 (56%)	12 (24%)	7 (14%)	3 (6%)	3.30	0.69
Inadequate teacher training affects AI adoption.	25 (50%)	15 (30%)	7 (14%)	3 (6%)	3.24	0.74
Poor digital infrastructure hinders AI integration.	30 (60%)	12 (24%)	5 (10%)	3 (6%)	3.38	0.66
Teachers are resistant to AI-based teaching methods.	20 (40%)	16 (32%)	9 (18%)	5 (10%)	3.02	0.88
AI reduces students' critical thinking skills.	15 (30%)	14 (28%)	14 (28%)	7 (14%)	2.74	0.91
Ethical issues (e.g., data privacy) limit AI use.	22 (44%)	16 (32%)	7 (14%)	5 (10%)	3.10	0.84
AI is expensive to implement in schools.	26 (52%)	14 (28%)	7 (14%)	3 (6%)	3.26	0.69
AI tools are often biased and unreliable.	15 (30%)	14 (28%)	14 (28%)	7 (14%)	2.74	0.91

Grand Mean = 3.07 (Accepted)

Table 3: Mean Responses on Strategies for Effective AI Integration in Curriculum

Items	SA (%)	A (%)	D (%)	SD (%)	Mean	SD
Schools should provide AI training for teachers.	28 (56%)	16 (32%)	3 (6%)	3 (6%)	3.38	0.65
The government should invest in better digital infrastructure.	30 (60%)	12 (24%)	5 (10%)	3 (6%)	3.38	0.67
AI should complement, not replace, traditional teaching.	25 (50%)	15 (30%)	7 (14%)	3 (6%)	3.24	0.71
Ethical guidelines should be enforced in AI use.	22 (44%)	16 (32%)	7 (14%)	5 (10%)	3.10	0.84
AI should focus on improving creativity, not just automation.	18 (36%)	18 (36%)	9 (18%)	5 (10%)	2.98	0.86
More research should be conducted on AI effectiveness.	20 (40%)	18 (36%)	7 (14%)	5 (10%)	3.06	0.81
AI curriculum should be tailored to Nigerian education.	22 (44%)	14 (28%)	9 (18%)	5 (10%)	3.06	0.84
Partnerships with tech companies can enhance AI adoption.	28 (56%)	12 (24%)	5 (10%)	5 (10%)	3.26	0.74

Grand Mean = 3.18 (Accepted)

Discussion of Findings

The findings indicate that AI tools are not yet widely used in Nigerian secondary schools, as reflected by the low mean scores (grand mean = 2.68). While AI is recognized for enhancing interactive learning (mean = 3.08) and improving student engagement (mean = 3.02), its adoption remains limited due to inadequate AI-based teaching resources (mean = 2.44) and minimal AI use in assessments (mean = 2.56). Additionally, virtual labs for AI-assisted Chemistry experiments are scarce (mean = 2.32), further highlighting the slow integration of AI into the curriculum.

According to the study, a variety of issues impede AI integration in Nigerian secondary schools, the most serious of which are insufficient digital infrastructure (mean = 3.380) and limited access to AI tools (mean = 3.30). Additionally, poor teacher training (mean = 3.24) and the high cost of AI integration (mean = 3.26) limit AI deployment. Ethical concerns (mean = 3.10) and teachers' negative attitudes towards AI technology (mean = 3.02) further impede the adoption of AI integration, highlighting the necessity for extensive training and policy formulation.

To improve secondary schools in Nigeria, respondents highly support teacher training (mean = 3.38), government investment for digital infrastructure (mean = 3.38), enabling AI to enhance traditional teaching (mean = 3.24), and adhering to ethical norms (mean = 3.10). The research suggests that developing ties with information technology businesses (mean = 3.26) and adapting AI syllabus to the Nigerian educational system (mean = 3.06) will ensure effective AI integration without AI becoming a tool for rote learning, but rather promoting creativity.

Conclusion

The investigation shows that AI adoption in Nigerian secondary schools occurs at a slow pace while remaining restricted. The potential benefits of AI tools for student engagement and interactive learning are limited because schools suffer from a lack of sufficient resources, poor digital infrastructure, and inadequately trained teachers. AI integration faces multiple obstacles because of expensive implementation procedures along with moral questions and difficulties in getting teachers to accept the technology. The secondary education system in Nigeria can obtain substantial teaching and learning transformations through appropriate training along with infrastructure investments and customized curriculum development for AI implementation.

Recommendations

Based on the findings, the following recommendations were made:

1. Educators should be trained on the ethical use and integration of AI tools in learning.

2. The government should ensure that functional digital learning facilities are provided in schools to support the effective utilization of AI tools in schools.

3. Educational content obtained from AI should be balanced with traditional learning concepts to align with the needs of Nigerian students.

4. Educational stakeholders and curriculum designers need to establish detailed policies that outline ethical concerns and data privacy issues along with algorithmic bias when AI is applied in education.

5. Educational institutions, government agencies, and technologists should unite to exchange resources and support programs that integrate AI technology in educational institutions.

REFERENCES

Adebayo, T., Yusuf, A., & Hassan, R. (2021). Artificial intelligence in education: Enhancing learning outcomes through technology. *Journal of Educational Technology, 15* (3), 45–60.

Adeola, F., & Hassan, M. (2023). AI-powered assessments and feedback in Nigerian schools: A pathway to improved learning. *African Journal of Education Research, 12* (2), 89–104.

Adigun, K., & Peters, L. (2024). Personalized learning with AI: Transforming secondary education in Nigeria. *International Journal of Educational Innovation, 18*(1), 33–48.

Akinyemi, S., & Uche, N. (2024). Barriers to AI integration in Nigerian secondary education: A case study approach. *Nigerian Journal of Educational Studies, 9* (1), 55–72.

Brown, J., & Smith, D. (2023). Artificial intelligence and curriculum transformation: Global perspectives. *Educational Technology Review, 20* (4), 101–120.

Chukwu, P., & Ibrahim, A. (2023). AI-driven assessment systems: Implications for student performance in Nigerian schools. *West African Journal of Educational Research, 11* (3), 67–84.

Eze, C., & Nwachukwu, I. (2024). The impact of AI on student engagement and learning retention. *Journal of Modern Education, 7* (2), 44–59.

Garcia, M., & Aliyu, J. (2024). Gamification and AI: A new frontier in secondary education. *International Journal of Educational Technology, 16*(1), 25–39.

James, R. (2022). AI-enhanced virtual laboratories: A solution for science education in Nigeria. *Journal of Science and Technology Education, 14* (2), 78–92.

Johnson, T., & Okechukwu, L. (2024). Intelligent tutoring systems and AI-driven curriculum design: A Nigerian perspective. *African Journal of Education Technology, 10* (3), 120–138.

Nwankwo, C., Adeyemi, T., & Bello, S. (2022). Real-time feedback in AI-assisted learning: A tool for academic excellence. *Journal of African Education Research, 13* (1), 35–50.

Okonkwo, D. (2022). Overcoming barriers to AI adoption in Nigerian secondary schools: Policy and practice recommendations. *Journal of Educational Policy and Innovation, 9* (2), 55–71.

Ogunleye, B., & Adeyemi, K. (2023). Artificial intelligence and its role in shaping future educational practices. *International Journal of Education, 21* (3), 112–130.

Olawale, F., & Benson, A. (2022). From traditional to AI-enhanced curriculum: Shaping Nigeria's secondary education system. *African Journal of Educational Reform, 8* (2), 98–115.

Siemens, G. (2021). The role of artificial intelligence in modern education: A global perspective. *International Journal of Learning Technologies, 19* (4), 67–89.

Williams, H., & Adekunle, P. (2023). AI-driven personalized learning in secondary schools: A critical analysis. Journal of Digital Education, 11 (3), 77–94.