African Journal of Applied Research
Vol. 11, No. 7 (2025), pp.358-370
http://www.ajaronline.com
https://doi.org/10.26437/ajar.v11
Received July 17, 2024
Peer reviewed: December 20, 2024
Revised: July 28, 2025
Published: December 2025

E-LEARNING INTEGRATION IN POST-SECONDARY SCIENCE EDUCATION: EVIDENCE FROM ANAMBRA STATE, NIGERIA.

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ABSTRACT

Purpose: The focus of the research was to assess the utilisation of e-learning facilities by science education educators and learners at postsecondary institutions.

Design/Methodology/Approach: A descriptive survey research methodology was employed, and one research question and one research hypothesis guided the study. A simple random sampling technique was used to select 295 respondents, which comprised 280 students and 15 lecturers from two universities in Anambra State, Nigeria. Descriptive statistics were employed, including calculation of mean scores, standard deviations, frequencies, and percentages. Additionally, a t-test was used to evaluate the hypothesis at the 95% confidence interval using the independent-samples t-test in SPSS Version 25.

Findings: Postsecondary institutions frequently use e-learning resources to improve learners' comprehension of scientific courses. Both teachers and students agree that e-learning resources are used to a moderate extent in the instruction and knowledge acquisition of science in postsecondary institutions in Anambra State, Nigeria.

Research Limitation: This research study was delimited to postsecondary institutions in Anambra State, Nigeria; therefore, the findings may not be fully generalizable to other states or regions with different levels of technological development, institutional support or educational policies.

Practical Implication: Practically speaking, the study found that by nurturing and maintaining learners' enthusiasm, understanding, and favour for science, educators in scientific education might support successful, non-abstract study of science.

Social Implication: The moderate use of e-learning facilities suggests a gradual shift toward digital learning cultures within post-secondary institutions, as this increased exposure to e-learning can enhance students' digital literacy skills, which are essential for participation in a technology-driven society.

Originality and Value: This research has helped school system administrators develop strategies and policies to enhance science instruction and knowledge acquisition. It has also highlighted the significance of e-learning resources for promoting effective science education among teachers.

Keywords: *Educators. e-learning. learners. post-secondary. utilisation*
ISSN: 2408-7920

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INTRODUCTION

The rapid advancement of technology and scientific innovation is exerting significant pressure on the education system. The advancement of a nation is greatly dependent on its progress in science and technology, especially in developing nations such as Nigeria (Ocra et al., 2025; Adelabu, 2014). Many developing countries lack a resilient economy to effectively manage this pressure (Aheto & Cronje, 2018). In contrast, developed countries have established a strong educational foundation, and an examination of 21st-century developed nations reveals that they apply their practices from the realms of science and technology to education (Karim-Abdallah et al., 2025; Ademiluyi, 2019).

Since the 21st century is often defined as an era of knowledge, many educational systems have made capacity building, skill development, and knowledge construction their top priorities in preparing learners for life in the digital age. Thus, it is anticipated that integrating new technologies into traditional education will transform and permeate all curricular areas of instruction and knowledge acquisition (Dhawan, 2020). Today's world is shaped by media and technology, providing seamless access to information, tools, and resources that influence various aspects of daily life (Horban et al., 2024; Eze, 2016). This transformation has altered social and cultural standards, particularly in education (Ibe, 2024).

There has been a noticeable increase in the integration of new technologies in the educational system due to the constantly changing nature of education. Ewim and Opateye (2021) stated that the education paradigm has changed as a result of this transformation and that new technologies must be integrated with pedagogy in teacher education programs to create a new culture of instruction and knowledge acquisition. Nevertheless, the rapid pace of advancements in science and technology makes it increasingly challenging to plan for and incorporate new technologies into education (Eze & Aja, 2014).

It is widely acknowledged that scientific literacy is the gateway to a nation's survival in the realms of science and technology, and this can only be attained through science education. Consequently, learners are being encouraged to pursue science-related courses within the context of science education. Furthermore, large class sizes pose substantial obstacles to effective instruction and knowledge acquisition (Tapera & Kujeke, 2019). This situation highlights the necessity of a shift in perspective on how courses should be delivered (Nwafor et al., 2022). The prevailing issues suggest that incorporating e-learning into science education could help address these challenges.

Currently, e-learning systems are among the most popular educational tools available, serving as an alternative to conventional teaching methods (Horban et al., 2024; Okure, 2018). Because of this, many learners are offering these kinds of courses, which pose challenges for both instruction and knowledge acquisition (Catherine & Edward, 2022). Additionally, a large class size poses a significant obstacle to efficient instruction and knowledge acquisition. As a result, a mental shift

ISSN: 2408-7920

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and a shift in perspective on how the course should be taught have become necessary (Ahmad et.al, 2019). The main challenges call for integrating electronic learning, or E-learning, into science instruction and knowledge acquisition, as it seems to be the way out of this maze (Edeh et.al, 2020). The e-learning system is one of the most popular educational systems available today, serving as a substitute for traditional classroom instruction.

E-learning fosters interactive learning experiences through forums and collaborative tools, promoting active participation. As noted by Arkorful and Abaidoo (2015), the adoption of e-learning has significantly improved the quality of education and teaching methods while also reducing student expenses (Sinnage et al., 2022). This indicates that learners can leverage e-learning to save money and utilise their spare time for other productive endeavours (Ibe, 2024). Employing technology fosters an engaging learning atmosphere where students actively participate in online classes and complete assigned tasks. Learners are guaranteed full participation in the learning process through e-learning resources that include interactive images, text, videos, audio, and cooperative sharing. Ouadoud et al. (2016) stated that e-learning is the most efficient method of instruction and learning during the coronavirus era and technological environment, and that e-learning adoption is at an early stage (Horban et al., 2024; Obi et al., 2022). E-learning, in its operational definition, is the process of learning that occurs via digital technology and the Internet between a teacher and a learner.

The need to educate and develop a variety of topics and skills leads to the creation of various platforms. To include learners more in the teaching-learning process, educators developed some e-learning resources. These amenities must be installed in the classrooms, as they are considered highly significant (Gilbert, 2015). The researcher anticipates that this will advance human endeavours in other domains beyond scientific education and learning. This article aims to investigate how scientific education instructors and learners at postsecondary institutions in Anambra state, Nigeria, use e-learning resources.

It is undeniably true that e-learning is effective in postsecondary education. It has been demonstrated to improve educational opportunities for people and groups unable to attend traditional institutions and to support the use of computers as tutors for exercises, practice sessions, and lesson delivery. The use of e-learning at postsecondary institutions is encouraged to enhance the effectiveness and efficiency of curriculum implementation. Higher education institutions have been adopting e-learning more and more. As the number of learners enrolled in distance learning programs at colleges and universities is rising quickly, many institutions and organisations have strategically adopted e-learning to address enrollment demands. Nevertheless, in the Nigerian context, overcrowding resulting from poor infrastructure appears to be impairing the efficiency of both lab and classroom instruction.

During an initial examination, the researcher noted that e-learning is being used. However, it is unclear to what extent educators and learners in scientific education use it for instruction and

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knowledge acquisition. In light of this, the researcher aims to examine how scientific education instructors and learners at postsecondary institutions in Anambra State, Nigeria, use e-learning resources. The research hypothesis considered in this paper is that there is no pronounced difference between educators' and learners' mean scores regarding the extent to which e-learning facilities are used in instruction and knowledge acquisition in sciences in postsecondary institutions in Anambra State, Nigeria.

E-LEARNING AND PEDAGOGY

E-learning can be viewed as an alternative to the face-to-face teaching method or as a complement to it. E-learning usually allows students greater choice and responsibility for their own learning (Okure, 2018). E-learning can change learning methods and overcome barriers to time, distance, and cost (Ouadoud et al., 2016). E-learning can be viewed as "disruptive technology" and as a new paradigm for learning (Dhawan, 2020). Disruptive technologies approach problems in entirely new and creative ways. E-learning challenges traditional teaching and learning, enables new alliances among educational and commercial entities, and offers new ways to solve old problems. For example, the role of teachers is likely to change from importers of knowledge to facilitators of the knowledge-gaining process. E-learning can be either synchronous or asynchronous. Synchronous means that the real-time communication is implemented, such as video conferencing, teleconferencing and online chat programmes. Asynchronous indicates that the communication methods utilised do not require real-time responses. Examples include: e-mail, blogs and online forums.

Theoretical Framework

This study is anchored in Vygotsky's social constructionism, which holds that people learn best when they engage in a social process of constructing an artefact for others (Obi et al., 2022). E-learning content is designed to guide learners through the material, offering a wide, ever-expanding set of interactions, experiences, assessments, and simulations. E-learning instructions are built around collaboration. It is interactive in nature. It can be studied alone or in collaboration with others. It assumes that knowledge (as meaning and understanding) is socially constructed.

Learning takes place through conversations about content and grounded interaction about problems and actions. Advocates of social learning claim that one of the best ways to learn something is to teach it to others. However, an increasing array of tools calls for the proper integration of e-learning instruction into the curriculum of education in Nigeria. The essential purpose is to employ modern computer technology to help solve problems arising from the population boom, the complexity of the science information to be taught and learned, the need for computer-aided science, and the shortage of experienced lecturers in the area of chemical reactions.

In educational programmes, therefore, it is very pertinent to provide lecturers with up-to-date

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information on a variety of e-learning tools and instructions on their proper use in teaching Chemistry in colleges of education and other tertiary institutions of learning (Catherine & Edward, 2022). As the world is changing technologically, it is no longer a science teacher-centred approach. Science instructors must employ modern teaching approaches, especially through digital storytelling presentations.

METHODOLOGY

The study employed a quantitative approach, specifically, a descriptive survey research design. Descriptive survey research involves collecting data from a sample representative of the entire population (Nworgu, 2018). This design is considered appropriate because the views of respondents (lecturers and students) were collected and analysed to determine the extent of e-learning in Chemistry education. A simple random sampling technique was used to select 295 respondents. The participants included the 280 2nd year undergraduate students and 15 lecturers at the Department of Science Education, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State, Nigeria (100 Chemistry education students and 6 lecturers); and Department of Science Education, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria (180 Chemistry education students and 9 lecturers).

To gather data, the researcher utilised an instrument titled "Utilisation of E-learning Facilities in Postsecondary Institutions" (UEFTI), which was distributed to both students and educators at the participating schools. The questionnaire's reliability was confirmed prior to its administration. The assessment utilised a four-point rating scale to evaluate various items. The scale included categories such as Very High Extent, assigned a value of 4 points to indicate a significant degree of agreement or presence; High Extent, which received 3 points to reflect a strong but not absolute affirmation; Low Extent, worth 2 points to represent a minor level of agreement; and Very Low Extent, with a score of 1 point to denote minimal acknowledgment or presence.

To address a specific research question, descriptive statistics were employed, including calculation of mean scores, standard deviations, frequencies, and percentages. Additionally, a t-test was used to evaluate the hypothesis at the 95% confidence interval using the independent-samples t-test in SPSS Version 25. The mean scores reflecting the extent of e-learning facilities utilised for instruction and knowledge acquisition in postsecondary institutions were categorised into three groups: low extent (scores of 2.49 or lower), moderate extent (scores of 2.50-3.49), and great extent (scores of 3.50-4.00). A mean score of 2.5 or above suggested a favourable response or consensus.

RESULTS AND DISCUSSION

This section outlines the results related to the research objectives. The responses to the questionnaire were assessed using a four-point Likert scale, where a score of one (1) represented

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the highest disagreement and four (4) represented strong agreement with the statements.

Demographic Information

The demographic information of the respondents is revealed in Tables 1 and 2. The study used 280 (94 male students and 186 female students) 2nd year undergraduate students and 15 lecturers (5 male lecturers and 10 female lecturers) at the Department of Science Education, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State, Nigeria (100 Chemistry education students & 6 lecturers); and Department of Science Education, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria (180 Chemistry education students & 9 lecturers). Most participants were between 18 to 20 years old for students and 30 to 50 years old for lecturers and held at least a master's degree.

Table 1: Demographic Information of Students

Characteristic	Category	Frequency (n=280)	Percentage (%)
Gender	Male	94	33.6
	Female	186	66.4
Age (Students)	18–20	280	100
Education (Students)	Secondary (SSCE)	280	100

Table 2: Demographic Information of Lecturers

Characteristic	Category	Frequency (n=15)	Percentage (%)
Gender	Male	5	33.3
	Female	10	66.7
(Age	30- 50	15	100
Education	Bachelor's	6	40
	Master's	9	60

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Table 3: Mean and standard deviation of the extent e-learning facilities are used in the Teaching and Learning of science education in post-secondary institutions in Anambra state, Nigeria.

S/N	Item	Mean	SD	Remark	Rank
1	The use of e-learning facilities to create, give, receive and grade students' assignments and test on-line	3.07	0.76	Moderate Extent	1st
2	The use of digital drop boxes for file sharing and written data	3.07	0.76	Moderate Extent	1st
3	We use e-learning platform in teaching and learning of science.	2.82	0.88	Moderate Extent	2nd
4	The use of simulation in teaching and learning Chemistry	2.75	0.91	Moderate Extent	3rd
5	The use of science software to draw molecular structures	2.60	1.08	Moderate Extent	4th
6	The use of interaction through electronic mail in teaching and learning of science.	2.58	0.92	Moderate Extent	5th
7	There are interrupted wifi service in my school	2.53	0.98	Moderate Extent	6th
8	We have software for the IUPAC nomenclature of compounds and complexes	2.47	1.05	Low Extent	7th
9	The use of power point in delivering lectures	2.32	0.84	Low Extent	8th
	Overall mean and Standard Deviation	**2.64**	**0.58**	**Moderate Extent**	

The results in Table 3 show that items 8 and 9 were to a low extent, while items 1, 2, 3, 4, 5, 6, 7, and 8 were to a moderate extent. Moreover, 2.64 and 0.58 were obtained as the overall mean score and standard deviation, respectively. This indicates that e-learning facilities are used to a moderate extent in the teaching and learning of Chemistry in colleges of education in the South East, Nigeria.

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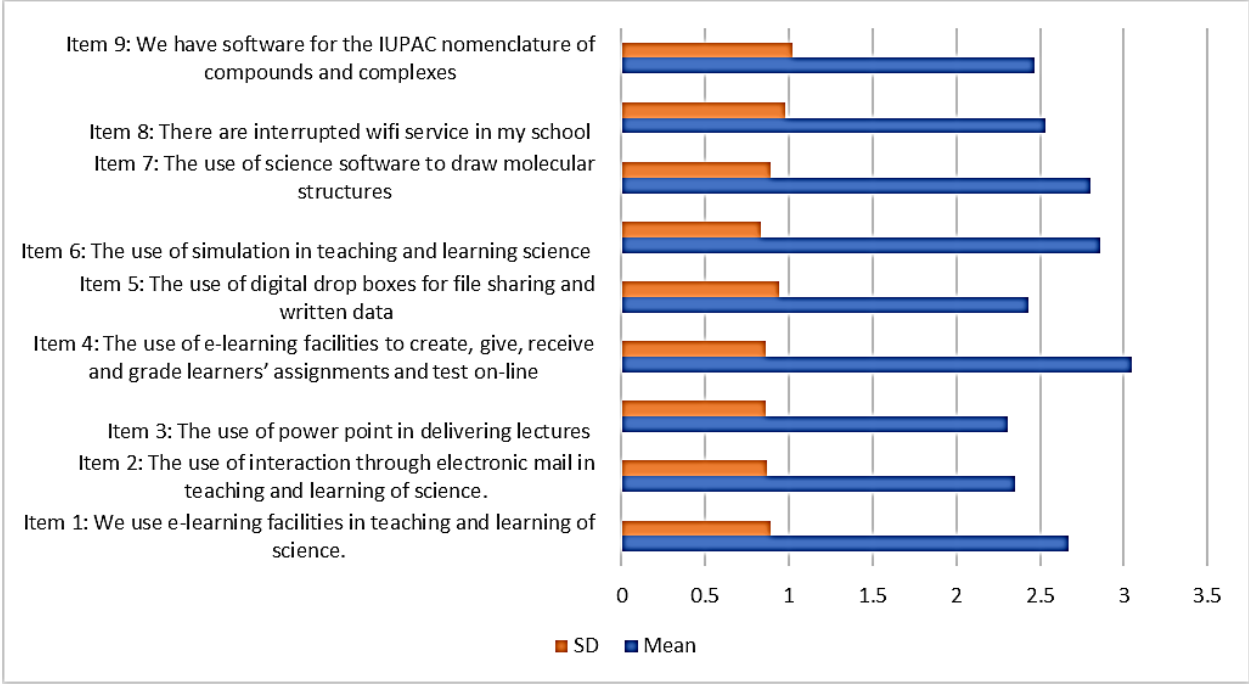

Figure 1: Mean and standard deviation of the extent e-learning facilities are used in the Teaching and Learning of science education in post-secondary institutions in Anambra state, Nigeria.

As shown in Figure 1, the findings indicate varying levels of e-learning facility utilisation in science instruction and knowledge acquisition. The item on the general use of e-learning facilities scored a mean of 2.67 with a standard deviation of 0.89, indicating moderate use. Interaction through email received a lower mean of (2.35) (SD = 0.87), indicating low utilisation. Similarly, the use of PowerPoint for lectures scored (2.31) (SD = 0.86), also demonstrating a low extent. Conversely, the use of e-learning for assignment management achieved a mean of (3.05) (SD = 0.86), indicating a moderate extent. Other areas, like the use of simulations (2.86) (SD = 0.83) and science software for molecular structures (2.80) (SD = 0.89), also reflected moderate usage. However, interrupted Wi-Fi services (2.53) (SD = 0.98) and software for IUPAC nomenclature (2.47) (SD = 1.02) were rated as low extent. The overall mean was (2.61) (SD = 0.90), suggesting moderate overall utilisation.

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Table 4: Summary of t-test statistics of the extent to which e-learning facilities are used in the Instruction and knowledge acquisition of sciences in postsecondary institutions in Anambra State, Nigeria

Group	N	Mean	SD	Std. Error Mean	Df	T	Sig.	Decision
Educators	15	2.75	.70	.18014	178	.766	.445	Not Sig.
Learners	145	2.63	.57	.04431				

Table 4 presents the results of the t-test for independent samples with comparable variances. The results indicate t(178) = 0.766, with a p-value of 0.445 (p > 0.05). This suggests that, when it comes to the utilisation of e-learning resources in scientific instruction at postsecondary institutions, there is no discernible difference in the mean scores of educators and students. As a result, both teachers and students agree that e-learning resources are used to a moderate extent in the instruction and knowledge acquisition of science in postsecondary institutions in Anambra State, Nigeria.

Discussion

The study found that e-learning facilities are used to a moderate extent for instruction and knowledge acquisition in sciences in postsecondary institutions in Anambra State, Nigeria. Further analysis revealed that there is no significant difference between the mean scores of lecturers and students on the extent e-learning facilities are used in the Instruction and knowledge acquisition of sciences in postsecondary institutions in Anambra State Nigeria; as both lecturers and students agree that e-learning facilities are used in the Instruction and knowledge acquisition of sciences in postsecondary institutions in Anambra State Nigeria to a moderate extent.

The study's findings support those of Catharine and Edward (2022), who acknowledged that lecturers and students are gradually integrating digital tools into science instruction, particularly for administrative and supportive academic activities such as assignments, communication, and resource sharing. However, the findings also indicate low usage of specific critical e-learning tools.

The use of PowerPoint in delivering lectures ($\bar{x}$ = 2.32) and the availability of software for IUPAC nomenclature of compounds and complexes ($\bar{x}$ = 2.47) were rated as low. This implies that although basic e-learning platforms are in use, more specialised instructional technologies that could enhance conceptual understanding in Chemistry are not sufficiently utilised. This may be due to limited access to licensed software, inadequate lecturer training, or insufficient institutional support. In relation to the comparison of mean scores between lecturers and students, the moderate overall mean suggests that both groups perceive e-learning usage similarly. This indicates that

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there is no wide disparity in their experiences regarding the extent to which e-learning platforms are used in science teaching and learning. Where differences exist, they are likely marginal and influenced by typical institutional constraints such as poor internet services, limited access to advanced software, and inadequate ICT infrastructure. This aligns with Ibe (2024), Arkorful and Abaidoo (2015), and Ouadoud et al. (2016), who noted that online teaching and learning can contribute to a positive learning environment and promote effective science education standards through proper design and the effective utilisation of technology.

Conversely, the findings of the study are against those of Obi et al. (2022) and Tapera and Kujeke (2019), who reported that most science educators do not utilise e-learning facilities in the teaching and learning of sciences because they lack the necessary skills and e-learning facilities. Finally, the findings imply that while e-learning facilities have been moderately integrated into science education in post-secondary institutions in Anambra State, their use remains suboptimal. There is a need for improved infrastructure, stable internet connectivity, provision of specialised science software, and continuous capacity-building programmes for lecturers to enhance the effective utilisation of e-learning platforms. Such improvements would help move e-learning usage from a moderate extent to a great extent and significantly improve the quality of science teaching and learning.

CONCLUSION

This current study examined the use of e-learning resources by science education instructors and students in postsecondary institutions in Anambra State, Nigeria. The findings indicate that postsecondary institutions are increasingly adopting e-learning resources to address the growing need to support students' learning and improve instructional delivery in science education.

The study's evidence shows that e-learning has provided multiple benefits, particularly by enhancing communication between lecturers and students and by supporting the development of learners' academic skills and competencies. The study also revealed notable challenges associated with e-learning adoption. Prolonged screen time and reduced face-to-face interactions were identified as factors that may contribute to social detachment among students.

In addition, several systemic constraints continue to limit the effective use of e-learning in science education. These include inadequate ICT infrastructure, heavy teaching workloads that limit time for integrating digital tools, irregular electricity supply, high costs of procuring and maintaining e-learning facilities, and limited digital literacy among some lecturers and students. Again, the findings demonstrate that students and lecturers value e-learning platforms for the opportunities

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they provide to enhance access to learning materials, improve knowledge acquisition, and develop relevant skills.

Many respondents acknowledged that e-learning resources help to address shortages of instructional materials and offer flexible learning opportunities that complement traditional classroom instruction. The contribution of this study lies in its empirical focus on both lecturers' and students' perspectives within postsecondary institutions in Anambra State, providing a balanced and specific understanding of e-learning use in science education. Unlike many earlier studies that emphasise benefits or challenges in isolation, this research integrates both dimensions while highlighting the practical realities that influence moderate adoption levels. The study further contributes by identifying institutional and infrastructural factors that jointly shape users' experiences, thereby offering evidence-based insights for improving policy and practice.

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Received July 17, 2024
Peer reviewed: December 20, 2024
Revised: July 28, 2025
Published: December 2025

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