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ASSESSING THE INTEGRATION OF EMERGING TECHNOLOGIES IN SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION CURRICULUM IN NIGERIAN UNIVERSITIES

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Abstract.
Science, Technology and Mathematics Education (STME) is widely recognized as an interdisciplinary programme designed to equip learners with the knowledge and skills required to address complex societal and global challenges. In recent years, the integration of emerging technologies has significantly transformed the ways scientific concepts are taught, visualized, and understood in educational settings. This study assessed the extent to which emerging technologies are integrated into the implementation of the STME curriculum in Nigerian universities. The study was guided by four research objectives and four corresponding research questions. A descriptive survey research design was adopted. The population consisted of lecturers and students of the University of Ilesa in Osun State, Nigeria. A sample of 130 respondents, comprising 30 lecturers and 100 students drawn from the Faculty of Education and Faculty of

Biological Sciences, was selected using a purposive sampling technique. Data were collected using a structured questionnaire and analyzed using descriptive statistics, specifically, frequencies, percentages, mean scores, and standard deviation. The findings revealed that the use of emerging technologies has brought tangible progress in embedding technological innovations in instructional practices in Nigeria Universities. It was recommended, among others, that the universities should organize regular digital literacy and pedagogy training for lecturers to strengthen their competence in using emerging technologies for instructional delivery.

Keywords: Emerging Technology, Technology Integration, STEM Education, Nigerian University, Educational Technology.

Introduction

The contemporary world is increasingly shaped by rapid technological advancement, which has significantly transformed various sectors, including education. In particular, the integration of digital tools has become central to improving teaching and learning in Science, Technology, and Mathematics Education (STME). Emerging technologies such as digital microscopes, virtual laboratories, simulations, and augmented and virtual reality are redefining how complex scientific ideas are presented and understood in educational environments. These technologies provide visual, interactive, and experiential learning opportunities that can improve students' conceptual understanding, retention of knowledge, and critical thinking skills.

In the 21st century, the integration of emerging technologies into science education has become increasingly important as educators seek innovative ways to prepare students for participation in a technology-driven global society. Globally, technologies such as Artificial Intelligence (AI), machine learning, robotics, the Internet of Things (IoT), and data science are reshaping educational practices by enhancing instructional delivery, enabling personalized learning, and facilitating real-world problem solving. These technological developments provide opportunities for students to engage with scientific concepts through simulations, data analysis, and inquiry-based learning experiences that were previously difficult to implement in traditional classrooms.

Emerging technologies in education can be broadly described as modern digital tools and systems that support teaching, learning, communication, and knowledge construction in innovative ways. In science education, these technologies often include AI-supported learning systems, virtual experimentation platforms, robotics applications, and interactive simulations that allow learners to explore scientific concepts in dynamic and immersive ways. According to Selwyn (2016), the presence of digital technologies in education creates new pedagogical possibilities such as personalized learning environments, real-time feedback mechanisms, and collaborative knowledge construction.

The integration of such technologies into science education is strongly supported by constructivist learning theory, which emphasizes active participation in the learning process. Constructivism views learning as a process through which individuals construct

knowledge based on their interactions with experiences and prior understanding. From this perspective, learners are not passive recipients of information but active participants who build meaning through inquiry, experimentation, and reflection. As noted by Ejiwale (2018), constructivist learning environments encourage exploration, questioning, and discovery, thereby enabling students to develop deeper conceptual understanding.

In technology-supported classrooms, constructivist principles are operationalized through student-centered instructional practices such as inquiry-based learning, problem solving, and interactive experimentation. Digital technologies make it easier for educators to implement these approaches by providing simulation tools, collaborative platforms, and access to scientific data. For this study, the constructivist framework guided the development of the research instrument by focusing on key indicators of technology integration, such as learner engagement, interactive learning environments, access to digital resources, and opportunities for inquiry-based exploration in science instruction.

Empirical evidence has shown that the integration of technology in STME can enhance students' analytical thinking, creativity, and problem-solving abilities while also preparing them for complex real-world challenges (Jung & Lee, 2020). Nevertheless, the successful implementation of emerging technologies in education depends on several factors, including curriculum design, teachers' technological competence, availability of infrastructure, and institutional support systems.

In Nigeria, the integration of emerging technologies into university curricula remains uneven despite growing recognition of their importance. The National Policy on Education emphasizes the need to incorporate innovative teaching approaches and digital technologies into educational practice (FGN, 2024). However, many universities still struggle with the practical implementation of these policy directives. Studies have identified several barriers to technology integration in Nigerian higher education institutions, including inadequate funding, limited digital infrastructure, insufficient professional development for lecturers, and rigid curriculum structures (Olaoye et al., 2020; Okonkwo & Ndubuisi, 2019).

Another major concern is the digital differences that exist between institutions in different regions, especially between public and private universities. Bamiro (2022) notes that disparities in access to technological infrastructure often influence the extent to which universities can adopt innovative teaching tools. As a result, students in some institutions may have limited exposure to modern scientific technologies that are essential for contemporary scientific practice.

Despite these challenges, there has been increasing interest in the adoption of technological innovations in Nigeria's tertiary education system. Recent initiatives have seen the gradual introduction of coding, robotics, artificial intelligence, and data science into some university curricula as part of efforts to align Nigerian education with global technological developments (Nwachukwu et al., 2021). These developments suggest that universities that invest in technological infrastructure and staff development may significantly enhance the quality of science education and better prepare students for emerging career opportunities.

In this study, the University of Ilesa represents an emerging institution with considerable potential for the strategic integration of educational technologies into science education programmes. As a growing university, the adoption of emerging technologies could significantly enhance teaching effectiveness, promote student engagement, and improve the overall quality of science education. However, the extent to which these technologies have been integrated into the implementation of the science education curriculum within the institution remains largely undocumented.

Assessing the current level of technology integration is therefore important for understanding institutional readiness, identifying existing challenges, and exploring opportunities for future improvement. Such an evaluation can provide valuable insights into the availability of technological infrastructure, the preparedness of lecturers and students to use digital tools, and the institutional policies that either support or constrain technological innovation in teaching and learning.

Consequently, this study examines the integration of emerging technologies in the implementation of the science education curriculum at the University of Ilesa. Specifically, the study seeks to evaluate current practices, identify challenges affecting technology adoption, and explore prospects for enhancing science education through technology-supported pedagogical approaches.

Statement of Problems

Studies have shown that emerging technologies such as artificial intelligence, virtual laboratories, digital simulations, and data analytics are increasingly transforming teaching and learning across the world, particularly in Science, Technology and Mathematics Education (STME). These technologies enable interactive learning, promote conceptual understanding, and support inquiry-based scientific investigation. As a result, many universities across developed and developing countries are progressively integrating technological innovations into their curricula in order to prepare students for participation in a rapidly evolving digital and knowledge-driven society.

However, the situation in many Nigerian universities appears to differ significantly from global trends. Despite the increasing emphasis on technological innovation in education, the integration of emerging technologies into science education remains limited and uneven across institutions. Empirical studies have reported that many lecturers still rely heavily on traditional lecture-based instructional approaches, while the use of digital tools for teaching and learning remains relatively low (Olaoye et al., 2020; Okonkwo & Ndubuisi, 2019). In addition, Bamiro (2022) observed that inadequate digital infrastructure, limited institutional funding, and insufficient professional training for lecturers continue to hinder the effective adoption of technology in Nigerian higher education institutions.

Although the National Policy on Education advocates the integration of information and communication technologies and other innovative practices into teaching and learning (Federal Republic of Nigeria, 2024), the practical implementation of these policy directives in many universities has been slow. Consequently, students in several science-related programmes often have limited opportunities to engage with modern

scientific tools such as simulations, virtual laboratories, and data-driven analytical platforms. This situation raises concerns about the preparedness of graduates from Nigerian universities to meet the technological and scientific demands of the contemporary global workforce.

While these challenges have been discussed broadly within the Nigerian higher education system, there is limited empirical evidence regarding the current level of emerging technology integration within specific institutions. In particular, little is known about the extent to which these technologies have been incorporated into the implementation of the Science, Technology and Mathematics Education curriculum at the University of Ilesa, a relatively new and developing university in Osun State, Nigeria.

Therefore, it becomes necessary to assess the extent to which emerging technologies are integrated into the implementation of the Science, Technology, and Mathematics Education curriculum at the University of Ilesa. Such an assessment will help determine existing practices, evaluate their effectiveness in improving teaching and learning outcomes, and identify the challenges that may hinder the full adoption of these technologies within the institution.

Research Questions

Based on the objectives above, the study is guided by the following research questions:

1. To what extent are emerging technologies integrated into the Science, Technology and Mathematics Education curriculum in Nigerian universities?
2. How effective are instructional delivery methods that utilize emerging technologies in enhancing teaching and learning outcomes in Science, Technology and Mathematics Education?
3. What challenges and barriers hinder the effective integration of emerging technologies into the STME curriculum in Nigerian universities?
4. What strategies and best practices can enhance the adoption and sustainability of emerging technologies in STME programmes in Nigerian universities?

Methodology

The study adopted a descriptive survey research design to assess the level of integration of emerging technologies in the implementation of the Science, Technology and Mathematics Education (STME) curriculum in Nigerian universities. A descriptive survey design was considered appropriate because it enables the researcher to collect data from both the lecturers and students in order to describe their perceptions, experiences, and opinions regarding the integration of emerging technologies into the STME curriculum.

The population of the study consisted of all lecturers and students in the Faculty of Education and the Faculty of Sciences at the University of Ilesa, Osun State, Nigeria, particularly those involved in science-related programmes. From this population, a sample of 130 respondents was selected, comprising 30 lecturers and 100 students drawn from the Science, Technology and Mathematics Education (STME) Department and the Departments of Physics, Chemistry, and Biological Sciences.

A purposive sampling technique was employed to select respondents who were directly involved in science education and were therefore considered capable of providing relevant information about the use of emerging technologies in teaching and learning. Lecturers who teach science-related courses and students enrolled in these programmes were intentionally selected because of their direct exposure to the STME curriculum.

Data for the study were collected using a structured questionnaire developed by the researchers, titled "Emerging Technology Questionnaire (ETQ)". The instrument consisted of 20 items for the students and 21 items for the lecturers, which were designed to measure the key objectives of the study.

The questionnaire was divided into four sections, namely: Availability of Emerging Technologies whose items assessed the presence of technological tools such as digital laboratories, simulation software, and internet-enabled learning platforms within the institution; Extent of Usage of Emerging Technologies whose items examined how frequently lecturers and students use these technologies in teaching and learning activities; Perceived Effectiveness of Emerging Technologies whose items measured respondents' views on how these technologies improve instructional delivery, students' engagement, and understanding of scientific concepts and; Challenges and Future Prospects of Technology Integration whose items identified barriers to effective technology integration and exploring possible opportunities for improving its adoption.

Responses were measured using a four-point Likert scale ranging from Strongly Agree (4), Agree (3), Disagree (2), to Strongly Disagree (1). To ensure content validity, the instrument was reviewed by three experts in Educational Measurement and Evaluation. These experts examined the questionnaire to determine the clarity, relevance, and adequacy of the items in relation to the research objectives. Their suggestions and corrections were incorporated into the final version of the instrument before it was administered to the respondents.

The reliability of the instrument was determined using Cronbach's alpha method, which measures the internal consistency of the questionnaire items. A pilot test was conducted using respondents with similar characteristics to the study population but outside the selected sample. The analysis produced a reliability coefficient of 0.73, indicating that the instrument was sufficiently reliable for the study.

The researchers personally administered the questionnaire to the selected respondents within their respective departments at the University of Ilesa. Before the administration of the instrument, the purpose of the study was clearly explained to the participants, and they were assured that the information provided would be used solely for academic purposes. The respondents were given adequate time to complete the questionnaire, after which the completed copies were collected immediately to ensure a high response rate.

The data collected were analysed using descriptive statistics, specifically frequencies, percentages, mean scores, and standard deviation, to answer the research questions. The Likert scale responses were assigned numerical values ranging from 4 to 1, and the mean scores of the items were computed to determine the level of agreement among respondents. These statistical techniques were considered appropriate because

they enabled the researchers to summarize and interpret the respondents' perceptions regarding the integration of emerging technologies in the STME curriculum.

Results

Descriptive Analysis of Research Questions

Research Question One: To what extent are emerging technologies integrated into the Science, Technology and Mathematics Education curriculum in Nigerian universities?

This research question was answered with different questionnaire items seeking the extent of incorporation of merging technology into the curriculum in Nigeria. The responses of both the students and the lecturers were analysed separately. The questionnaire was structured in such a way that Strongly Agree had a value of 4, Agree had a value of 3, Disagree had a value of 2, while Strongly Disagree had a value of 1. The values of the responses to each of the questionnaire items were summed up to represent the extent of incorporation of technologies into the curriculum. On the measure, the minimum and maximum values are 13 and 24, respectively. The scores were divided into low extent, moderate extent, and great extent. The analysis is presented in Table 1.

The result of the analysis based on students' responses with reference to each research objective is presented below:

Table 1. Extent of Incorporation of Emerging Technologies

Extent	N	%
Low	5	5.0%
Moderate	56	56.0%
High	39	39.0%

Table 1 shows the extent of incorporation of emerging technologies. The table shows that 5% of the students agreed on a low extent of incorporation, 56% agreed to a moderate extent, while 39% agreed to a great extent of incorporation of emerging technologies.

In summary, the extent of incorporation of emerging technologies into the STME curriculum was moderate. However, for the lecturer's responses, this research question was answered with different questionnaire items seeking the extent of incorporation of merging technology into the curriculum in Nigeria. The responses of both the students and the lecturers were analyzed separately. The questionnaire was structured in such a way that Strongly Agree had a value of 4, Agree had a value of 3, Disagree had a value of 2, while Strongly Disagree had a value of 1. The values of the responses to each of the questionnaire items were summed up to represent the extent of incorporation of technologies into the curriculum. On the measure, the minimum and maximum values are 12 and 24, respectively. The scores were divided into low extent, moderate extent, and great extent. Those with scores from 12 to 15 were regarded as low extent, those with scores from 16 to 20 were regarded as moderate, while those with scores from 21 to 24 were regarded as great extent. The analysis is presented in Table 2

Table 2. Extent of Incorporation of Emerging Technologies

Level	N	%
Low	1	3.3%
Moderate	6	20.0%
High	23	76.7%

Table 2 shows the extent of incorporation of emerging technologies. The table shows that 3.3% of the students agreed on a low extent of incorporation, 20.0% agreed to a moderate extent, while 76.7% agreed to a great extent of incorporation of emerging technologies. In summary, the extent of incorporation of emerging technologies into the STME curriculum was high.

Research Question 2:
How effective are instructional delivery methods that utilize emerging technologies in enhancing teaching and learning outcomes in Science, Technology and Mathematics Education?

To analyse this objective, the values of the responses to each of the questionnaire items were summed up to represent the extent of incorporation of technologies into the curriculum. On the measure, the minimum and maximum values are 10 and 26, respectively. The scores were divided into not effective, effective, and very effective. The analysis is presented in Table 3.

Table 3: Effectiveness of Emerging Technologies in Enhancing Learning

Effectiveness	N	%
Not effective	3	3.0%
Effective	35	35.0%
Very effective	62	62.0%

Table 3 shows the effectiveness of emerging technologies in enhancing learning. The table shows that the 3% of the students showed that it has not been effective, 35% showed that it has been effective, while 62% showed that it has been very effective.
In summary, the use of emerging technologies in instructional delivery has been very effective.

For the lecturer's responses, to analyse this objective, the values of the responses to each of the questionnaire items were summed up to represent the extent of incorporation of technologies into the curriculum. On the measure, the minimum and maximum values are 11 and 19, respectively. The scores were divided into not effective, effective, and very effective. Those respondents with scores from 11 to 13 were regarded as not effective, those with scores from 14 to 16 were regarded as effective, while those with scores from 17 to 19 were regarded as very effective. The analysis is presented in Table 4

Table 4: Effectiveness of Emerging Technologies in Enhancing Learning

Effectiveness	N	%
Not Effective	3	10.0%
Effective	19	63.3%
Very Effective	8	26.7%

Table 4 shows the effectiveness of emerging technologies in enhancing learning. The table shows that the 3% of the respondents showed that it has not been effective, 63.3% showed that it has been effective, while 26.7% showed that it has been very effective.

Research Question Three

What challenges and barriers hinder the effective integration of emerging technologies into the STME curriculum in Nigerian universities?

Table 5: Challenges and Barriers to Integration of Emerging Technologies

		SA	A	D	SA
9	Limited access to devices hinders my ability to learn using emerging technologies	32 32.0%	49 49.0%	15 15.0%	4 4.0%
10	Poor internet connectivity affects my learning experience when using technology.	44 44.0%	31 31.0%	20 20.0%	5 5.0%
11	I face difficulties in using certain technological tools required in my courses.	23 23.0%	39 39.0%	27 27.0%	11 11.0%
12	My lecturers lack sufficient training to effectively use emerging technologies in teaching	10 10.0%	23 23.0%	52 52.0%	15 15.0%

Table 5 presents the challenges and barriers faced by students in the use of emerging technologies in the STME curriculum. The table shows that poor internet connectivity was the highest challenge faced by the students. In addition, limited access to devices ranked second as the challenge hindering the emerging technology. Difficulty using certain technological tools ranked 3rd , while lecturers lacking sufficient training ranked least.

Table 6: Challenges and Barriers to Integration of Emerging Technologies

		SA	A	D
7	Limited access to funding affects the integration of emerging technologies in science education.	12 41.4%	15 50.0%	2 6.7%
8		14	13	2

	There is inadequate technical support for the maintenance of technological tools.	46.7%	43.3%	6.7%
9	The existing infrastructure for technology integration in the university is insufficient.	12 40.0%	-	13 43.3%
10	Some lecturers lack sufficient digital literacy skills to fully utilize emerging technologies.	13 43.3%	11 36.7%	3 10.0%

Table 6 shows the challenges and barriers affecting the integration of emerging technologies into the STME curriculum as perceived by the lecturers. The table shows that inadequate technical support was ranked the highest according to the responses of the lecturers. Limited access to funds ranked second, lack of sufficient digital literacy skills by the lecturers ranked third, while the least ranked challenge was the insufficiency of existing infrastructure.

Research Question Four

What strategies and best practices can enhance the adoption and sustainability of emerging technologies in STME programmes in Nigerian universities?

Table 7. Analyses based on the responses of the students

13	More training should be provided to students on the use of emerging technologies.	67 67.0%	33 33.0%	-	-
14	The university should invest in more up-to-date technological tools for learning.	69 69.0%	25 25.0%	4 4.0%	2 2.0%
15	Collaboration between universities and tech companies would improve technology integration in teaching.	62 62.0%	37 37.0%	1 1.0%	-

Table 7 presents the recommended strategies and best practices for improving the adoption and sustainability of emerging technologies training and re-training of lecturers ranked first, investment in up-to-date technological tools ranked second, while collaboration between university and tech companies ranked third.

Table 8. Analyses based on responses of the lecturers to recommend strategies and best practices for improving the adoption and sustainability of emerging technologies in STME programmes

		SA	A	D	SD
16	Collaboration with external technology providers can enhance science teaching.	22 73.3%	-	6 23.3%	2 6.7%
17	More training programs should be provided for lecturers on using emerging technologies in teaching.	20 66.7%	10 33.3%	-	-
18	Student-led technology projects should be encouraged in science programs.	16 53.3%	-	12 40.0%	2 6.7%
19	Funding should be allocated specifically for technological innovation in science education.	24 80.0%	-	5 16.7%	1 3.3%
20	Expanding internet access across the campus will enhance digital learning opportunities.	16 53.3%	14 46.7%	-	-
21	Curriculum revision should prioritize technology integration in all science-related courses.	24 80.0%		4 13.3%	2 6.7%

Table 8 shows the responses of the lecturers to the strategies and best practices that can improve the adoption and sustainability of emerging technologies in STME programmes in the university. From the table, organising training programmes for the lecturers ranked highest, provision of adequate funds ranked second, expanding internet access across the campus and curriculum revision to prioritise technology integration ranked third, collaboration with external technology providers ranked fifth, while encouraging Student-led technology projects ranked lowest.

Discussion

This study examined the integration of emerging technologies in Science, Technology and Mathematics Education (STME) curriculum implementation in Nigerian universities. Analyses were based on responses from both students and lecturers from the University of Ilesa, Ilesa, Osun State. The findings were discussed with respect to the four key objectives and aligned with relevant theoretical and empirical literature.

1. Extent of Incorporation of Emerging Technologies in STME Curriculum

The findings revealed that both students (71.7%) and lecturers (76.7%) perceived a high extent of incorporation of emerging technologies into STME curriculum activities. Most lecturers reported that they frequently used digital tools and platforms in teaching (56.7%

strongly agreed), and a majority of students indicated that technology was integrated into their learning activities. This high level of integration suggests that universities have made tangible progress in embedding technological innovations into instructional practices.

This finding supports Adegboye and Ige (2023), who found that the gradual adoption of digital tools in Nigerian higher education has improved lesson delivery and engagement in science-based courses. Similarly, Akomolafe and Adedoyin (2022) reported that the inclusion of technological tools in STEM classrooms promotes students' motivation and conceptual understanding. However, despite this advancement, the study also noted inconsistencies in the provision of adequate facilities, especially in laboratory-based instruction, where modern tools are still limited in some institutions.

The result aligns with the Technology Acceptance Model (TAM), which posits that perceived usefulness and ease of use determine users' acceptance of technology (Davis, 1989). Lecturers' willingness to integrate technology indicates positive behavioral intention, while students' positive perception reflects growing adaptability to digital learning environments. Thus, while the extent of incorporation is great, sustainability depends on continuous infrastructural support and institutional commitment.

2. Effectiveness of Emerging Technologies in Enhancing Teaching and Learning Outcomes.

The findings revealed that 63.3% of lecturers and 68.3% of students perceived emerging technologies as effective in enhancing teaching and learning outcomes. Emerging technologies such as virtual laboratories, interactive simulations, and artificial intelligence-based tools were reported to enhance collaboration, critical thinking, and learner engagement. These outcomes align with prior studies by Eze et al. (2021) and Kpolovie (2020), who emphasized that digital technologies facilitate student-centered learning and improve scientific literacy and problem-solving skills.

Furthermore, the findings underscore the role of technology in improving conceptual understanding and science process skills, consistent with constructivist learning theories that promote experiential learning through digital engagement. However, a small proportion of respondents (10%) noted limited effectiveness due to poor connectivity and inconsistent access to digital devices. This suggests that while technological integration is conceptually effective, practical limitations undermine its full potential.

This finding implies that technology-enhanced learning in Nigerian universities has moved beyond pilot experimentation to moderate institutionalization. Nevertheless, ensuring sustained effectiveness requires consistent upgrading of digital infrastructure and capacity building among lecturers and students.

3. Challenges and Barriers to the Integration of Emerging Technologies.

The study revealed that both respondents (students and lecturers) identified insufficient technical support, inadequate funding, limited digital literacy, and weak infrastructure as major challenges hindering full integration. Lecturers ranked inadequate technical support and limited funding as the top barriers, while students similarly pointed to

unreliable internet connectivity and lack of access to devices. These findings corroborate those of Okoye and Afolabi (2022), who reported that Nigerian universities face infrastructural and financial constraints that impede technology-driven pedagogy. Similarly, UNESCO (2021) observed that digital inequality remains a major setback for African universities seeking to implement blended or AI-assisted instruction. Additionally, the study highlighted a digital competence gap among some lecturers, reflecting the need for targeted professional development. This aligns with the argument of Yusuf and Balogun (2020) that teacher digital literacy significantly determines the success of educational technology integration.

4. **Strategies for Improving Adoption and Sustainability of Emerging Technologies.**

The findings revealed a strong consensus among lecturers that continuous training and adequate funding are critical for improving the adoption of emerging technologies. Expanding internet connectivity, revising curricula to include technology integration, and fostering collaboration with technology providers were also highlighted as effective strategies. These recommendations resonate with the propositions of Aina and Olaoye (2023), who stressed the importance of institutional policies that promote ongoing staff development and funding for digital infrastructure. They also align with the World Bank's (2022) framework for digital transformation in higher education, which emphasizes investment in capacity building and sustainable innovation ecosystems. Generally, the findings demonstrate a shared understanding between students and lecturers that technology adoption enhances learning outcomes but requires systemic reforms for continuity. Universities should adopt a holistic digital strategy encompassing curriculum design, staff training, infrastructural provision, and policy support to ensure effective and sustainable integration.

Conclusion and Recommendations

Based on the findings of the study, it was then concluded that the use of emerging technologies has brought tangible progress in embedding technological innovations in instructional practices in Nigeria Universities. Also, in order to sustain the progress achieved so far requires deliberate investment in human and material resources, curriculum reform, and institutional support systems.

Based on the conclusion, the following recommendations were proposed:

1. Universities should organize regular digital literacy and pedagogy training for lecturers to strengthen their competence in using emerging technologies for instructional delivery.
2. Government and university management should prioritize funding for digital infrastructure, virtual laboratories, and reliable internet connectivity across campuses.
3. Science, Technology and Mathematics Education curricula should be periodically reviewed to incorporate technological competencies, digital ethics, and AI-assisted instructional modules.

4. Institutions should collaborate with technology firms, NGOs, and development partners to access modern educational tools and professional training.
5. The Federal Ministry of Education should develop a national framework guiding the integration of emerging technologies into higher education, with specific benchmarks for implementation and evaluation.

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