

Practical Approach to Integrating Emerging Technologies in Curriculum Implementation at the Senior Secondary School Level in Nigeria

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Abstract: The rapid evolution of emerging technologies offers transformative opportunities for enhancing curriculum implementation at Nigeria's senior secondary schools. The first part of this paper examines strategies for integrating tools like artificial Intelligence (AI), virtual reality, mobile devices, and online platforms into educational practices. It highlights the importance of policy support, capacity building for teachers, infrastructural development, and stakeholder collaboration to harness benefits such as personalized learning, increased access, and improved assessment methods. The second part examines the challenges, including infrastructural deficits, limited teacher training, policy gaps, and financial constraints are discussed. The proposed practical approach emphasizes starting with simple tools, ongoing professional development, and fostering supportive communities to promote effective adoption. Ultimately, integrating emerging technologies can revolutionize Nigeria's education system, making learning more inclusive, engaging, and aligned with global educational standards.

Keywords: Integration, emerging technology, curriculum, implementation

Introduction

Emerging technologies characterized by their radical novelty, rapid growth, and significant impact are reshaping the educational landscape worldwide. In Nigeria, their integration into senior secondary school curricula promises to enhance teaching and learning

experiences by fostering personalized, accessible, and engaging educational environments. Technologies such as Artificial Intelligence (AI), virtual reality, and mobile devices offer unprecedented opportunities to bridge educational gaps, especially in underserved areas. Understanding the attributes and potential of emerging technologies is critical for educators, policymakers, and stakeholders to navigate the challenges and leverage their transformative potential for Nigeria's educational advancement.

Understanding of what constitutes an emerging technology varies depending on the socio-political and educational perspectives. A technology may be considered emergent due to its novelty and anticipated socio-economic and educational influence, considered as a natural extension of existing technologies. Emerging technologies in the context of education, are global tools, innovations, and breakthroughs used in performing many functions in the teaching and learning processes. Emerging technologies are radically novel, relatively fast-growing technologies that exhibits a certain degree of coherence over time and has the potential to exert a substantial impact on socio-economic and educational domains of a country. Almufarreh and Arshad (2023) elucidated that emerging technologies enable a personalized, adaptable, and differentiated focus on learning needs and pedagogy and give learners more choices than a teacher-controlled, "one-size-fits-all" approach.

Emerging technologies are usually characterized by certain attributes considered as primary that have been identified by Rotolo, Hicks, & Martin (2015) they include: (a) Radical novelty: Meaning that they are radically new, fulfilling functions through fundamentally different principles compared to previous approaches (b) Relatively Fast Growth: They tend to exhibit rapid development and expansion relative to established, non-emerging technologies (c) Coherence: Over time, emerging technologies develop a consistent identity and momentum (d) Prominent Impact: They significantly influence specific domains or broader educational and socio-economic systems. They can alter the composition of actors and institutions, reshape patterns of interaction, and influence knowledge production processes (e) Uncertainty and Ambiguity: These technologies are characterized by uncertain outcomes, uses, and societal impacts, which may include unintended or undesirable consequences. There is also ambiguity in how different social groups interpret and assign meaning to the technology.

The senior secondary school curriculum of various subjects in Nigeria has stipulated the use of Information Technology in the teaching and learning process ie implementation of the curriculum and evaluation where applicable. This paper presents a practical approach to integration of emerging technologies in the implementation of senior secondary school curriculum in Nigeria.

CONCEPTS OF INTEGRATION AND CURRICULUM

Integration refers to merging two things or two systems of education together to form a whole. Oluniyi and Olufemi (2013) as cited in (Danzaria, 2017) defined integration as an intellectual effort aiming at connecting academic, career, and technical domain in instructional process in such a way that learners are prepared and equipped for further education, employment and career development. Curriculum is a planned learning experience aimed at achieving desired goals and set values for result purposes. Anyasodo and Ikonne (2020) defined curriculum as planned experience concerned with result. Tanner and Tanner (1995) as cited in Anyasodo and Ikonne (2020) defined curriculum as the planned and guided learning experiences and intended outcomes, formulated through systematic reconstruction of knowledge and experience, under the auspices of the school, for learners continuous and willful growth in personal and social competence.

According to Beane (1997) as cited in Danzaria (2017), curriculum integration involves four major aspects - The integration of experience which involves experiences that literally become part of life as new experiences; Social integration - the portion of the school program devoted to this integration has often been referred to as “general education” because it is meant for all young people regardless of background or aspirations; Integration of knowledge which makes knowledge more accessible and more meaningful by bringing out separate subject compartments and placing it in contexts that will supposedly make more sense to young people; and integration as a curriculum design. Emerging technologies can be integrated into these four major aspects to create a hybrid education system via curriculum implementation of the senior secondary schools in Nigeria.

Emerging Technologies and Senior Secondary Schools Curriculum Implementation

Emerging technologies differs in terms of availability, usage, location and expertise. Some of the emerging technologies that can be integrated in the implementation of the senior secondary schools curriculum in Nigeria may include mobile smart phones, androids, online platforms and Artificial Intelligence (AI) due to their availability, affordable nature and easy access. Rotolo, Hicks and Martin (2015) elaborated that mobile devices, online platforms and Artificial Intelligence (AI) can reach students in remote or underserved areas, mitigating geographical and socio-economic disparities, enable adaptive learning, catering to individual student needs thereby promoting active and personalized learning which will to a large extent revolutionize curriculum implementation in Nigeria through enhancing access and equity. As to Abbas, Hosseini, Nunez, & Sastre-Merino (2021), the adoption and integration of emerging technologies in education provides an opportunity to introduce novel and innovative

pedagogical strategies to improve existing educational structures, as well as to prepare both teachers and students to grow and compete in an increasingly digital world.

Emerging technologies that can be integrated in the implementation of senior secondary school curriculum in Nigeria include the following as enumerated by Exquitech (2025): Artificial Intelligence (AI) for Special Education that supports neurodiverse learners with tailored resources; Digital Gaming in Education that engages students through immersive learning aligned with real-world contexts; AI Grading and Assessment Tools that streamlines evaluation and delivers instant feedback; Metacognitive Support Systems that fosters reflection and self-regulation among students; Neural Networks that predict student performance and personalize learning paths; Learning Analytics that analyzes patterns to inform instructional design and interventions; and Chatbots and Conversational Agents that offer on-demand support and enhance independent learning.

According to Davis (2023) emerging technologies in education that can be integrated in the implementation of the curriculum include: Artificial Intelligence (AI) which is one of the emerging technologies that is revolutionizing the education sector by providing personalized learning experiences for students; Virtual and Augmented Reality in Education (VR and AR) which are transforming the traditional classroom experience by offering immersive learning experiences, collaborative learning environments where students can be able to collaborate on projects and share experiences, regardless of their physical location; Gamification where educators can make learning more enjoyable and interactive by incorporating game elements into the learning process, such as adaptive learning paths in gamified platforms that allow students to progress at their own pace and receive customized learning experiences, learning analytics in gamified environments that provide educators valuable insights into student performance and engagement, enabling them to make data-driven decisions about their teaching methods and curriculum, and game-based assessments offer a more engaging and comprehensive way to evaluate student learning and progress. In addition, Williams (2023) identified Internet of Things (IoT) as one of emerging technologies in education that can be used in the implementation of the curriculum. Internet of Things supports the integration of sensors and smart devices like digital whiteboards where educators can provide diversified and interactive instruction with these technologies.

Integrating Emerging Technologies And Their Application In Teaching And Learning Process

There are many emerging technology tools available that can be integrated in senior secondary school curriculum implementation in Nigeria, but selecting the right ones depends

on their functionality, applications and relevance. Below are some of the emerging technologies for teachers and students proposed by Exquitech (2025):

- a. Google Gemini: This is an AI-driven chatbot for brainstorming lesson plans, summing up content, answering in-class questions. For example, a teacher can ask Gemini, ‘summarize the causes and effects of military rule in Nigeria in 150 words’ or ‘draft a lesson plan for senior secondary school II in Nigeria on the causes of military rule in Nigeria’.
- b. Google AI Studio: This is a web-based tool that allows developers to build, test, and deploy AI models, particularly focusing on generative AI applications. For example senior secondary teachers can create AI-powered interactive chatbots that simulate historical figures, allowing students to engage in virtual Question and Answer sessions based on senior secondary school curriculum.
- c. Notebook LM: This is a Google AI-powered research assistant that helps senior secondary school teachers organize and summarize their lesson notes. For example, a teacher can upload multiple research questions on democracy and use Notebook LM to generate audio, summaries and discussion points for a class debate.

Famodu (2025) has added the following emerging technologies for use by teachers and students:

- a. DALL·E/Adobe Firefly: This technology generates AI-created images for classroom use, providing visual aids for lessons and projects.
- b. Canvas: This emerging technology creates AI-generated posters and presentations, making visual content creation easier and more engaging.
- c. Magic School Tools: This technology offers a wide range of tools for teaching and learning, enhancing various aspects of the educational process.
- d. ElevenLabs: This is an emerging technology that converts text to speech for accessibility by teachers and students.

Applications of Emerging Technologies in Curriculum Implementation

Integration of emerging technologies in the implementation of senior secondary school curriculum in Nigeria can be through the following as expatiated by Exquitech (2025):

- a. Intelligent Tutoring (ITS): This is an AI-powered emerging technology like Google Gemini and ChatGPT that assist teachers and students with writing, problem-solving, and interactive learning.

- b. **Adaptive Learning:** This is AI that customizes learning experiences by adjusting content based on student performance. For example, Khanmigo which provides personalized tutoring.
- c. **Automated Grading:** This is an AI-driven grading system that automates assessments, save time by evaluating multiple-choice quizzes, short answers, and essays based on set rubrics. Key tools here that can be integrated in the implementation of senior secondary school curriculum include Gradescope for assignment evaluation, Tunitin for plagiarism checks and writing feedback, and Google Forms AI for automatic quiz grading and instant feedback.
- d. **Content Creation:** This is AI-powered emerging technology that enhance content creation for educators by generating lesson plans, quizzes, slides, and interactive activities. Key tools to be integrated include Google Gemini and ChatGPT for lesson planning, Canva AI for educational visuals, and MagicSchool AI for worksheets and assessments.
- e. **Student Progress Tracking:** This is another AI-powered tool that tracks student's performance in real-time, helps educators identify learning gaps and provide targeted support. Key tools to be integrated include Google Classroom Analytics for engagement tracking, Edmodo and Schoology AI dashboards for learning insights, and DreamBox Insights for predicting students needing extra math support.
- f. **Administrative Automation:** This is an AI emerging technology that enhances teacher productivity by automating routine tasks such as attendance tracking, email automation for personalized communication, and AI scheduling tools like Google Calendar for organizing meetings and reminders.

Table 1: Emerging Technologies and Classroom Application in Tabular Form

S/NO	TOOLS	CLASSROOM APPLICATION
1	ChatGPT	Brainstorming lesson ideas, summarizing readings, generating writing prompts.
2	Grammarly	Helping students improve grammar, clarity, and structure in essays.
3	Turnitin	Plagiarism detection, ensuring originality in students' assignments.
4	Quizlet AI	Generating quizzes and flashcards, creating customized study sets for test preparation.
5	Gmind AI	Creating formal and casual AI-driven conversations for effective teaching and learning.

6	Google Gemini	AI-driven chatbot for brainstorming lesson plans, summing up content, answering in-class questions.
7	Google AI Studio	A web-based tool that allows developers to build, test, and deploy AI models, particularly focusing on generative AI applications.
8	Notebook LM	AI-powered research assistant that helps teachers organize and summarize notes.
9	Gradescope	Automated grading for assignment evaluation by teachers
10	Canva AI	Helps in creating educational visuals, designs, images for presentation in classes.
11	Edmodo and Schoology	Social learning platform Connecting teachers, students and parents to facilitate teaching and learning.
12	Google Classroom Analytics	Provides educators and administrators with data on student performance and student progress tracking
13	DreamBox	Predicting students needing extra math support

Insights

Source: Danzaria, Ibrahim & Dada (2025)

Pre-Requisites for Integrating Emerging Technologies in Curriculum Implementation

Integration of emerging technologies in the implementation of senior secondary schools curriculum in Nigeria requires addressing gaps to effectively utilize the technologies. In order to explore more benefits in using the technologies in the delivery of the curriculum, the following needs to be taken into consideration:

- a. **Teacher Training:** Ongoing Professional Teacher Development is vital to boost educators' confidence in using the emerging technologies tools.
- b. **Showcase Success:** Real-life teacher experiences with emerging technologies can inspire broader adoption.
- c. **Supportive Communities:** Peer collaboration online and offline is important in helping educators overcome challenges together.
- d. **Start Small:** In order to have smooth integration of the emerging technologies, teachers and students should begin with simple tools or pilot projects to reduce hesitation and build skills.

- e. **Resource Accessibility:** Resources should be accessible and available for proper integration of the emerging technologies in the implementation of the curriculum.
- f. **Student Collaboration:** Learners need to be empowered to explore emerging technologies and present their findings, as their mutual discovery strengthens engagement.
- g. **Celebrate Innovation:** Teachers innovating emerging technologies need to be recognized through awards and public recognition.

Strategies for the Integration of Emerging Technologies in Curriculum Implementation

For effective integration of emerging technologies in the implementation of senior secondary schools curriculum in Nigeria, National Policy on Education (2013), Akinbobola and Akinbobola (2019), Adeniran and Olaleye (2020), and UNESCO (2019) suggested that stakeholders must adopt the following comprehensive strategies:

- a. **Policy Development and Curriculum Reforms:** Governments should revise national curricula to embed technology integration explicitly, aligning with global best practices.
- b. **Capacity Building:** Regular training programs for teachers on digital pedagogy and technology use should be given much attention.
- c. **Infrastructure Enhancement:** Investment in reliable power supply, internet connectivity, and hardware distribution is critical in the integration of emerging technologies in the implementation of senior secondary school curriculum.
- d. **Public-Private Partnerships:** To enhance greater integration of the emerging technologies in the implementation of the curriculum, collaboration with technology firms can facilitate resource mobilization and innovative solutions.
- e. **Monitoring and Evaluation:** Through the establishment of a strong monitoring and evaluation mechanisms to assess the effectiveness of technology integration in the teaching and learning processes, continuous improvements in the integration may be achieved.

According to Williams (2023), there are some few steps schools/teachers can take to select the best emerging technologies. These steps are key in the implementation of senior secondary schools curriculum as follows:

- a. **Assessment of Learning Goals:** Schools/teachers should ensure emerging technologies align with student learning goals and provide successful learning outcomes. It is important to assess how these technologies add value to schools.
- b. **Prioritize Student Needs:** Schools/teachers should consider what emerging technologies would best offer to students, set students up for success with digital tools they will need to continue their education or enter the workforce.

c. **Utilize Trials and Demos:** Some emerging technologies offer a free trial or demo of their tools. A practice run can ensure the tools are fitting for the learning environment, and this will facilitates smoother technology integrations.

d. **Adopt User-Friendly Technologies:** Schools/teachers should opt for user-friendly technology tools, making it easier for educators and students to navigate.

Challenges to Integration of Emerging Technologies in Curriculum Implementation

Several obstacles hinders the integration of emerging technologies in the implementation of the senior secondary schools curriculum in Nigeria. Adeniran and Olaleye (2020), Abdullahi and Salawu (2019), World Bank (2020) and UNESCO (2016) have identified the following obstacles to integrating emerging technologies in curriculum implementation:

a. **Infrastructural Deficits:** Such as inadequate electricity and poor internet connectivity;

b. **Limited Teacher Training:** Many teachers lack the necessary skills and confidence to employ emerging technologies effectively;

c. **Policy and Curriculum Gaps:** Existing curricula may not explicitly incorporate emerging technologies, and policy frameworks are often outdated; and

d. **Financial Constraints:** Such as funding limitations restrict procurement of emerging technological tools and maintenance.

Conclusion and Recommendation

Conclusion

Integrating emerging technologies into Nigeria's senior secondary school curricula presents a hopeful lane to modernize education, promote inclusivity, and improve learning outcomes. Success hinges on strategic policy formulation, continuous teacher training, infrastructural enhancement, and stakeholder collaboration. Overcoming challenges such as infrastructural deficits and financial limitations is essential to realize the full benefits of technological integration. With deliberate and sustained efforts, Nigeria can harness emerging technologies to create a dynamic, equitable, and future-ready education system that aligns with global standards and addresses local needs.

Recommendations

1. Government should develop and implement policies that explicitly incorporate emerging technologies into the national curriculum.

2. Government should regularly train teachers on digital pedagogy and the use of emerging technological tools.

3. Government and other stakeholders should invest and ensure a reliable electricity, internet connectivity, and provision of technological hardware across schools.

4. Encourage collaborations with technology firms to facilitate resource mobilization and innovative solutions.
5. Establish mechanisms to assess technology integration effectiveness, ensuring continuous improvement and adaptation.

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