Accessibility and Utilization of E-Learning Tools for Teaching Biology in Senior Secondary Schools in Ilorin Metropolis

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ABSTRACT

E-learning tools technology is a paradigm shift in facilitating learning in our world today and the driving force of education in developed countries. The main purpose of this study is to investigate the accessibility and utilization of E-learning tools for teaching biology in secondary schools in Ilorin metropolis. The study was guided by the technology acceptance model theory, and employed a descriptive survey design. The population of the study were all biology teachers in public secondary schools in Ilorin metropolis. The sample size was determined from the estimate of the target population which is 368. The sample size for this study was 250 respondents from 100 public secondary schools. A well-structured questionnaire was the instrument. The data collected was analysed using descriptive and inferential statistics. The findings showed lack of access and low or non-utilization of E-learning tools for teaching biology in public secondary schools in Ilorin metropolis while factors observed to be responsible for the findings are low or lack of awareness on the part of teachers, poor policy formulation to incorporate the use of e-learning tools and poor infrastructure in the schools.

Keywords: *E-learning Tools; accessibility; Utilization; Biology teacher*

INTRODUCTION

Educators in the 21st century are encouraged to employ innovative strategies that enable learners to acquire skills that are adaptable to an evolving world. One such innovative strategy is the integration of information and communication technology (ICT) into the teaching and learning process, a trend observed in various countries worldwide (Bhasin, 2012; Ndidiamaka & Kingsley, 2019). In accordance with the 2030 United Nations (UN) agenda for sustainable development, each member country of the United Nations is expected to utilize ICT across various sectors to foster national development (United Nations, 2016). Recognized as a crucial tool for national development, ICT is highlighted under the 17th goal of the UN international framework, aligned with the UN Agenda. The 2015 Africa Union Summit underscored the importance of ICT infrastructure development as a key priority for achieving Vision 2063. The realization of this policy hinges on the provision of reliable and affordable ICT-related services, including the expansion of broadband connectivity, by all African countries.

Ensuring the availability of ICT in all levels of schooling and investing in ICT-related initiatives has been emphasized by the Africa Union Commission (2015). Incorporating information and communication technology (ICT) into the educational process has been shown to foster an environment conducive to active and constructive student participation (Volman & van Eck, 2001; Ratheeswari, 2018). Particularly in teaching biology, the use of ICT, especially through visuals and animations, enhances the learning environment, making it more engaging, motivating, and appealing to students, thereby increasing their focus on the subject matter and promoting effective teaching and learning (Tomliienovic & Zovko, 2010; Hussain et al., 2018).

ICT has the potential to transform traditional classrooms into smart classrooms, and its utilization for educational purposes, particularly in e-learning, has seen significant growth (Sangra et al., 2012; Usman et al., 2019). E-learning, characterized by students interacting with various ICT tools, encompasses a wide array of educational technology used in teaching and learning (Ratkalle, 2020). It involves the use of electronic technology, typically the Internet, to facilitate education, covering online courses, virtual classrooms, multimedia resources, and interactive learning experiences (Chitra & Raj, 2018; AbdelSalam & Madji, 2021).

Within the e-learning ecosystem, there are two key components: e-learning platforms and e-learning tools, each fulfilling distinct roles. E-learning platforms serve as comprehensive digital systems providing infrastructure for online education delivery, including course management, content creation, student tracking, and communication tools (Piotrowski, 2010; Aljawaraneh et al., 2010; Alameri et al., 2020). Examples include Moodle, Canvas, and Google Classroom.

On the other hand, e-learning tools are individual software applications or technologies designed to enhance the e-learning experience, offering functionalities such as content creation, collaboration, assessment, or multimedia delivery (Encarnacion et al., 2021; Vasishta et al., 2021). Examples range from learning management systems and video conferencing software to interactive simulations and authoring tools like Articulate Storyline or Adobe Captivate. Additionally, mobile phones, tablets, and other audio devices serve as e-learning tools (Bhatia, 2011; Encarnacion et al., 2021).

The significance of e-learning accessibility and its utilization, particularly in Africa, including Nigeria, has escalated in recent years (UNESCO, 2017). However, in Africa, accessing e-learning can be daunting due to various challenges such as limited Internet connectivity, insufficient infrastructure, and economic disparities. In Nigeria specifically, factors like the high cost of ICT facilities, unstable power supply, and inadequate funding for ICT education further impede access to ICT and e-learning tools (Ogunode et al., 2020). Many African nations, including Nigeria, grapple with issues like unreliable Internet connections, high data costs, and a scarcity of available devices, all of which hinder the widespread adoption of e-learning. Additionally, cultural and language barriers must be addressed to ensure the effective utilization of e-learning across diverse African communities.

Despite these obstacles, there is a pressing need to surmount barriers to e-learning accessibility in Nigeria and Africa as a whole (Ajah & Chigozie-Okwum, 2019; Obodike & Okekeokosis, 2020). Further, it has been noted that endeavors are required to enhance e-learning accessibility, ensure its quality and efficacy, and cater to the distinct needs of diverse learners within the African context (Taylor & Newton, 2018). Barriers to effective e-learning utilization encompass challenges related to Internet connectivity, infrastructure, affordability of devices and data, digital literacy, and language localization. Moreover, ensuring the quality and efficacy of e-learning programs, along with addressing diverse learning styles, abilities, and cultural backgrounds, remains a challenge (Obodike & Okekeokosis, 2020).

Despite these challenges, e-learning is gaining traction in Africa, particularly in Nigeria, as a means to bridge educational and training gaps (Ajadi et al., 2008; Alzahrani & Salam, 2020). In Nigeria, e-learning is employed across various sectors, including formal education from primary to tertiary levels, as well as for professional training and development across different industries (Ajadi et al., 2008; Usman et al., 2019). E-learning platforms and tools facilitate the delivery of educational content, offer interactive learning experiences, and foster communication and collaboration among learners and educators (Huang et al., 2019). Particularly in addressing challenges related to geographical distances, limited resources, and the need for flexible learning options, e-learning proves to be invaluable (Desi & Djukri, 2020). According to Chua and Sim (2019), e-learning platforms and tools are versatile, serving purposes such as formal education, vocational training, professional development, and lifelong learning.

Biology represents a distinctive branch within the realm of natural science, dedicated to delving into the intricacies of natural phenomena and occurrences. It encompasses two primary domains: functional biology and historical biology, the latter also recognized as evolutionary biology (Frilov, 1984; Mayr, 2004). Functional biology revolves around the physiological processes of living organisms, often elucidated through the application of natural laws from physical sciences, particularly at the cellular and molecular levels. The central inquiry in functional biology predominantly revolves around the question of "how?" On the other hand, historical biology necessitates a comprehensive understanding of the past to expound upon various aspects of the living world, particularly those intertwined with historical time. Unlike in functional biology, experiments may not always suffice to address the "why" and "how" inquiries commonly posed within this field. Instead, historical narrative serves as the principal methodology for elucidating phenomena (Mayr, 2004).

The Nigerian secondary school biology curriculum partially mirrors these facets of the discipline. It adopts a conceptual approach, covering topics such as the essence of life, fundamental ecological principles, nutritional processes in plants and animals, conservation of matter and energy, as well as concepts pertaining to variation, variability, evolution, and genetics (WAEC, 2023). The curriculum aims to equip students with proficient laboratory and field skills in biology, impart meaningful and applicable knowledge, foster the ability to apply scientific insights to everyday life, cultivate a sound scientific demeanor, and instill an awareness of the interconnectedness between biology and other scientific disciplines (NERDC, 2008; WAEC Curriculum, 2023). These objectives can only be realized through the effective implementation of appropriate teaching methodologies aligned with the content of the biology curriculum.

Biology, as a scientific discipline, encompasses intricate interconnections among unfamiliar and abstract concepts alongside specialized terminologies, rendering it challenging both to comprehend and teach. Many students encounter difficulties in grasping certain biological principles, often resorting to rote memorization rather than genuine understanding (Hadiprayitno et al., 2019; Kilic & Salam, 2004). The senior secondary school biology curriculum prioritizes hands-on field studies, guided exploration, laboratory proficiency, and conceptual reasoning (NERDC, 2008), aligning these methods with the curriculum's objectives, content, and contextual relevance. Moreover, in the contemporary educational landscape, biology educators must embrace innovative, technology-driven, and student-centric pedagogical strategies (Sawa, 2009; Hattie, 2009). The national policy on ICT in education (2019) underscores the government's commitment to furnishing adequate information technology resources to enhance educational practices.

The incorporation of e-learning tools into instructional approaches stands out as a pioneering strategy. Effective biology instruction necessitates a blend of practical and theoretical components. Ariani (2021) advocates for a blended learning approach to optimize online learning efficacy. Teaching approaches encompass a spectrum of methodologies, strategies, and techniques employed by educators to facilitate learning. While traditional methods tend to be teacher-centered, student-centric approaches have demonstrated superior learning outcomes (Hattie, 2009), including problem-based learning, inquiry-based learning, collaborative learning, and experiential learning.

E-learning seamlessly integrates into instructional practices, bolstering a student-centered paradigm by fostering active engagement, personalized learning, and access to diverse resources and tools (Almuhaisen et al., 2020; Garrison & Kanuka, 2004; Means et al., 2010). For instance, e-learning platforms offer interactive virtual laboratories, multimedia resources, and online forums conducive to problem-solving, inquiry, and collaborative endeavors among students (Lazonder & Hermsen, 2016; Harasim, 2017; Samoylenko et al., 2022).

A comparative analysis of literature has unveiled a consistent perspective on the awareness and utilization of e-learning tools. Chuma (2018) conducted a study titled "Utilization of e-learning Technologies Amongst Selected Undergraduate Students in a Nigerian University of Agriculture: The Umudike Study Southeastern Nigeria," revealing a notable level of awareness among undergraduate students regarding e-learning technologies (mean=2.89). Various types of e-technologies were employed, with audio conferencing (mean=2.98), application sharing (mean=2.96), and forum discussions (mean=2.94) being highly preferred for learning purposes. Additionally, there was a significant correlation between awareness and usage of e-learning technologies among undergraduate students in COED, MOUAU.

Nwadi et al., (2023) affirmed that VTE students exhibit high awareness and utilization rates for e-learning tools, particularly the e-learning website (84.8%), Google Classroom (75.6%), and smart boards/video conferencing (60.6%), albeit some students remain unaware of platforms such as the Moodle Learning Management System and the Canvas e-learning platform at the University of Nigeria Nsukka. The recommendation stemming from these findings is that VTE students should undergo proper training to optimize their use of available e-learning technologies, thereby fostering creativity and innovation.

Furthermore, Nuhu (2021) investigated the awareness and utilization of e-learning tools among lecturers in higher institutions (colleges of Education), revealing a high level of awareness (grand mean=3.98) and willingness to adopt Learning Management Systems for instructional delivery (grand mean=4.05). The recommendation based on these results suggests that the government, in collaboration with school administrators, should provide facilities to encourage lecturers to utilize various Learning Management System platforms to enhance teaching quality.

Okpechi et al., (2018) found that lecturers and students were aware of synchronous e-learning technologies in teaching business education courses, with a preference for synchronous tools. It was suggested that seminars and workshops be organized to sensitize lecturers and students on the need to maximize available e-learning technologies for teaching and learning in universities.

Despite the wealth of literature focusing on tertiary institutions, there is a dearth of research on the awareness and utilization of e-learning tools among secondary and primary school teachers and students, which form the foundation for higher education. Hence, investigating the accessibility and utilization of e-learning tools for teaching biology in public secondary schools becomes imperative. This study is motivated by the observation that existing research on e-learning in Nigeria predominantly centers on the accessibility, prospects, and challenges within public and private tertiary institutions. Thus, exploring the accessibility and utilization of e-learning tools for teaching biology in public secondary schools is of utmost importance (Afolayan, 2015; Aboderin, 2015; Ifijeh et al., 2015; Eze et al., 2018).

PURPOSE OF THE STUDY

The main purpose of this study is to find out the accessibility and utilization of e-learning tools for teaching biology in secondary schools in Ilorin metropolis. The specific objectives are to find out:

- The level of awareness of e-learning tools among Biology teachers in secondary schools in Ilorin metropolis.
- The available e-learning tools for teaching Biology in secondary schools in Ilorin metropolis.
- The accessible e-learning tools for teaching Biology in secondary schools in Ilorin metropolis.
- The utilization of e-learning tools for teaching Biology in secondary schools in Ilorin metropolis.

RESEARCH QUESTIONS

1. What is the level of awareness of e-learning tools among Biology teachers in secondary schools in Ilorin metropolis?
2. What are the available e-learning tools for teaching secondary school Biology in Ilorin metropolis?
3. Do Biology teachers access available e-learning tools for teaching Biology in secondary schools in Ilorin metropolis?
4. Do Biology teachers utilize e-learning tools for teaching Biology in secondary schools in Ilorin metropolis?

RESEARCH HYPOTHESES

- Ho1: There is no significant difference between the levels of awareness and accessibility to e-learning tools among secondary school Biology teachers in Ilorin Metropolis.
- Ho2: There is no significant difference between the levels of awareness and utilization of e-learning tools among secondary school Biology teachers in Ilorin metropolis.

METHODOLOGY

This study is a descriptive research design of the survey type. This study is aimed at investigating the awareness, availability, accessibility and utilization of e-learning tools for teaching Biology in secondary schools in Ilorin metropolis. The target population was all the biology teachers in public secondary school in Ilorin metropolis. Three local government areas were randomly selected among the six local government areas making up Ilorin metropolis, and the sample was drawn from the three local government areas, that is, Ilorin West, Ilorin East and Ilorin South in Ilorin metropolis. The sample size was determined from the estimate of the target population which is 368 (according to Kwara State Teaching Service Commission, 2023). Using Cohen et al., 2007 table of random sampling, at 99 percent confidence level, the sample size for this study was 250.

The research instrument utilized was a researcher- designed questionnaire. The questionnaire consisted of a 4-point Likert-scale titled the e-learning, awareness availability, accessibility and utilization questionnaire (EAAAUQ). The questionnaire contained two sections, A and B. Section A dealt with respondent demography; it contained information on respondents such as gender, educational qualification, and work experience while Section B dealt with items on awareness, availability, accessibility and utilization of e-learning tools in teaching Biology.

To ensure face and content validity of the instrument (EAAAUQ), the questionnaire was given to the researcher's supervisor, an expert in measurement and evaluation to check the suitability and viability of the instrument. The researcher visited the secondary schools where the study would be carried out to seek permission from the authorities of the schools. The questionnaire was then administered to biology teachers and retrieved immediately for data analysis. The data obtained was analyzed using descriptive statistics and inferential statistics. Percentages were used to analyze demographic information provided by respondents. Mean and standard deviation were used to analyze data and provide answer to the research questions. Independent t-test would further be used as the inferential statistics to test the null hypothesis.

RESULTS AND INTERPRETATION

Research Question 1: What is the level of awareness of e-learning tools among biology teachers in secondary schools in Ilorin metropolis?

In other to provide the answer to this question, the data gathered in the study were subjected to descriptive statistical analysis with the aid of the SPSS version 20.0. The results of the analysis are as presented in Table 1 below.

Table 1: *Descriptive Statistics on Biology Teachers' awareness on e-learning tool*

Awareness on e-learning tool	N	Sum	Mean	Std. Deviation
I am comfortable using a computer and the Internet.	250	932	3.73	.551
I know how to open, modify, save and upload documents.	250	901	3.60	.587
I am comfortable navigating web pages and sending and receiving e-mail.	250	879	3.52	.609
I am aware that e-learning could be synchronous or asynchronous.	250	881	3.52	.647
I am aware of different e-learning tools and platforms.	250	834	3.34	.664
Blackboard and Google classroom are examples of e-learning platforms.	250	804	3.22	.782
Aggregate Mean			**3.49**	

NB: Mean score < 2.00 = Low awareness *level, Mean score >2.00 ≤ 3.00=Moderate* awareness *level, Mean score>3.00 = High* awareness *level.*

The aggregate mean score for biology teacher level of awareness of e-learning tools is 3.49 as indicated in Table 1. This result revealed that the level of awareness of e-learning tool among biology teachers in Ilorin metropolis is high. This level of awareness is satisfactory, considering the high rate at which technology has been employed for teaching globally in the recent time, most especially in the sciences.

Research Question 2: What are the available e-learning tools for teaching secondary school biology in Ilorin metropolis?

The data in Table 2 below shows the descriptive and percentage count on availability of e-learning tools for teaching biology in senior secondary schools in Ilorin metropolis. The data shows a high percentage on non-availability of e-learning tools for teaching biology which are expected to be provided by the school management. Conversely, the result revealed that biology teachers have access to personal tools that can be of use in their quest to make use of e-learning tools.

Table 2: Descriptive Statistics on Availability of e-learning tools in secondary school Ilorin metropolis

Availability of e-learning tools	Yes	%	No	%
My school has a computer laboratory	76	30.4	174	69.6
My school has a computer laboratory that is internet enabled	61	24.4	189	75.6
I have smart phone and some other devices	245	98.0	5	2.0
My school has multimedia devices as instructional media	45	18.0	205	82.0
I have a personal laptop	215	86.0	35	14.0

Research Question 3: Do biology teachers have access to the available e-learning tools for teaching biology in Ilorin metropolis?

Table 3: Descriptive Statistics on Biology Teachers' access to e-learning tools for teaching biology

Biology Teachers' access to e-learning tools	Yes	%	No	%
I have access to computer laboratory in my school	68	27.2	**182**	**72.8**
I have access to internet in my school	61	24.4	**189**	**75.6**
I have access to multimedia devices in my school	45	18.0	**205**	**82.0**
I have access to e-learning platforms and tools on my smart phone	**250**	**100**	0	0

Table 3 shows the descriptive and percentage count of biology teachers' access to e-learning tools for teaching biology. The data revealed that a high percentage of teachers have no access to e-learning tools for teaching biology that are expected to be provided by the school management.

Research Question 4: Do biology teachers utilize e-learning tools for teaching biology in secondary schools in Ilorin metropolis?

Table 4 below shows the descriptive and percentage count of biology teachers' utilization of e-learning tools for teaching biology. The data revealed that a high percentage of teachers do not utilize e-learning tools for teaching biology. This result is in-line with the fact that lack of accessibility will result in non-utilization of e-learning tools. The data in the table also revealed that a high percentage of biology teachers understand the implication of using e-learning tools for teaching biology but a low percentage are actually implementing it or integrating in the teaching process. This may be due to inability to access these e-learning tools for teaching biology.

Table 4: *Descriptive Statistics on Biology Teachers Utilization of E-learning Tools for teaching biology*

	Utilization of E-learning Tools	Yes	%	No	%
1.	I use my Smartphone and laptop to teach biology	57	22.8	193	77.2
2.	I use the school computer laboratory to teach student biology	40	16.0	210	84.0
3.	I can use blackboard platform to teach biology	70	28.0	180	72.0
4.	I can use Google classroom to teach biology	70	28.0	180	72.0
5.	Biology practical session cannot use e-learning tools to achieve learning	63	25.2	187	74.8
6.	Biology concepts are easy to teach using e-learning platforms	250	100	0	0
7.	I combine the traditional teaching methods and e-learning tools	79	31.6	171	68.40
8.	Use of e-learning devices and application improve teaching and learning	250	100.0	0	0.0

DISCUSSION

This study examined the accessibility and utilization of e-learning tools for teaching biology in senior secondary schools in the Ilorin metropolis. With regard to the research questions, the analyzed data showed that the level of awareness about e-learning tools is high among biology teachers in Ilorin metropolis as shown in Table 2. Based on the findings in this study, e-learning tools that are expected to be provided by the school management are not available as shown in Table 3. Thus the teachers do not have access to the schools' e-learning tools as shown in Table 4 and corroborated with the findings of Obodike & Okekeokosis (2020); and Ajah & Chigozie-Okwum (2019).

Thus, due to lack of access to schools' e-learning tools to teach biology, there is low utilization of e-learning tools as shown in Table 4. This is corroborated by the findings of Obodike & Okekeokosis (2020). Some teachers make use of personal gadgets like a smartphone. However, the teachers' perception of e-learning utilization is positive as shown in Table 4 and this finding is supported by Huan et al., (2019).

Limitation and Future Extension: This research is quantitative and the population size and sample are limited to students in secondary schools in Ilorin metropolis. Thus, further studies should collect and collate a larger number of data to allow more generalization. In addition, further research is required in the same type of research with students to provide a more balanced view.

RECOMMENDATIONS

From the result findings in this study, the researcher recommends the following:
- Government should provide ICT facilities that are internet-abled in all public schools
- Government should ensure maintenance of the e-learning provided.

- Curriculum developers and policy makers in Kwara Ministry of Education and Teaching service commission should include information retrieval skills in school syllabus /curriculum.
- Government should make policies that will enforce the use of e- learning tools in all schools.
- Government should give prior attention to capacity building (ICT skills acquisition) of teachers via regular in-service training

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