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Technological Innovations in Teaching and Learning in Nigeria: A Review of Progress, Engagement Strategies, and Challenges

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ABSTRACT

This study provides an in-depth review of the engagement of technological innovations in teaching and learning within the Nigerian educational landscape from 2010 till 2025. It examines the key technological tools and platforms adopted, focusing on their role in fostering student engagement (behavioral, emotional, and cognitive). The paper analyzes the evolution of EdTech in Nigeria, influenced by national policies, socio-economic factors, and global trends, including the significant impact of the COVID-19 pandemic. While highlighting progress in areas such as mobile learning, e-learning platforms, and the use of social media, the review also critically assesses the persistent challenges that hinder widespread and effective integration. These include infrastructural deficits, digital literacy gaps, policy implementation inconsistencies, and socio-economic disparities. Drawing on recent literature, this paper discusses opportunities for enhancing technological engagement and proposes future directions for research, policy, and practice to create more interactive, inclusive, and effective learning environments in Nigeria.

1. INTRODUCTION

The years 2010 to 2025 represent a pivotal phase in the global conversation about including technology into the classroom. With a growing young population, Nigeria is the most populous country in Africa; hence, it is especially important for this country to use technological innovations for improved teaching and learning results (Atete and Ogeh, 2020). Excellent use of these technologies guarantees not only access but also active participation, deeper learning, and the acquisition of 21st-century skills, so transcending their mere availability. From 2010 to the present, this paper examines the trajectory of interesting technological innovations in Nigerian education, including the different types of technologies adopted, their impact on student engagement, the policy environment, and current obstacles.

Over the past decade, the Nigerian government has developed several policies meant to advance Information and Communication Technology (ICT) in education, including the National Policy on ICT in Education (FRN, 2019). Further

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creating opportunities for innovation are the arrival of mobile technologies, growing internet usage (though uneven) and a thriving tech startup ecosystem (Chaman Law Firm,2025). Particularly the COVID-19 pandemic served as an unexpected catalyst, driving a fast, if often makeshift, adoption of remote learning technologies throughout all levels of education (Ekeh, et al., 2025). However, the narrative runs on mixed success. Despite pockets of innovation and active engagement exist, systematic problems usually limit the potential benefits. This paper aims to address:

i. What key technological innovations have been noticeable in Nigerian educational system between 2010 and 2025?
ii. Which main challenges prevent the efficient and interesting application of technology in Nigerian education?
iii. What opportunities and future directions might improve technology-driven engagement in learning?

This paper attempts to give an in-depth overview and critical analysis of the situation of the intriguing technological innovations in Nigerian education by synthesizing present literature, including recent studies up to 2025.

2. MATERIAL AND METHODOLOGY

This paper employs a comprehensive literature review methodology. The study explored peer-reviewed journal articles, conference proceedings, books, official government reports, and publications from respectable technology and educational organizations are all included in the review. The time frame from January 2010 to May 2025 was the main focus of the search for pertinent literature.

Search engines and databases like African Journals Online (AJOL), Web of Science, Scopus, Google Scholar, and ERIC were used. Combinations of "educational technology Nigeria," "ICT in Nigerian education," "student engagement technology Nigeria," "mobile learning Nigeria," "e-learning Nigeria," "EdTech challenges Nigeria," "Nigerian education policy ICT," and particular years within the timeframe were among the search terms used.

Relevance to technological advancements in Nigerian teaching and learning, an explicit or implicit emphasis on student engagement, and a publication date within the allotted time frame were requirements for inclusion in the sources. Empirical research, systematic reviews, and policy analyses were prioritized. To find important trends, innovations, engagement tactics, obstacles, and opportunities, the synthesis employed thematic analysis.

3. DISCUSSIONS FROM THE STUDY-THEORETICAL FOUNDATIONS

Key Technological Innovations and Engagement Strategies in Nigeria (2010-2025)

Mobile Learning (M-learning)

Given that so many people own a mobile phone, m-learning has a lot of potential.

a. Engagement Strategies: Using educational apps, sending announcements via SMS, using WhatsApp for group discussions and prompt feedback, and using mobile devices to access e-books and open educational resources (OERs).
b. Impact: More effective access to educational resources at any time and

location encourages behavioral engagement (e.g., learning on the go). Locally designed EdTech apps and websites. Platforms like YouTube turned into important resources (Itedjere, 2025). Although distractions are still a concern, the ease and familiarity of mobile devices can improve emotional engagement.

E-learning Platforms and Learning Management Systems (LMS)

Adoption increased, especially during and after COVID-19 and in higher education through;

a. Engagement Strategies: Personalized learning modules (where available), discussion boards, assignment submissions, interactive tests, and multimedia content delivery.
b. Impact: LMS made it easier to learn remotely and gave students organized access to course materials. Platform activity and logins demonstrate behavioral engagement. Well-crafted interactive tasks and group projects in the LMS can encourage cognitive engagement (Nakitare et al., 2025). However, lecturer training and institutional support are frequently necessary for effectiveness (Mohamed and Hermansyah, 2024).

Social Media

Platforms like Facebook, WhatsApp, and blogs have been used for more than just socializing. They have also been turned into educational tools. Some of the strategies for getting people involved includes, making learning communities, sharing tools, working on projects together, and having live Q and A sessions with teachers. The effect is that peer interaction and a sense of community make people more emotionally involved. Behavioral engagement by taking an active role in discussions. Cognitive engagement through group debate and knowledge creation
(Age and Echoda, 2021). However, challenges include distraction and the spread of misinformation.

Digital Content and Open Educational Resources (OER)

Increased availability of locally created and globally sourced digital materials.

a. Engagement Strategies: Use of interactive simulations, educational videos, virtual labs, and access to diverse academic databases and e-libraries.
b. Impact: Catered to different learning styles and potentially increased cognitive engagement through exposure to varied and rich content. OERs reduce cost barriers, potentially improving emotional engagement by lessening financial stress.

Interactive Whiteboards and Classroom Technologies

Slow but steady adoption in some well-resourced schools.

a. Engagement Strategies: Dynamic presentations, interactive polling, and direct manipulation of on-screen content.
b. Impact: Can significantly enhance behavioral and cognitive engagement in physical classroom settings by making lessons more dynamic and participatory (Chaman Law Firm, n.d.).

Gamification and AI-Powered Adaptive Learning

These are more recent trends (post-2020) with nascent adoption.

a. Engagement Strategies: Incorporating game mechanics (points, badges, leaderboards) into learning activities; AI tutors providing personalized feedback and learning paths.

b. Impact: High potential for boosting emotional and cognitive engagement by making learning more enjoyable, challenging, and tailored to individual needs (EduTech Global, 2025). However, the implementation in Nigeria is still in its early stages.

Figure 1 shows conceptual framework of engaging technological innovations in teaching and learning in Nigeria from 2010 – present.

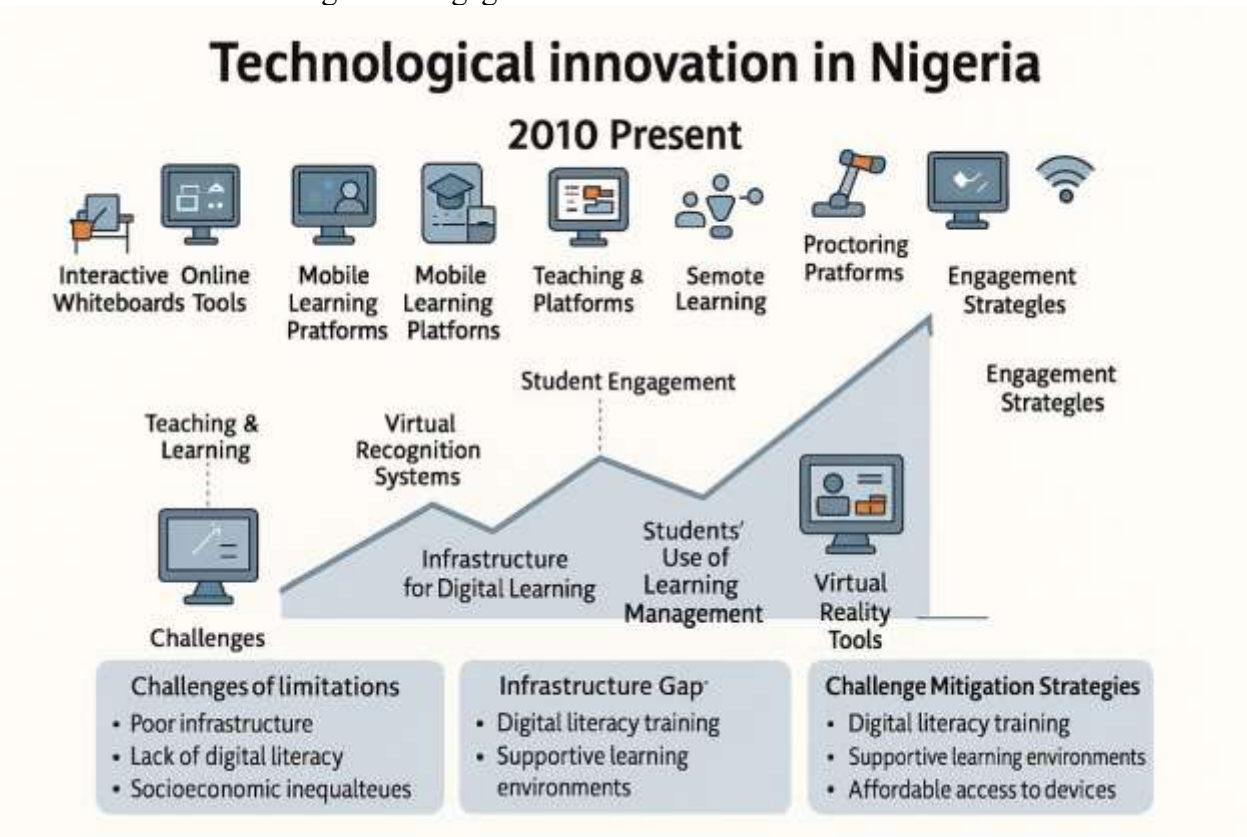

Figure 1: Conceptual Framework for Trends in Technological Innovations in Teaching and Learning in Nigeria

Challenges to Engaging Technological Innovations in Nigeria

Despite potential and obtained accomplishments, there are significant obstacles to the efficient and effective integration of technology in Nigerian education:

a. Infrastructure Deficit: One of the most significant challenges is a power supply that is unstable (Akpomiemie,

2025; RSUFECJ, n.d.). Access and functionality are limited by expensive and limited internet bandwidth, particularly in underserved and rural areas (Mohamed and Hermansyah,2024).

b. Lack of Digital Resources and Devices: The inability of educators and students to obtain computers, tablets, and other necessary hardware continues to be a major obstacle (Ekeh et al., 2025; RSUFECJ, n.d.).
c. Digital Literacy and Skills Gap: Many teachers and students are not equipped with the digital skills required to use technology for instruction and learning (Re Learn, 2024; Bello et al, 2024). ICT integration training for teachers is frequently out-of-date or insufficient (Akpomiemie, 2025).
d. Policy Implementation and Funding: Although there are policies such as the National Policy on ICT in Education, their execution is frequently hindered by a lack of funds, poor coordination, and insufficient monitoring and evaluation systems (Re Learn, 2024; Ahmadu et al., 2025).
e. Pedagogical and Curriculum Issues: It is feasible that the curriculum is not always improved to make good use of technology. Instead of integrating technology into all subjects to improve engagement and critical thinking, there is frequently an emphasis on teaching fundamental ICT skills (Akpomiemie, 2025).
f. Social and Economic Inequalities: The digital divide exacerbates educational disparities by reflecting socioeconomic inequality, with students from low-income families and those living in rural areas having substantially less access to technology (Mohamed and Hermansyah, 2024).
g. Maintenance and Sustainability: Installed facilities are frequently not used because there is a lack of expertise and strategy for maintaining and improving technological infrastructure.
h. Opposition to Change: Some teachers may be reluctant to embrace new technologies because they are unfamiliar with them, anticipate their workload will increase, or lack confidence (Akpomiemie, 2025).

4. RECOMMENDATIONS AND FUTURE DIRECTIONS

Despite challenges, Nigeria has significant opportunities to improve the interesting application of technological developments in education, this study recommends the following:

1. Leveraging Mobile Technology: Keep profiting from the high mobile penetration by encouraging the creation and application of affordable and essential mobile learning tools and resources. Zero-rating apps and websites for educational purposes could increase access.
2. Public-private partnerships (PPPs) encourage government, EdTech companies, telecom providers, and NGOs to improve infrastructure, create local content, and provide teacher training (Ahmadu et al., 2025; NigeriaMag, 2025).
3. Teacher Professional Development: In addition to technical skills, but also substantially invest in ongoing, practical professional development for teachers concentrated in

pedagogical integration of technology. Useful guide may discover the Technological Pedagogical Content Knowledge (TPACK) framework.

For national ICT in education policies, guarantee sufficient funding, well defined implementation schedules, and robust monitoring and evaluation. The most current National Digital Learning Policy (NESG, 2023) exhibits continuous intention. Starting from elementary education, encourage digital literacy initiatives for teachers as well as for their students. Encourage the development of digital learning materials in line with the Nigerian curriculum which reflect local cultures and contents, so achieving localized and culturally relevant content. Support research in educational technology to identify best practices, assess the impact of various interventions, and foster native innovations (Re Learn, 2024).

Emphasize equity and inclusion; develop strategies to ensure underprivileged categories such as rural area students and those with disabilities have access to innovative technologies. This encompasses examining community technology centers and offline solutions. Post-COVID, there is an opportunity to develop sustainable blended learning models combining the best of face-to-face instruction with technology-mediated learning (EduTech Global, 2025).

5. CONCLUSION

The journey of engaging technological innovations in teaching and learning in Nigeria from 2010 to 2025 has been characterized by both promising advancements and persistent systemic obstacles. Social media use, e-learning platforms, and mobile learning have all demonstrated potential in fostering different aspects of student engagement. Although disruptive, the COVID-19 pandemic also gave particular attention to EdTech's potential and demand. However, socioeconomic inequalities policy implementation difficulties, digital literacy gaps, and infrastructure constraints severely limit the full potential.

It is crucial to take a multifaceted approach going forward that includes strong teacher professional development, strategic public-private partnerships, ongoing government commitment, and an emphasis on equitable access. By addressing these challenges and capitalizing on the opportunities presented by its dynamic youth population and growing tech ecosystem. Nigeria can more effectively harness technological innovations to create engaging, inclusive, and high-quality learning experiences for all its citizens, thereby contributing to national development and global competitiveness. The focus must shift from mere deployment of technology to its thoughtful and pedagogically sound integration to truly engage learners and transform educational outcomes.

Suggestions for future study

The following areas can be the focus of future research:

i. Longitudinal study to monitor how particular technologies affect learning outcomes and engagement

ii. Effective models for scaling up successful pilot projects, as well as comparative analyses of various EdTech interventions in the Nigerian context.

iii. Another important area of research will be examining the moral ramifications of growing AI use in education.

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