



**HARNESSING TECHNOLOGY FOR EFFECTIVE SCIENCE TEACHING
PEDAGOGIES IN HIGHER INSTITUTIONS IN NIGERIA IN AN ERA OF
INSECURITY AND ECONOMIC MELTDOWN.**

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Abstract

The study investigated Harnessing Technology for Effective Science Teaching Pedagogies in Higher Institutions of Learning in Nigerian in an era of Insecurity and Economic Meltdown. This is a descriptive survey study. The study was carried out in Nnamdi Azikiwe University Awka, South East Nigeria. To guide the research, three questions were formulated by the researchers. The population of the study comprises of all teaching staff members from faculty of education Nnamdi Azikiwe University Awka. A simple random sampling technique was used to select 125 teaching staff from Science Education, Health Education and Human Kinetics departments in Faculty of Education at Nnamdi Azikiwe University Awka for the study. Data collection was done using a validated questionnaire instruments on Harnessing Technology for Effective Science Teaching Pedagogies in Higher Institutions in an era of Insecurity and Economic Meltdown (HTESTPHILEIEM), consisting of 25 items which were distributed and were collected on the spot to ensure that the instruments returned completely. The reliability index was determined by administering the questionnaire to 20 teaching staff from the science education, Health Education and Human Kinetics department in faculty of Education at Chukwuemeka Odumegwu Ojukwu University, yielding an impressive coefficient of 0.86 through Cronbach Alpha technique coefficient analysis. Mean and standard deviation was used to answers the research questions. The findings of this study showed established that technology-enhanced pedagogies for science teaching in higher institutions of learning were effective, infrastructural requirements are needed for the successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning and, that educator support is needed for successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning in an era of insecurity and economic meltdown. Based on the findings, recommendations were made among which are that higher institution in Nigeria should endeavour to have technological infrastructures and facilitate regular training of teachers on the effective ways of integrating technology for effective science teaching pedagogies in our institutions of learning in the best interest of our nation and our students in particular.

Keywords: Harnessing, Technology, Effective Science Teaching, Pedagogies, era of insecurity and economic meltdown



Introduction

In an era marked by insecurity and economic challenges, technology can serve as a powerful tool for enhancing science teaching pedagogies in institutions of higher learning globally. By integrating technology into teaching and learning systems, educators can create more engaging, accessible, and effective learning experiences, even in challenging circumstances. This includes leveraging online resources, simulations, and interactive tools to foster critical thinking, problem-solving skills, and deeper understanding of scientific concepts.

Technology can be harnessed for effective science teaching in insecure environments through enhanced accessibility and flexibility, utilizing online learning platforms such as Moodle, Google Classroom, or Canvas, to deliver course materials, assignments, and assessments remotely. This is particularly crucial in areas with limited access to physical classrooms or where safety concerns restrict in-person gatherings.

Blended learning approaches, combining online learning with occasional face-to-face sessions, can maximize flexibility and engagement, allowing for a mix of self-paced learning online and interactive, hands-on activities in a controlled environment. Digital libraries and resources can provide access to a wide range of online scientific journals, research databases, and educational videos, ensuring students can access up-to-date information and resources regardless of physical location.

According to Lai (2023), incorporating interactive quizzes, educational games, and gamified learning platforms can make learning more engaging and enjoyable, while simultaneously assessing student understanding. Universities and other higher institutions can harness the power of technology to create a more resilient and effective science education system, even in the face of insecurity, by utilizing online discussion forums, data analysis tools, open educational resources (OER), bridging the digital divide, accessibility features, training and support, remote assessment, contingency planning, and mental health support.



The integration of Information, Communication, and Technology (ICT) into teaching and learning can assist teachers in attaining the global requirement of replacing traditional teaching methods with technology-based teaching and learning tools and facilities (Ghavifekr & Rosdy, 2015). Technology integration into education is paramount for several reasons. Firstly, it enhances engagement and interaction in the learning process, as students are provided with opportunities to explore concepts through multimedia resources, interactive simulations, and virtual environments (Mohebi, 2021). This engagement fosters active participation and deeper understanding, ultimately leading to improved retention of knowledge.

In the face of economic hardship, institutions of higher learning and universities can leverage technology to enhance effective science teaching pedagogies by adopting innovative approaches like blended learning, virtual labs, and online resources, making learning more engaging, accessible, and cost-effective, ultimately improving student outcomes. Technology can be harnessed for effective science teaching during an economic downturn using blended learning, personalized learning, increased accessibility, cost-effectiveness, and other online channels.

The utilization of technology in teacher education has witnessed a burgeoning popularity, affording educators a broader spectrum of choices in formulating pioneering pedagogical strategies (Adedayo, 2024). The integration of technology into the learning environment has an important place in the education process, providing many advantages for both teachers and students (Esra, Sümeyra & Elif, 2023). This study investigates harnessing technology for effective science teaching pedagogies in higher institutions of learning in Nigeria, in an era of insecurity and economic meltdown, building on the global context and literature on technology integration in education.

Statement of the Problem

Persistent insecurity and economic instability significantly affect school activities. Sit-at-home on Mondays order in the south east, hunger, economic challenges, and other lives threatening circumstances pose big challenges because there is no free movement for the fear of being attacked, and this has also affected economic growth in the region (Njoku, 2022).



This is not only peculiar to south East as all parts of the country are adversely affected by one insecurity issue or the other. In the North-East, boko haram menace, kidnapping and banditry, terrorism/ insurgency, North-West; armed banditry conflicts. North -Central; farmer herder conflicts and other forms of criminalities, South-West; armed robbery and kidnapping, South South; oil theft, militancy to mention but a few. Concurrently, economic meltdowns result in severe underfunding of the education sector, inadequate infrastructure and laboratory facilities, a lack of essential teaching materials (such as modern equipment and internet connectivity), and poor remuneration for teachers, which further demotivates staff and impacts the quality of instruction. These combined crises severely disrupt the traditional face-to-face science teaching pedagogy, which often relies on consistent laboratory access and a stable learning environment, leading to poor student engagement, inadequate development of critical scientific skills and ultimately, the production of a subpar workforce ill-equipped to address national challenges or contribute to economic recovery. While technology offers a potential solution to mitigate these disruptions (e.g., through remote learning, virtual labs, and online resources), its effective integration is hindered by the very same challenges of inadequate infrastructure, lack of teacher training, and financial constraints inherent in the current environment. Therefore, there is a pressing need to investigate and develop sustainable, technology-enhanced science teaching pedagogies that are resilient to the constraints imposed by insecurity and economic instability, to ensure continuity of learning, enhance teacher competency, and produce scientifically literate graduates capable of fostering future transformation and development. These prompted the study on Harnessing Technology for Effective Science Teaching Pedagogies in Higher Institutions of Learning in Nigerian in an era of Insecurity and Economic Meltdown

The Purpose of this study are to:

1. Identify effective technology-enhanced pedagogies for science teaching in higher institutions of learning in an era of insecurity and economic meltdown.
2. Examine infrastructural requirements needed for the successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning in an era of insecurity and economic meltdown.



3. Investigate educator support needs for successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning in an era of insecurity and economic meltdown.

Research Questions

1. What is the effective technology-enhanced pedagogies for science teaching in higher institutions of learning during the periods of insecurity and economic challenges?
2. What infrastructural requirements are necessary for successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning in an era of insecurity and economic meltdown?
3. What support do educators need for effective and successful integration of technology-enhanced pedagogies into science teaching in the higher institutions of learning in an era of insecurity and economic meltdown?

Methodology

The research design for this study is a descriptive survey design. The study was carried out at Nnamdi Azikiwe University Awka. The population of the study comprises of all teaching staff members from faculty of education Nnamdi Azikiwe University Awka. A simple random sampling technique was used to select 125 teaching staff from Science Education, Health Education and Human Kinetics departments all in faculty of Education at Nnamdi Azikiwe University Awka for the study. Data was collected using questionnaire instrument on Harnessing Technology for Effective Science Teaching Pedagogy in Institutions of Higher Learning in Nigeria in an era of Insecurity and Economic Meltdown (HTESTPHILEIEM) structured by the researchers which consisted of 25 items. The instruments were administered on the respondents by the research assistances directly and they collected them on the spot to ensure complete return of the instruments. The research instruments questionnaire titled: Harnessing Technology for Effective Science Teaching Pedagogies in Higher Institutions of Learning in an era of Insecurity and Economic Meltdown (HTESTPHILEIEM) was validated by three experts, two from Science Education Department and one from Measurement and Evaluation in Educational Foundations



Department. They all looked at the contents and coverage and established that they are in line with the stated objectives of the study, and good to measure what is designed to measure. Items were adjusted and corrected according to the experts' feedback. The reliability index was determined by administering the questionnaire to 20 teaching staff from the Science Education, Health Education and Human Kinetics departments in Faculty of Education at Chukwuemeka Odumegwu Ojukwu University, yielding an impressive coefficient of 0.86 through Cronbach Alpha technique coefficient. A total of 125 questionnaires were distributed to all the respondents who were asked to read the statements given and choose their answers based on 4-Likert scale ranged from 4= Strongly Disagree, 3= Disagree, 2= Agree and 1= Strongly Agree. The questionnaires consisted of 4 sections. All the data collected from the respondents were gathered together and analysed using Statistical Package for the Social Sciences (SPSS) version 21. The researchers used descriptive analysis of mean and standard deviation to answer the research questions. The decision rule for interpretation of the mean scores of the data is 2.5 benchmarks. Items with mean scores higher or equal to 2.5 will be considered as agreed or competent and items below 2.5 will be categorized as mean scores within not agreed or low competent level.

Results

Research Questions 1: What is the effective technology-enhanced pedagogies for science teaching in higher institutions of learning during the periods of insecurity and economic challenges?

Table 1: mean and standard deviation of the effective technology-enhanced pedagogies for science teaching in higher institutions of learning during the periods of insecurity and economic challenges

S/N	Items	SA	A	D	SD	X	ST. DEV.	Decision
1	Using Online Simulations which is an interactive simulation that mimic real-world experiments, reducing the need for physical resources and enabling students to learn remotely in university is very good in an era of insecurity and economic meltdown.	40	30	30	25	2.68	1.125	AGREED
2	Virtual Laboratories which provide students with a simulated laboratory environment, allowing them to conduct experiments and	40	25	30	30	2.6	1.171	AGREED



- investigations remotely in university is very good for usage in an era of insecurity and economic meltdown.
- 3 Using Video Lectures with pre-recorded video lectures can be delivered reducing the need for physical presence and enabling students to learn at their own pace in higher institutions of learning is apt in an era of insecurity and economic meltdown. 45 25 40 30 2.75 1.188 AGREED
- 4 Using Online discussion forums which can facilitate student engagement, collaboration, and feedback, even in times of insecurity or economic constraints in university in an era of insecurity and economic meltdown is very imperative. 30 45 25 25 2.84 1.011 AGREED
- 5 Gamification elements, such as points, badges, and leaderboards, which can enhance student engagement and motivation in science learning in universities are good for use in an era of insecurity and economic meltdown. 40 30 25 30 2.64 1.166 AGREED
- 6 Using Mobile Learning Apps which can provide students with access to learning resources, quizzes, and interactive activities on-the-go in university are imperative in an era of insecurity and economic meltdown. 45 30 20 30 2.74 1.189 AGREED
- 7 Adoption of flipped classroom approach which involves students learning content at home through videos or readings, and then working on activities and discussions in class in university is essential in an era of insecurity and economic meltdown. 42 32 36 15 2.81 1.037 AGREED
- 8 Technology-enabled collaborative projects which can facilitate student teamwork, problem-solving, and communication skills, even in remote or distributed teams in



university boasts teaching and learning in an era of insecurity and economic meltdown.

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|---|--|----|----|----|----|------|-------|-----------|
| 9 | Using Interactive quizzes which can provide students with immediate feedback and assessment, helping to identify areas where they need additional support in universities is very good mostly in an era of insecurity and economic meltdown. | 30 | 25 | 29 | 41 | 2.35 | 1.173 | DISAGREED |
|---|--|----|----|----|----|------|-------|-----------|

Grand Mean

2.68

From the table above, the grand mean cluster mean of 2.68 is an indication that the teaching staff agreed to the fact that Online discussion forums, Video Lectures, Virtual Laboratories, Online Simulations, gamification elements, mobile learning APPs, flipped classroom discussion, technology enabled collaboration, interactive quizzes and others as indicated in the items above are the effective technology enhanced science teaching pedagogies needed in the institutions of higher learning especially in an era of insecurity and economic meltdown.

Research Questions 2: What infrastructural requirements are necessary for successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning in an era of insecurity and economic meltdown?



Table 2: mean and standard deviation of infrastructural requirements are necessary for successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning in an era of insecurity and economic meltdown.

		SA	A	D	SD	X	ST. DEV	REMARKS
10	Reliable power supply constitutes fundamental necessity, especially in areas with economic constraints and potential insecurity, as it underpins all technological operations	45	25	30	25	2.75	1.154	AGREED
11	Robust internet connectivity Is a necessity for effective integration technology-enhanced science teaching during this era of insecurity and economic meltdown.	55	20	15	35	2.76	1.278	AGREED
12	Essential hardware connectivity which has Widespread access to modern computing infrastructure is needed for technological integration for both students and faculty in an era of insecurity and economic meltdown.	15	20	25	65	1.88	0.075	DISAGREED
13	Equipped classrooms with Interactive whiteboards, projectors, and Smart screens are essential for technological integration into science teaching in an era of insecurity and economic meltdown.	50	20	5	50	2.56	1.364	AGREED
14	Mobile gadgets are necessary to support internet-enabled devices to facilitate flexible learning in an era of insecurity and economic meltdown.	80	15	20	10	3.32	1,012	AGREED
15	Learning Management Systems (LMS) for course management and content delivery are part of the prerequisite for integration of technology- enhanced science teaching during the era of insecurity and economic meltdown.	40	30	20	35	2.6	1.60	AGREED



16	My university provided technical support to enable continuous and easily accessible technical support staff to manage infrastructure, troubleshoot issues, and assist teachers and students during the era of insecurity and economic meltdown.	20	15	45	45	2.08	1.059	DISAGREED
17	Provision for training and professional development programs which are essential, focusing on not just technical skills but also pedagogical strategies for successful integration of technology-enhance pedagogies during the era of insecurity and economic meltdown.	55	15	40	15	2.88	1.111	AGREED
Grand Mean						2.60		

With the total grand mean of 2.60, this finding has revealed that reliable power supply, technical support, provision of training and professional development programs, learning management system, mobile gadgets, Essential hardware, Robust internet among others are the necessary requirements for the successful integration of technology -enhanced pedagogies into science teaching in higher institutions of learning especially in an era of insecurity and economic meltdown.

Research Questions 3: What support needs do educators need for effective and successful integration of technology-enhanced pedagogies into science teaching in the higher institutions of learning in an era of insecurity and economic meltdown?



Table 3: mean and standard deviation of support needs do educators need for effective and successful integration of technology-enhanced pedagogies into science teaching in the higher institutions of learning in an era of insecurity and economic meltdown

S/N	Items	SA	A	D	SD	X	ST. DEV	REMARKS
18	There is need for a reliable power supply which constitute stable and fundamental necessity, especially in areas with economic constraints and potential insecurity, as it underpins all technological operations.	45	30	20	30	2.75	1.189	AGREED
19	There is need for robust internet connectivity in my university during this era of insecurity and economic meltdown.	60	15	10	40	2.76	1.340	AGREED
20	My university does not need essential hardware which has Widespread access to modern computing infrastructure is needed, Computers/Laptops for both students and faculty in an era of insecurity and economic meltdown.	15	20	40	40	2.24	1.110	DISAGREED
21	My university does not require equipped classrooms with Interactive whiteboards, projectors, and smart screens in an era of insecurity and economic meltdown.	10	15	40	60	1.8	0.941	DISAGREED
22	My university provided mobile gadgets to support internet-enabled devices to facilitate flexible learning in an era of insecurity and economic meltdown.	40	30	20	35	2.6	1.205	AGREED
23	My university provided Learning Management Systems (LMS) for course management and content delivery during the era of insecurity and economic meltdown.	40	30	30	25	2.68	1.126	AGREED
24	My university provided technical support to enable continuous and easily accessible technical support staff to manage infrastructure, troubleshoot issues, and assist	30	40	40	15	2.68	0.972	AGREED



teachers and students during the era of insecurity and economic meltdown.

25	My university made provision for training and professional development programs which are essential, focusing on not just technical skills but also pedagogical strategies for successful technology-enhance pedagogies integration during the era of insecurity and economic meltdown.	10	15	40	60	1.8	0.942	DISAGREED
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Grand Mean

2.41

The findings of this research revealed that the above items listed in items 18 to 25 are the infrastructure needs which the educators need to effectively integrate technology -enhanced technology pedagogies into science teaching in an era of insecurity and economic meltdown.

Discussion of the results

Table 1 indicated that the result of the finding showed that agreed that technology-enhanced pedagogies for science teaching in higher institutions of learning in an era of insecurity and economic meltdown was effective. The findings of the study showed that the teaching staff members agreed to the fact that Online discussion forums, Video Lectures, Virtual Laboratories, Online Simulations, gamification elements, mobile learning APPs, flipped classroom discussion, technology enabled collaboration, interactive quizzes etc are the effective technology enhanced science teaching pedagogies needed in the institutions of higher learning especially in an era of insecurity and economic meltdown. This finding is in tandem with Ahmed and Opoku (2021) whose study also reveals that by overcoming some of the technical challenges such as slow internet connection and interruptions, lessons learnt from the sudden migration to online delivery amid COVID-19, will help create new opportunities for the use of blended learning approaches to meet the needs of the on-going COVID and future online deliveries. Also, in collaboration with the



findings of Adedayo (2024) research which revealed a complex support mechanism for integrating technology into instructional

Also, table 2 showed that the result of the finding agreed that infrastructural requirements are needed for the successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning in an era of insecurity and economic meltdown. This study also revealed that reliable power supply, technical support, provision of training and professional development programs, learning management system, mobile gadgets, Essential hardware, Robust internet among others are the necessary requirements for the successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning especially in an era of insecurity and economic meltdown. This aligns Ohiare-udefu & Chukwuemeka (2024) who established that well-developed technology infrastructure significantly enhances teaching, learning, and administrative processes, thereby promoting successful curriculum implementation.

This finding is in tandem with Ahmed & Opoku (2021) whose study also revealed that by overcoming some of the technical challenges such as slow internet connection and interruptions, lessons learnt from the sudden migration to online delivery amid COVID-19, will help create new opportunities for the use of blended learning approaches to meet the needs of the on-going COVID and future online deliveries.

The result from Table 3 showed that educator support is needed for successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning in an era of insecurity and economic meltdown. This research revealed further that the above items listed in items 18 to 25 are the infrastructure needs which the educators need to effectively integrate technology-enhanced technology pedagogies into science teaching in an era of insecurity and economic meltdown. This result is also in agreement with the finding of Adedayo (2024) who, through his research findings revealed a complex support mechanism for integrating technology into instructional procedure. Also, in consonance with the findings of Ghavifekr & Rosdy (2015) which indicated that teachers' well-equipped preparation with ICT tools and facilities is one the main factors in success of technology-based teaching and learning.



Conclusion

In conclusion, the findings of this study showed empirical evidence and established that technology-enhanced pedagogies for science teaching in higher institutions of learning in an era of insecurity and economic meltdown were effective.

The study also revealed empirically that infrastructural requirements are needed for the successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning in an era of insecurity and economic meltdown.

The study revealed through empirical observation that educator support is needed for successful integration of technology-enhanced pedagogies into science teaching in higher institutions of learning in an era of insecurity and economic meltdown.

Recommendation

1. The federal, state and all the owners of private tertiary institutions of learning in Nigeria should as a matter of necessity provide technology enhanced facilities such as steady power supply facilities like electricity, (solar generators and mobile hotspot or USB modem especially for those in rural areas), online discussion forums, Video Lectures, Virtual Laboratories, Online Simulations, gamification elements, mobile learning APPs, flipped classroom discussion, technology enabled collaboration, interactive quizzes etc which are the effective technology enhanced science teaching pedagogies needed in the institutions of higher learning especially in an era of insecurity and economic meltdown.
2. Provision of reliable power supply, technical support, learning management system, mobile gadgets, Essential hardware, Robust internet among others to higher institutions of learning.
3. Provision of regular training and professional development programs to the teaching staff as this the necessary requirements for the successful integration of technology -enhanced pedagogies into science teaching in higher institutions of learning especially in an era of insecurity and economic meltdown



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