CHALLENGES AND PANACEA FOR THE UTILIZATION OF E-LEARNING IN THE TEACHING AND LEARNING OF BIOLOGY IN FEDERAL COLLEGE OF EDUCATION, ABEOKUTA, OGUN STATE

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Abstract:

This study examined the challenges and potential solutions associated with the utilization of e-learning in the teaching and learning of biology at the Federal College of Education, Abeokuta, Ogun State. Using a descriptive survey design, a total of 150 biology students were selected across three levels (100–300) through stratified random sampling. Data were collected via structured questionnaires and analyzed using descriptive statistics. The findings revealed a positive perception of e-learning's impact on motivation, skill development, and student engagement. However, several challenges were identified, including inadequate funding, unstable electricity, high data costs, and limited access to ICT tools. The study recommends improvements in infrastructure, ICT skill development, provision of subsidized learning tools, and policy interventions to enhance the effective integration of e-learning in biology education.

Keywords: Digital, E-learning, ICT integration, Engagement, Challenges

Introduction:

Biology is a foundational science central to understanding life and addressing global issues such as biodiversity loss, deforestation, climate change, and resource management. It forms the bedrock of various professional fields, including medicine, agriculture, environmental science, and biotechnology (Vargas-Hernandez, Pallagst & Hammer, 2017). In today's rapidly evolving knowledge economy, the teaching of biology must adapt to digital innovations, particularly through the integration of e-learning tools that promote access, interaction, and deeper understanding. E-learning, broadly defined, involves the use of electronic technologies to deliver educational content beyond the boundaries of the traditional classroom (Aboderin, 2015; Adebayo & Balogun, 2019). It encompasses various formats such as blended learning, online modules, virtual classrooms, and web-based tools. These platforms have been shown to increase flexibility, support self-paced learning, and facilitate student engagement (Galy, Downey & Johnson, 2011). As learners increasingly rely on digital technologies for academic development, the role of e-learning in science education becomes even more critical.

The effectiveness of e-learning lies in its ability to personalize learning experiences and support interactive instruction through tools such as learning management systems, video conferencing, simulations, and multimedia content (Abdullah & Azzedine, 2011; Epignosis, 2014). These technologies enhance student-centered approaches and help build essential 21st-century skills, including digital literacy and problem-solving. In biology education, e-learning can support the visualization of complex concepts, facilitate access to virtual laboratories, and extend learning beyond the classroom through mobile and web platforms (Ajayi, 2008; Aparicio, Bacao & Oliveira, 2016). Despite these advantages, e-learning adoption in Nigerian colleges of education faces considerable obstacles. Challenges such as unstable electricity, limited ICT infrastructure, high costs of digital devices and internet access, and inadequate digital skills among educators and students persist (Nwagbo & Ugwuanyi, 2011; Agboeze, Ugwoke & Onu, 2012). Furthermore, the integration of e-learning into the biology curriculum is often insufficient, and

many practical biology lessons still suffer from a lack of resources, which virtual labs could potentially alleviate (Chukunyerenmuwa, 2013).

Although information and communication technologies (ICTs) are increasingly used in Nigerian colleges of education, the integration of e-learning into teaching practices, particularly in science education, remains limited and underdeveloped. Existing research indicates that e-learning adoption has not achieved its full potential in many tertiary institutions due to a combination of infrastructural, economic, and human resource challenges (Oyediran, Makinde & Olawoyin, 2021; Arhin & Boateng, 2023). Moreover, with the rise of digital education tools like Zoom, WhatsApp, and virtual field trips, there are increasing opportunities for collaborative and flexible learning. These tools allow for asynchronous and synchronous learning activities, such as sharing assignments, virtual discussions, and independent exploration of biological content (Offorma, 2004). When effectively used, they also reposition teachers as facilitators of knowledge rather than sole transmitters.

In the context of Nigeria's educational system, particularly within teacher training institutions, there is a pressing need to expose biology students to a range of e-learning resources. This exposure would not only enhance their current academic experiences but also equip them with the pedagogical and technological competencies needed in modern classrooms. Nigeria, as a developing country, faces systemic issues such as inadequate funding for education, poor ICT infrastructure, and limited investment in engineering and technological innovation (Daniel, 2022). These deficits hinder the effective use of e-learning tools such as digital classrooms, multimedia systems, and online courseware, which are crucial for enriching science teaching and learning. Moreover, the rapid increase in student enrollment across tertiary institutions has placed immense pressure on the already fragile infrastructure, leading to overcrowded classrooms, insufficient digital resources, and limited access to computers and stable internet connectivity. Compounding this is the shortage of educators who are adequately trained to deliver instruction through e-learning platforms, thereby affecting the quality of education and graduate preparedness for the digital workforce (Maatuk et al., 2022).

These challenges are particularly pronounced in biology education, where both theoretical and practical components require interactive and resource-rich environments. The limited integration of e-learning tools into biology instruction has contributed to a disconnect between educational outcomes and the technological demands of today's globalized world. This study, therefore, seeks to investigate the challenges and proffer solutions for enhancing e-learning adoption in the teaching and learning of biology at the Federal College of Education, Abeokuta, Ogun State.

Aims and Objectives of the study

The main purpose of this study is to evaluate the challenges and panacea in the utilization of e-learning in the teaching and learning of biology in Federal College of Education, Abeokuta, Ogun State. Specifically, this study sought out to:

i. Examine the impact of e-learning in the teaching and learning of biology
ii. Find out the challenges encountered by students' and teachers in the utilization of e-learning in biology.
iii. Proffer solutions to the challenges encountered by students' and teachers in the utilization of e-learning in biology.

Research Questions

i. What is the impact of e-learning in the teaching and learning of biology
ii. What are the challenges encountered by students' and teachers in the utilization of e-learning in biology.
iii. What are the solutions to the challenges encountered by students' and teachers in the utilization of e-learning in biology.

Methodology

This study adopted a descriptive survey research design to investigate the challenges and possible solutions in utilizing e-learning for teaching and learning Biology at the Federal College of Education, Abeokuta, Ogun State. The survey design was deemed appropriate as it enabled the researcher to gather comprehensive data from a large population within a specific context using a structured instrument. This approach facilitated the collection of firsthand responses from students regarding their experiences with e-learning technologies.

The target population comprised all students in the Biology Department within the School of Secondary Education (Science) at the Federal College of Education, Abeokuta. From this population, a sample of 150 students was selected using a stratified random sampling technique to ensure equal representation across academic levels. Specifically, fifty students each were selected from the 100, 200, and 300 levels, ensuring a balanced and diverse range of responses across different stages of academic exposure and experience.

Data for the study were gathered using a structured questionnaire developed by the researcher. The instrument was divided into two sections: Section A captured demographic information including age, gender, and level of study, while Section B comprised fifteen (15) statements related to the study's objectives. These statements were rated using a four-point Likert scale: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). This design allowed for both quantitative interpretation and the assessment of trends in the respondents' perceptions.

The data collection process involved the direct administration of the questionnaires to the selected students within one week. The researcher distributed the questionnaires physically, allowed time for completion, and collected them immediately to ensure a high return rate and data integrity. This personal approach also minimized the likelihood of non-response or loss of instruments.

For the analysis of the data, descriptive statistics primarily frequencies and percentages were employed to summarize responses and answer the research questions. The results were presented in tabular form to facilitate clarity and ease of interpretation. This method of analysis provided insight into the general trends, attitudes, and experiences of the students regarding the use of e-learning in biology education.

Results

Table 1: Demographic Results of Respondents

Age Distribution of Respondents		
Age Range (Years)	**Frequency (F)**	**Percentage (%)**
16–20	70	46.7%
21–25	60	40.0%
26–30	20	13.3%
Total	**150**	**100%**
Gender Distribution of Respondents		
Gender	**Frequency (F)**	**Percentage (%)**
Male	52	34.7%
Female	98	65.3%
Total	**150**	**100%**
Distribution of Respondents by Academic Level		
Level	**Frequency (F)**	**Percentage (%)**
100	50	33.3%
200	50	33.3%
300	50	33.3%
Total	**150**	**100%**

The age distribution shows that the majority of respondents (46.7%) fall within the 16–20 age bracket, indicating that most participants are likely in the early stages of their college education. Students aged 21–25 make up 40% of the sample, while only 13.3% are within the 26–30 age range.

In terms of gender, the data reflects a predominance of female students (65.3%) in the biology department, with male students representing 34.7% of the respondents. This may suggest higher female enrollment in the biology program at the Federal College of Education, Abeokuta.

Academic level distribution is evenly spread, with 33.3% of respondents each from 100, 200, and 300 levels. This equal representation ensures a balanced perspective across different stages of the academic journey, enhancing the reliability of the findings.

Table 2: Impact of E-learning on Biology Education

Item Statement	SA	A	D	SD	% Agree (SA + A)
E-learning makes biology instruction interesting and student-centered	62	83	5	0	96%
It enhances the acquisition of biology knowledge and development of scientific and ICT skills	80	68	1	1	98%
It helps students prepare effectively for presentations and develop skills via interaction with content	65	73	7	5	92%
It makes students more motivated and attentive in the teaching and learning of biology	50	100	0	0	100%
Teacher-student communication is enhanced via platforms like email and WhatsApp	85	64	1	0	99%

A significant majority of respondents (above 90%) agreed that e-learning positively impacts biology education. They noted its ability to enhance student-centered learning, improve motivation, support ICT skill development, and foster better communication. This supports the position that when properly utilized, e-learning can transform the traditional biology classroom into a more interactive and learner-driven environment.

Table 3: Challenges of E-learning in Biology Education

Item Statement	SA	A	D	SD	% Agree (SA + A)
Instability of electricity is a challenge in the use of e-learning	55	95	0	0	100%
High cost of personal computers/laptops limits access	86	52	5	7	92%
Data prices are unaffordable for many students	89	50	7	4	92%
Some teachers and students lack adequate ICT skills	56	83	8	3	92%
Inadequate funding limits the effective use of e-learning tools	51	87	6	6	90%

The data reveal that critical challenges affecting e-learning adoption include power supply issues, high cost of devices and data, inadequate digital skills, and poor funding. With agreement rates exceeding 90% on all items, it is evident that these constraints must be systematically addressed for effective integration of e-learning in biology education.

Table 4: Solutions to Enhance E-learning Use in Biology Education

Item Statement	SA	A	D	SD	% Agree (SA + A)
There should be a regular and steady power supply to encourage use of e-learning	87	63	0	0	100%
The cost of personal computers/laptops should be reduced or subsidized	130	20	0	0	100%
Free Wi-Fi access should be provided on campus	86	62	2	0	99%
Data prices should be lowered to make e-learning affordable	87	63	0	0	100%
Biology curriculum should be designed to integrate e - learning resources and delivery	81	69	0	0	100%

Respondents overwhelmingly supported several key interventions: stable electricity, affordable ICT resources, campus-wide internet access, and curriculum reforms tailored to e-learning. These solutions, if implemented, would significantly enhance the accessibility, quality, and sustainability of e-learning in biology education.

Discussion of Findings

The findings of this study highlight the dual nature of e-learning in biology education, its transformative potential and the persistent barriers that limit its adoption. A majority of students acknowledged the beneficial impact of e-learning on engagement, ICT competency, and communication. This aligns with recent literature which identifies e-learning as a catalyst for improved academic performance, especially in science education (Maatuk et al., 2022). Students found e-learning to be both enriching and flexible, reflecting studies by Al-Samarraie et al. (2021) that emphasize the shift from teacher-centered to student-centered learning through digital platforms. Enhanced student motivation and active participation reported in this study also mirror findings by Uchenna and Okonkwo (2020), who observed that multimedia instruction significantly improves students' interest in science subjects.

However, this study also confirms several known challenges. Electricity instability, high data and device costs, and insufficient ICT skills were consistently flagged by respondents. These are recurring themes in sub-Saharan Africa's e-learning discourse (Daniel, 2022; Oyediran et al., 2021). Despite infrastructural limitations, the awareness and readiness of students to embrace technology suggest that the main issues are structural and policy-based, not attitudinal. The overwhelming agreement on recommended solutions such as free Wi-Fi, power supply, ICT training, and curriculum development reinforces the idea that students are not only aware of the challenges but also have clear views on what must be done. This is supported by recent work by Arhin and Boateng (2023), who found that when institutions actively implement student-informed ICT policies, engagement and academic outcomes improve dramatically.

Overall, this study adds to the growing body of evidence advocating for a systems-level response to digital inclusion in education. Strategic investments in infrastructure, targeted ICT capacity building, and thoughtful integration of e-learning into course design will be essential for scaling its benefits in biology education and beyond.

Conclusion

The findings of this study expose the dual reality of e-learning in the context of biology education at the Federal College of Education, Abeokuta. On one hand, e-learning has been shown to significantly enhance student engagement, promote independent learning, develop ICT competencies, and improve access to instructional resources. Students overwhelmingly acknowledged the benefits of e-learning in making biology instruction more interactive, flexible, and skill-oriented. On the other hand, the study also reveals persistent challenges that hinder the full adoption and effective utilization of e-learning. These include inadequate

infrastructural support, such as unstable electricity supply, limited access to affordable ICT tools and internet services, and insufficient digital literacy among students and teachers. Furthermore, the absence of well-integrated e-learning components in the biology curriculum and lack of institutional support systems compound these barriers.

In light of these findings, it is evident that while e-learning holds great promise for transforming biology education, its potential can only be fully realized through a concerted effort to address the existing limitations. Stakeholders in education such as policy makers, institutional leaders, curriculum developers, and educators must take proactive measures to strengthen the technological and pedagogical infrastructure required for effective e-learning implementation. Ultimately, bridging the digital divide in biology education requires not just the provision of technology but a holistic strategy that includes training, curriculum reform, funding, and sustainable policy frameworks. When these elements are addressed, e-learning can serve as a powerful tool to enrich science education, improve learning outcomes, and equip students with the competencies needed for success in a technology-driven world.

Recommendations

On the basis of the findings from this study, it is recommended that:

1. Government and college management should ensure consistent electricity supply and provide standby generators to support e-learning activities.
2. Institutions should collaborate with ICT firms to subsidize the cost of laptops and provide low-cost internet access to students and lecturers.
3. Mandatory ICT skill development programs should be introduced for both lecturers and students.
4. Biology curricula should be redesigned to include e-learning components and virtual laboratory simulations.
5. Colleges should invest in robust e-learning platforms (e.g., Moodle, LMS) and employ dedicated technologists to manage these systems

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