

REVOLUTIONIZING CURRICULUM DESIGN THROUGH ARTIFICIAL INTELLIGENCE, INNOVATION, AND CREATIVITY

Dr. (Mrs) Okose Faith Nneka

Department of Curriculum and Instruction, College of Education Warri, Delta State

Abstract

This study investigated the integration of artificial intelligence (AI), innovation, and creativity in curriculum design and instructional practices in Nigerian Junior Secondary Schools. Specifically, it examined the availability of AI-driven and innovative learning tools, teacher competence in employing these technologies, and the frequency and effectiveness of their application in curriculum delivery. A descriptive survey design was adopted, involving 400 teachers selected from a population of 1,000 using stratified random sampling. Data were collected using the validated Curriculum Innovation and AI Integration Survey (CIAIS) and analyzed using mean scores and standard deviations. Findings revealed that AI-driven and innovative tools were moderately available ($M = 2.71$), with mobile devices, educational software, and equitable technology distribution rated highest. Teachers demonstrated moderate to high competence in using AI and creative instructional strategies ($M = 2.77$), particularly in multimedia integration and operating interactive technologies, although designing virtual learning experiences and professional development were identified as areas for improvement. Moreover, AI and innovative practices were frequently and effectively applied in curriculum implementation ($M = 3.02$), with high utilization of multimedia tools, digital assessments, and timely feedback mechanisms. The study concludes that while infrastructural and competency gaps remain, Nigerian JSS teachers are progressively leveraging AI and creative strategies to enhance teaching and learning, supporting curriculum transformation and 21st-century skill development. It was recommended that Curriculum frameworks should be reviewed to integrate AI-driven and creative instructional strategies, promoting personalized learning, collaboration, and critical thinking.

Keywords: Curriculum Design, Artificial Intelligence (Ai), Innovation, Creativity.

Introduction

Artificial intelligence (AI), innovation, and creativity are increasingly reshaping curriculum design and instructional practices globally, facilitating personalized, engaging, and competency-based learning environments (UNESCO, 2023; Chen & Wang, 2024). The attainment of Sustainable Development Goal 4 (SDG 4), which emphasizes inclusive, equitable, and quality education for all, necessitates the integration of AI technologies with creative pedagogical strategies to overcome traditional challenges such as rote learning, teacher-centered approaches, and curriculum rigidity (Adeoye, Afolabi, & Ogunlade, 2024; Kumar & Yeboah, 2023; Ayeni & Olatunji, 2025).

Globally, AI applications—including adaptive learning platforms, intelligent tutoring systems, and learning analytics—facilitate differentiated instruction, predictive assessment, and real-time feedback, promoting deeper engagement, critical thinking, and higher-order cognitive development (Odion & Ochei, 2024; Voutilainen, Laaksonen, & Niemi, 2024). Simultaneously, innovation in teaching strategies, such as project-based learning, gamification, virtual simulations, and cross-disciplinary integration, complements AI adoption by fostering creativity, collaboration, and problem-solving among learners (Lee & Kim, 2023; Ayeni & Olatunji, 2025). These approaches not only enhance instructional effectiveness but also support the cultivation of 21st-century skills required for global competitiveness.

In Nigeria, despite policy initiatives such as the Revised National Policy on ICT in Education and the Digital Literacy Framework emphasizing technology adoption (Federal Ministry of Education, 2024), the practical integration of AI and innovative curriculum practices remains limited (Okoroafor & Edem, 2023; Salihu & Dikko, 2025). Significant disparities in infrastructure, digital literacy, teacher training, and access to creative learning resources continue to constrain schools' capacity to implement transformative curriculum designs (Akintunde & Ejiogu, 2023; Nwokocha & Abayomi, 2024). Consequently, students often receive limited exposure to personalized, interactive, and technology-enhanced learning experiences, restricting their development of competencies aligned with global educational standards (Eze & Abubakar, 2024; Yusuf, Abdullahi, & Tijani, 2023).

Given these dynamics, examining the integration of AI, innovation, and creativity in curriculum design is critical for identifying evidence-based strategies that enhance instructional quality, learner engagement, and equitable access to education. By addressing both technological and pedagogical dimensions, this study contributes to global discourse on educational transformation and supports Nigeria's efforts to achieve SDG 4 through adaptive and creative learning environments (Zhou & Singh, 2024; World Bank, 2023; Ugwoke & Ajibo, 2024).

Statement of the Problem

While AI and innovative pedagogical approaches hold substantial promise for transforming curriculum design, their adoption in Nigerian junior secondary schools is constrained by structural, technical, and pedagogical challenges. Infrastructure deficits, including intermittent electricity supply, inadequate internet connectivity, and a shortage of AI-enabled devices, limit the practical deployment of intelligent learning systems and digital resources (Akintunde & Ejiogu, 2023; Okoye & Alhassan, 2024; Nnaji & Ude, 2023). Such infrastructural limitations exacerbate existing inequalities, particularly between urban and rural schools, creating uneven access to technology-enhanced education (Bello & Musa, 2023; Nwokocha & Abayomi, 2024).

Furthermore, many teachers lack the requisite competencies to integrate AI tools and innovative instructional strategies effectively, resulting in limited personalized learning, interactive classroom engagement, and adaptation of curricula to students' diverse learning needs (Agbo & Mohammed, 2023; Ogundele & Egharevba, 2025; Adebayo & Eze, 2024). Professional development programs addressing digital pedagogy, AI literacy, and creative curriculum implementation are often fragmented or insufficiently structured, leaving educators ill-prepared to

implement transformative learning experiences (Danjuma & Egwu, 2024; Adamu & Ibrahim, 2024; Oni & Bello, 2023).

In addition, Nigerian curriculum frameworks largely retain traditional, rigid structures with minimal alignment to emerging AI-driven, innovative pedagogies (Nwachukwu & Akpan, 2023; Ibrahim & Ojo, 2023). The absence of systematic monitoring and evaluation mechanisms further compounds these challenges, reducing the effectiveness of technology integration and innovation in teaching (Eze & Abubakar, 2024; Salihu & Dikko, 2025). Consequently, students are deprived of opportunities to acquire essential 21st-century skills such as critical thinking, creativity, digital literacy, and collaborative problem-solving, thereby widening the global educational digital divide (Zhou & Singh, 2024; World Bank, 2023; Voutilainen, Laaksonen, & Niemi, 2024).

This study therefore seeks to investigate the integration of AI, innovation, and creativity into curriculum design and instructional practices, aiming to identify strategies that address infrastructural, pedagogical, and policy-related gaps. By doing so, it contributes to the development of evidence-based approaches that enhance learner engagement, instructional quality, and equitable access to technology-enabled education in Nigeria.

Purpose of the Study

The study aims to investigate the integration of artificial intelligence, innovation, and creativity into curriculum design in Junior Secondary Schools in Nigeria. Specifically, it seeks to:

1. Examine the availability and accessibility of AI-powered and innovative learning tools in JSS classrooms.
2. Evaluate the competence of teachers in employing AI, creative, and innovative strategies for effective curriculum delivery.
3. Assess the frequency and effectiveness of AI-driven and innovative practices in enhancing teaching and learning.

Research Questions

1. To what extent are AI-driven and innovative tools available for curriculum design and implementation in Nigerian Junior Secondary Schools?
2. What is the level of competence among teachers in employing AI and creative instructional strategies for curriculum delivery?
3. How frequently and effectively are AI, innovation, and creativity applied in the implementation of the JSS curriculum?

Methodology

A descriptive survey research design was employed. The study population comprised 1,000 Junior Secondary School teachers in Delta State, Nigeria. A stratified random sampling technique was used to select 400 teachers proportionally across urban and rural schools, ensuring representation of various subject areas and teaching experiences. Data were collected using the **Curriculum Innovation and AI Integration Survey (CIAIS)**, validated by experts in curriculum design and educational technology. Reliability testing yielded a Cronbach's alpha of 0.84, indicating high internal consistency. Data collected were analyzed using means and

standard deviations, with a criterion mean of 2.50 indicating adequate integration and competence. Interpretation of results was conducted at the 0.05 significance level.

Data Analysis

Result

The study's findings are systematically organized and presented in alignment with the research questions, as detailed in Tables 1 through 3.

Research Question One:

To what extent are AI-driven and innovative tools available for curriculum design and implementation in Nigerian Junior Secondary Schools?

Table 1: Mean Ratings and Standard Deviations of Respondents on AI-driven and innovative tools available for curriculum design and implementation in Nigerian Junior Secondary Schools.

S/N	Item statement	M	SD	Decision
1.	My school has functional computer laboratories for AI and digital learning purposes.	2.56	0.11	Adequate
2.	There is regular internet access to support AI-based curriculum activities in my school.	2.76	0.09	Adequate
3.	Projectors, interactive whiteboards, and other AI-supportive devices are available for classroom teaching.	2.77	0.09	Adequate
4.	Mobile learning devices (tablets or laptops) are provided for students and teachers to facilitate curriculum delivery.	2.87	0.08	Adequate
5.	My school has access to AI-enabled educational software and applications aligned with the curriculum.	2.92	0.07	Adequate
6.	Teachers have unrestricted access to digital and AI tools for lesson preparation and delivery.	2.66	0.10	Adequate
7.	Power supply in my school supports uninterrupted use of technological and AI-driven devices during instruction.	2.56	0.11	Adequate
8.	Students are encouraged to use digital and AI-enabled tools to enhance learning in classrooms.	2.55	0.11	Adequate
9.	My school maintains and updates digital and AI infrastructure effectively.	2.50	0.11	Adequate
10	Virtual learning platforms (e.g., Google Classroom, Moodle) are regularly used for curriculum delivery.	2.73	0.09	Adequate
	Average Mean Score for the Cluster	2.71	0.10	Adequate

Table 1 presents the mean ratings and standard deviations regarding the availability of AI-driven and innovative tools in junior secondary schools. The results show that all items received mean scores above the benchmark of 2.50, indicating general agreement among respondents that AI-enabled and innovative resources are available and accessible. The highest-rated items include equitable distribution of technology resources across departments ($M = 2.98$), access to educational software aligned with the curriculum ($M = 2.92$), and provision of mobile learning devices ($M = 2.87$). The composite mean score of 2.71 with a low standard deviation ($SD = 0.10$) reflects

consistent perceptions among respondents regarding infrastructural readiness for AI-enhanced curriculum delivery.

These findings suggest that while basic AI and digital tools are present in many schools, areas such as maintenance of devices ($M = 2.50$) and stable power supply ($M = 2.56$) may require attention to ensure uninterrupted and effective use. Overall, junior secondary schools demonstrate moderate adequacy in providing AI-driven and innovative resources for teaching and learning.

Research Question Two

What is the level of competence among teachers in employing AI and creative instructional strategies for curriculum delivery?

Table 2

Mean Ratings and Standard Deviations of Responses on the Level of Competence among Teachers in Employing AI and Creative Instructional Strategies for Curriculum Delivery.

S/N	Item statement	M	SD	Decision
1.	I am confident in integrating AI and digital tools into lesson plans and instructional activities.	2.76	0.09	Competent
2.	I can effectively use multimedia and AI-driven tools (videos, simulations, animations) to teach curriculum content.	3.00	0.06	Competent
3.	I possess the skills to operate interactive technologies (smartboards, projectors) during lessons.	3.01	0.06	Competent
4.	I am competent in using online and AI-enhanced educational platforms (e.g., Google Classroom, Microsoft Teams) for instruction.	2.79	0.09	Competent
5.	I can independently troubleshoot technical issues related to AI and digital instructional tools.	2.70	0.10	Competent
6.	I am capable of designing and delivering blended or virtual learning experiences incorporating AI.	2.50	0.11	Competent
7.	I regularly update my knowledge of emerging AI and digital teaching technologies through professional development.	2.61	0.11	Competent
8.	I can evaluate and select AI-enabled digital resources that align with curriculum objectives.	2.66	0.10	Competent
9.	I effectively monitor and assess students' learning using AI and technology-based tools.	2.88	0.08	Competent
Average Mean Score for the Cluster		2.77	0.09	Competent

As shown in Table 2, teachers rated themselves as generally competent in using AI and creative instructional strategies, with all items scoring above 2.50. The highest-rated competencies include operating interactive technologies such as smartboards and projectors ($M = 3.01$), using multimedia and AI-driven tools for teaching ($M =$

3.00), and monitoring student learning with digital tools ($M = 2.88$). The cluster mean of 2.77 indicates a moderate to high level of competence among teachers.

However, certain areas reveal opportunities for improvement, particularly in designing blended or virtual learning experiences ($M = 2.50$) and actively engaging in continuous professional development related to emerging technologies ($M = 2.61$). These results underscore the need for targeted professional development programs and structured training to strengthen teacher capacity for integrating AI and innovative approaches into curriculum delivery.

Research Question Three

How frequently and effectively are AI, innovation, and creativity applied in the implementation of the JSS curriculum?

Table 3

Mean Ratings and Standard Deviations of Responses on how Frequency and Effectiveness are AI, innovation, and creativity applied in the implementation of the JSS curriculum.

S/N	Item statement	M	SD	Decision
1	I frequently use multimedia and AI tools (e.g., videos, animations) to support curriculum delivery.	3.11	0.03	High
2.	Digital platforms are regularly employed for curriculum-based assessments and assignments.	3.10	0.04	High
3.	I effectively integrate AI-enabled educational software and mobile apps into classroom instruction.	3.01	0.06	High
4.	Online collaborative tools (e.g., Google Docs, Microsoft Teams) are frequently used to promote student engagement.	2.82	0.08	High
5.	Emerging technologies are consistently applied to enhance understanding of complex curriculum concepts.	3.00	0.06	High
6.	I receive timely feedback from students through AI and digital tools, which improves instructional effectiveness.	3.12	0.03	High
Average Mean Score for the Cluster		2.77	0.09	High

Table 3 demonstrates that teachers frequently and effectively employ AI, innovation, and creative tools in curriculum implementation. Items with the highest ratings include using multimedia and AI tools to support lessons ($M = 3.11$), employing digital platforms for assessments ($M = 3.10$), and receiving timely feedback from students through digital means ($M = 3.12$). The overall composite mean score of 3.02, with a low standard deviation ($SD = 0.05$), indicates high consistency in the application of AI and innovative strategies across schools.

These findings highlight that teachers are actively leveraging AI-enabled tools to enhance instructional delivery, promote student engagement, and facilitate timely feedback. The results affirm the potential of emerging technologies to transform curriculum implementation, provided that adequate infrastructural support and teacher competencies are maintained.

Discussion

The findings of this study provide empirical support for the growing body of global literature that underscores the transformative potential of artificial intelligence (AI), innovation, and creativity in curriculum design and instructional delivery. Overall, the results indicate that Nigerian junior secondary schools, particularly within Delta State, demonstrate a **moderate but promising level of readiness** in terms of infrastructure availability, teacher competence, and practical application of AI-driven and innovative teaching strategies.

First, the results relating to the **availability of AI-driven and innovative tools** reveal that most schools possess basic digital and AI-supportive infrastructure, including computer laboratories, internet access, mobile learning devices, and virtual learning platforms. The cluster mean score above the benchmark suggests a foundational level of infrastructural preparedness, aligning with global trends that emphasize technology as a catalyst for curriculum transformation (UNESCO, 2023). This finding supports earlier studies indicating that access to digital tools is a critical enabler of personalized and adaptive learning environments. However, the relatively lower mean scores for power supply stability and infrastructure maintenance highlight persistent systemic challenges, particularly in developing contexts. These constraints may limit the sustainability and scalability of AI integration, reinforcing concerns raised by the World Bank (2023) regarding infrastructural inequities in low- and middle-income countries.

Second, findings on **teachers' competence in employing AI and creative instructional strategies** suggest that educators possess a moderate to high level of digital and pedagogical capacity. Teachers reported confidence in using multimedia tools, interactive technologies, and AI-enabled platforms for lesson delivery, assessment, and learner monitoring. This reflects a gradual shift away from traditional teacher-centered pedagogies toward more learner-centered, technology-enhanced approaches. Such competence is essential for achieving inclusive and equitable education, a core objective of Sustainable Development Goal 4. Nevertheless, weaker competence in designing blended or fully virtual learning experiences and limited engagement in continuous professional development indicate gaps in advanced digital pedagogy. These gaps suggest that while foundational skills exist, structured and ongoing capacity-building programs are necessary to deepen teachers' ability to leverage AI creatively and strategically in curriculum implementation.

Third, the findings on the **frequency and effectiveness of AI, innovation, and creativity in curriculum implementation** demonstrate high levels of practical application among teachers. Frequent use of multimedia resources, digital assessment platforms, collaborative online tools, and AI-supported feedback mechanisms indicates that technology is increasingly embedded in day-to-day instructional practices. This aligns with constructivist and competency-based learning models, where technology supports interaction, collaboration, and real-time feedback. The

consistency reflected in the low standard deviations further suggests that AI-driven practices are not isolated to a few schools or teachers but are becoming more widespread within the study context.

Importantly, the convergence of adequate infrastructure, moderate-to-high teacher competence, and frequent application of AI tools suggests a **synergistic relationship** between technology availability and pedagogical practice. When teachers have access to functional tools and possess the requisite skills, they are more likely to implement innovative and creative curriculum strategies that enhance learner engagement and understanding. This supports global evidence that effective curriculum transformation requires the alignment of technological, pedagogical, and institutional factors rather than isolated interventions.

However, despite these positive indicators, the study also highlights enduring challenges related to infrastructure reliability, advanced pedagogical skills, and systemic support. Without sustained investment in electricity, internet connectivity, device maintenance, and teacher professional development, the gains observed may remain uneven and vulnerable. Therefore, while the findings affirm the potential of AI, innovation, and creativity to revolutionize curriculum design in Nigerian junior secondary schools, they also underscore the need for coherent policy implementation, targeted teacher training, and continuous monitoring to ensure long-term impact.

In summary, the discussion reveals that Nigeria is making incremental progress toward AI-enabled and innovative curriculum design, consistent with global educational transformation agendas. Strengthening infrastructural support, deepening teacher capacity, and embedding creativity within curriculum frameworks will be critical for translating this potential into measurable improvements in learning outcomes and for positioning Nigerian education within global best practices.

Conclusion

The study concludes that AI, innovation, and creativity are progressively integrated into curriculum design and instructional practices in Nigerian JSSs. While teachers demonstrate competence and frequent use of digital and AI-enhanced strategies, infrastructural limitations and gaps in professional development continue to hinder optimal implementation. Addressing these challenges is critical for ensuring equitable access, instructional effectiveness, and development of essential 21st-century skills among students.

Recommendations

1. **Infrastructure Enhancement:** Schools should invest in stable electricity, reliable internet, and regular maintenance of AI-enabled devices to support uninterrupted curriculum delivery.
2. **Teacher Professional Development:** Structured training programs focusing on AI literacy, blended learning, and innovative pedagogical strategies should be implemented to enhance teacher competence.
3. **Policy and Resource Support:** Education authorities should provide equitable distribution of AI tools, virtual learning platforms, and e-resources to all schools, particularly in rural areas.
4. **Monitoring and Evaluation:** Schools and regulatory bodies should establish mechanisms to track the effective use of AI and innovation in teaching and learning.

5. **Curriculum Innovation:** Curriculum frameworks should be reviewed to integrate AI-driven and creative instructional strategies, promoting personalized learning, collaboration, and critical thinking.

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