Journal of Centre for Distance & e-Learning
(JCDeL), Vol. 3, No. 1, 2024
ISSN: 1595-5362
https://cdeljournal.unn.edu.ng

AVAILABILITY AND UTILIZATION OF E-LEARNING FACILITIES IN TEACHING AND LEARNING OF CHEMISTRY IN TETIARY INSTITUTIONS: A CASE STUDY OF THE UNIVERSITY OF NIGERIA.

Dave-Ugwu, P.O., Ezema, Geraldine C. & Eze, Gloria Nkiruka
Department of Science Education,
Faculty of Education,
University of Nigeria, Nsukka
priscilla.daveugwu@unn.edu.ng

Abstract

The use of electronic media and e-learning hardware facilities has substantially changed the world, reduced the world to a global village and has made the most tremendous impact in education. This study was carried out to investigate the availability and utilization of E-learning facilities for teaching and learning of Chemistry in Tertiary Institutions using the University of Nigeria as a case study. A descriptive survey research design was adapted for the study and the study was guided by three research questions. The population of the study consisted of one hundred and fifty-nine undergraduates (male:28; Female: 131) undergraduate students of Chemistry Education in the Department of Science Education, Faculty of Education, University of Nigeria Nsukka. Eighty-four (84) respondents which comprised of thirty-three (33) third year students and fifty-one (51) final year students of the Department of Science Education in the 2022/2023 academic session were sampled. The instrument used for data collection were; the Availability of E-learning Facilities for Teaching and Learning of Chemistry Check list(AEFTLCC), Utilization of E-learning Facilities for Teaching and Learning of Chemistry checklist(UEFTLCC) and Challenges of the use of E-learning Facilities in Teaching and Learning of Chemistry Questionnaire(CEFTLQ). The instruments were validated by experts and the reliability carried out which gave an overall coefficient of 0.93 using Cronbach alpha. Frequency, mean and standard deviation were used to answer the research questions. The results obtained showed among other things that E-learning facilities are not adequately available for teaching and learning of chemistry in university of Nigeria. The available ones are not well utilized because of some outstanding challenges. Based on these findings, recommendations were made.

Key words: E-learning facilities, Chemistry, Teaching and Learning.

Introduction

The place of chemistry knowledge and skills in economic and industrial development in the Nigerian society cannot be underestimated. Essentially chemistry goes beyond processes in chemical industries as fertilizers, petroleum, paper and pulp, iron and steel, cement, coal, glass, electronics industries and so on. It plays major roles in the vital sectors of the economy, industries and in the improvement of quality life as it contributes immensely as a school subject in the area of medicine, agriculture, engineering and other scientific disciplines. As such much attention is needed in the impartation of Chemistry knowledge at every level of education. Statistics shows that students run away from Chemistry and Chemistry related courses, and those

who dare most times, do not graduate by the stipulated time and many of those that graduated end up with result far below their expectations, despite the much effort put up by Chemistry educators. A review of the UNN 2018/2019 graduates' records revealed that out of 45 graduates in the field of chemistry education, 8 graduated with second class (upper division) degrees, 12 with second class (Lower Division) degrees and 25 were unable to graduate with others. (Science Education, Examination Officer's report, 2019; UNN graduation list, 2019). A similar trend was observed in the 2019/2020-degree graduation list, their records also revealed that 45 undergraduate chemistry education students were registered, only 18 students graduated and 27 could not graduate (UNN, Science Education, Examination Officers report, 2020; UNN graduation list, 2020). Report from the Department of Pure and Industrial Chemistry Department shows a similar or even worse trend. Also, the Enugu State Scholarship and Education Loans Board (ESSELB) in the past few years, recorded low enrolment in Chemistry and Chemistry related courses (ESSELB, 2021).

The above state of affair is worrisome because, Chemistry is one of the basic unit of natural science that is central to the learning of other sciences but contains a number of concepts characterized as abstract which makes its teaching very challenging. Abdel rim, (2015) points out that the complexity and abstract nature of some chemistry concepts makes its teaching and learning more challenging than all the other science disciplines. Atkins, (2013), says that Chemistry goes beyond the study of the transformation of matter to the development of methods and to manipulate those transformations to create new and useful forms of matter. This being the case, special attention, skills, strategies and technologies need to be adopted in the impartation of Chemistry knowledge to ease off the teaching challenges, reduce the content complexities and abstractness, then bring up students' interest in Chemistry. Extra skills and strategies developed by Chemistry educators have been noted by scholars to improve learning greatly (Okoli & Osuafor,2019). Apart from these skills and strategies, modern technologies have also been reported to greatly impact learning. Gideon and Ogologo, (2021), opines that, e-learning as an aspect of information and communication technology (ICT) if integrated fully into the teaching of sciences would be a better and a more effective tool in the teaching and learning processes. Also, Adesoji (2013) noted that, the use of some of these e-learning facilities will permit real interaction between the teacher and the learner in such a way that appear like the conventional classrooms even where the recipients are far apart. Some notable modern e-learning facilities that are widely used in teaching and learning are; use of email, WhatsApp messages, and social network tools that any internet user would use, integration of modern telecommunication equipment and Internet Communication Technology resources such as the computers, scanners, printers, televisions, phone systems, Wireless Application Protocols (WAP), radios, multimedia projector, electronic boards, video recorders, social media handles, YouTube videos, among others. As well as, virtual laboratory, whiteboards, computer simulation, electronic board, projector, radio player, flash drive, printer, video recorders, instructional television, CD-ROM, laptop computers, and scanner, Social media handles, YouTube videos, online study materials and other internet media and online study materials.

Teaching is simply a process of imparting knowledge, skills, values, and attitudes to a student or a group of students. It involves creating a supportive and stimulating learning environment, understanding the learners' needs and abilities and adapting teaching strategies accordingly, geared towards achieving the educational objectives for chemistry teaching and learning. The need for adequate provision and utilization of e-learning facilities for the teaching

and learning of Chemistry in tertiary institutions in the Nigerian is what this work is poised to X-ray. E-learning in teaching is the use of electronic media and technology to deliver educational contents and facilitate learning. This has transformed the learning landscape globally and has emerged as a vital component of modern education, offering flexible and accessible learning opportunities. E-learning has made the most tremendous impact in education. It has revolutionized education by making all vital information available to learners. Integrating e-learning in education could be a veritable instrument for improving the performance of students in Chemistry especially in some aspects like; spectroscopy, complex formation (bond breakage and formation), periodic table, extraction and separation of organic solvents among others. These concepts can be made less abstract and more interesting to learners by the integration of e-learning as aforementioned. The question this survey intends to address is; Are these facilities available and utilized adequately for this purpose in tertiary institutions where Chemistry is the heart of all science disciplines? One striking benefit of integrating e-learning in the teaching and learning of Chemistry is in the use of virtual laboratory which enables students to perform experiments that would have been difficult for them to carry out. Virtual laboratory is an interactive digital simulation of activities that typically take place in physical laboratories which offers unique opportunity for teachers and students to improve the way they teach and learn.

Notably, Nigeria's tertiary education system is facing numerous challenges, including inadequate infrastructure, limited access to technology, and poor internet connectivity. This has tremendously affected the potentials of the Nigerian students to have increased access to quality education and enhanced academic performance. Sadly, research has shown that a great number of tertiary institutions in Nigeria do not have access to these E-learning facilities (Atsumbe, et al,2012; Gabardine, et al, (2015; Osuafor, et al,2015; Wokocha, et al,2017; Emesi,2018), despite the need. However, the finding by Okoli et al, (2019), indicate that a greater number and percentage of e-learning facilities are available in science education program in Federal Universities in South Eastern Nigeria, but the question remains, how many of the available ones are accessible, relevant and utilized for the teaching and learning of Chemistry in most of these Universities taking University of Nigeria as a case study. The availability and utilization of such facilities in these institutions remain a concern and much doubtful, hence the clarion call for wide investigation into the availability and utilization of E-learning facilities in the teaching and learning of chemistry in the tertiary institutions in Nigeria. This study aims to investigate the availability and utilization of e-learning facilities in tertiary institutions in Nigeria, using the university of Nigeria as case study. It seeks to explore the current state of e-learning infrastructure, the extent to which these facilities are utilized, and the challenges in the use of these facilities. The findings of this study is expected to contribute to the knowledge of the importance of e-learning in Nigeria's tertiary education sector and inform strategies for improving the availability and utilization of e-learning facilities. This study therefore, is poised to find out the availability and utilization of e-learning facilities for the teaching and learning of Chemistry and the challenges of using the facilities for effective teaching and learning of Chemistry in the University of Nigeria.

Research Questions

The following research questions guided this study;

1. What are the e-learning facilities available for teaching and learning of Chemistry in university of Nigeria?
2. What is the extent of utilization of e-learning facilities in teaching and learning of Chemistry in university of Nigeria?
3. What are the challenges facing the use of e-learning facilities in teaching and learning of Chemistry in university of Nigeria?

Research Methods

The study adopted a descriptive survey research design. The study was carried out in University of Nigeria, Nsukka.The population of this study comprises of 159 (male 28, females 131) undergraduate chemistry education students from first year to final year in university of Nigeria. Sample size of the study is 84 respondents, thirty-three (33) third year students and fifty-one (51) final year students, all are undergraduate Chemistry Education students in University of Nigeria. Third year and final year undergraduate Chemistry Education classes were purposely sampled because they have almost completed most of their coursework in the Science Education Department and in the Department of Pure and Industrial Chemistry, Faculty of Physical Sciences, University of Nigeria. They have had more exposure on the field of study and have been exposed to using all the available facilities in the two departments. The instrument used for data collection were; the Availability of E-learning Facilities for Teaching and Learning of Chemistry Check list(AEFTLCC), Utilization of E-learning Facilities for Teaching and Learning of Chemistry checklist(UEFTLCC) and Challenges of the use of E-learning Facilities in Teaching and Learning of Chemistry Questionnaire(CEFTLQ). The instruments were validated by experts and the reliability carried out, which gave an overall coefficient of 0.93 using Cronbach alpha. The researchers administered the instrument directly to the respondents and also retrieved them on the spot for further analysis. Frequency count and percentage was used to answer research question one while mean and standard deviation was used to answer research question two and three.

Results

Research Question One:
What are the available e-learning facilities used in teaching and learning of Chemistry in University of Nigeria?

Table 1: Frequency and Percentage of e-learning Facilities Available for Teaching and Learning of Chemistry in University of Nigeria.

S/N	e-learning facilities	Available		Not Available		Decision
		Frequency	Percentage %	Frequency	Percentage %	
1	Computer	74	87.1	10	11.8	A
2	Flash drive	49	57.6	35	41.2	A
3	Multimedia projector	59	69.4	25	29.4	A
4	Internet/Wi-Fi	77	90.6	7	8.2	A
5	Instructional radio	13	15.3	71	83.5	NA
6	Electronic notice board	32	37.6	52	61.2	NA
7	Presentation Clicker	30	35.3	54	63.5	NA
8	Software packages	40	47.1	44	51.8	NA
9	Mobile phones	78	91.8	6	7.1	A
10	Audio tape	41	48.2	43	50.6	NA
11	YouTube	72	84.7	12	14.1	A
12	CD/DVD ROM	37	43.5	47	55.3	NA
13	Interactive white board	34	40.0	50	58.8	NA
14	Video tape	23	27.1	61	71.8	NA
15	Instructional television	20	23.5	64	75.3	NA
16	Laptop	70	82.4	14	16.5	A
17	Microsoft PowerPoint	70	82.4	14	16.5	A

Available = A and Not Available = NA

Table 1 shows that most of the e-learning facilities are not available in the school. For example, the chemistry students responded that there was no instructional radio, electronic notice board, presentation clicker, software packages, audio tape, CD/DVD ROM, interactive white board, video tape and instructional television in the school. This implies that the school is not using them for classroom instructions. On the other hand, the result showed that computers, flash drive, multimedia projector, internet/Wi-Fi, mobile phones, YouTube, laptops and Microsoft PowerPoint are available in the school.

Research Question Two:
What is the extent of utilization of e-learning facilities in teaching and learning of Chemistry in University of Nigeria?

Table 2: Mean Ratings and Standard Deviation of Responses on the Extent of utilization of e-learning facilities in teaching and learning of chemistry in University of Nigeria.

S/N	ICT Tools	Mean	Std. Deviation	Decision
1	Computer	2.88	0.80	HE
2	Flashdrive	2.31	0.74	HE
3	Multimedia projector	2.25	0.77	HE
4	Internet/Wi-Fi	3.05	0.82	VHE
5	Instructional radio	1.81	0.84	LE
6	Electronic white board	1.68	0.71	LE
7	Presentation Clicker	1.61	0.73	LE
8	Software packages	2.02	0.86	HE
9	Mobile phones	3.15	0.98	VHE
10	Audio tape	2.30	0.83	HE
11	YouTube	2.83	0.94	HE
12	CD/DVD ROM	2.00	0.93	LE
13	Interactive white board	1.80	0.80	LE
14	Video tape	1.77	0.77	LE
15	Instructional television	1.64	0.71	LE
16	Laptop	2.93	0.97	HE
17	Microsoft PowerPoint	2.70	0.83	HE

VHE= Very High Extent, HE = High Extent, LE = Low Extent and VLE = Very Low Extent.

Table 2 revealed that not all the available e-learning facilities are being utilized by the chemistry teachers and the students. For example, instructional radio, electronic whiteboard, presentation clicker, CD/DVD ROM, interactive whiteboard, video tape and instructional television that are not available are not utilized while the available ones like; computers, flash drive, multimedia projector, internet/Wi-Fi, mobile phones, YouTube, laptops and Microsoft PowerPoint are utilized but in low extent.

Research Question Three:
What are the challenges facing the use of e-learning facilities in teaching and learning of Chemistry in University of Nigeria?

Table 3: Mean Ratings and Standard Deviation of Responses on the Challenges facing the use of e-learning facilities in teaching and learning of chemistry in University of Nigeria.

S/N	ICT Tools	Mean	Std. Deviation	Decision
1	Insufficient knowledge of how to use e-learning facilities	2.85	0.98	A
2	Inadequate e-learning infrastructure	2.95	0.89	A
3	Poor implementation of policy on e-learning	2.77	0.92	A
4	Limited number of chemistry teacher who are e-learning proficient	2.83	0.76	A
5	Low telecommunication service penetration	2.86	0.92	A
6	Poor internet connections	2.43	1.14	NA
7	Difficulty in maintaining engagement and interaction	2.36	0.4	NA
8	Limited access to e-learning facilities	2.71	0.94	A
9	Lack of technical know-how on e-learning	2.83	0.80	A
10	Teachers' lack of e-learning skills	2.80	0.82	A
11	Teachers lack of confidence in using e-learning tools	2.35	0.98	NA
12	Insufficient knowledge of appropriate software to apply	2.79	088	A

A=Agreed, NA = Not Agreed

In table 3 above majority of the factors listed had the mean scores above the acceptable cut-off point of 2.50. For instance, out of twelve (12) items listed above. The students agreed that nine (9) factors are notable challenges facing the use of e-learning facilities in teaching and learning of chemistry in University of Nigeria.

Findings of the Study

After the analyses and interpretations of the data, the following were found:

1. Computers, flash drives, multimedia projectors, internet/Wi-Fi, mobile phones, laptops and Microsoft PowerPoint are the only available e-learning facilities for teaching and learning of chemistry in the University of Nigeria.
2. Instructional radio, presentation clicker, CD/DVD ROM, video tapes and instructional television and software packages such as; virtual laboratories, audio tapes, YouTube are not available for the teaching and learning of chemistry. Electronic white boards are available in two classrooms in the Department of Science Education but are not in use because they are in dilapidated conditions, so it is deemed not available.
3. Challenges facing the use of e-learning facilities for the teaching and learning of Chemistry include but not limited to inadequate e-learning infrastructures, insufficient knowledge of how to use the available e-learning facilities, poor implementation of policy on e-learning, limited number of staff who are e-learning proficient among others.

Discussion of Findings

The result of the research revealed that most of the e-learning facilities are not available in University of Nigeria. There is no instructional radio, electronic white board, presentation clicker, software packages, audio tape, CD/DVD ROM, video tape and instructional television. The use of Virtual Laboratory is not yet in view. Electronic white board are available in some classrooms but are not in use. Computers, flash drive, multimedia projector, internet/Wi-Fi, mobile phones and laptops are available in a reasonable proportion but not adequately used during the teaching sessions. This means that, **t**here is a low extent to which available E-learning facilities are utilized in the teaching and learning of chemistry in University of Nigeria. This finding is consistent with the findings of Atsumbe, et al, (2012), Gabardine, et al, (2015), Osuafor, et al, (2015), Wokocha, et al, (2017), Emesi, (2018) who reported that, there is a considerable lack of E-learning facilities in many tertiary institutions in Nigeria. This is a worrisome situation that must be tackled with every seriousness if Nigeria must flow with the drifting current of technological advancement and the Sustainable Development Goals. The challenges facing the use of E-learning facilities in the teaching and learning of Chemistry were revealed by this research work which include: insufficient knowledge of how to use E-learning facilities, insufficient E-learning infrastructures, poor implementation policy, poor internet connection, epileptic power supply, lack of technical know-how, weak policy implementation, inadequate funding among others. It can therefore be deduced from findings that, there are a whole lot of challenges facing the use E-learning facilities in the university of Nigeria and hence, tertiary institutions in Nigeria.

Conclusion

The E-learning facilities available for the teaching and learning of Chemistry in University of Nigeria is very poor and therefore not encouraging. On the other hand, the available ones are not adequately utilized. The utilization of the available E-learning facilities in the teaching and learning of Chemistry is to a very low extent. The situation is worrisome and must be addressed with the speed of light, this is because these findings hold some implications for the Nigerian technological, economic and political advancement.

Recommendations

In the light of the findings and the implications of this study, the following recommendations are made:

1. The government should adequately provide of e-learning facilities that are functioning for all the tertiary institutions in Nigeria.
2. Tertiary institutions should recruit staff with e-learning skills, this will ensure that the E-learning facilities are in good working conditions and are utilized responsibly and optimally by the teachers in the teaching and learning process.
3. There should be a periodic training, seminars and workshop for lecturers and the technical staff in the tertiary institutions whose responsibility it is to use these facilities in teaching Chemistry courses, fully sponsorship by the Federal Government and Education Authorities.

4. Government, none governmental organizations as well as other stakeholders and philanthropists are encouraged to support tertiary institutions, by providing the fund for equipping the institutions with e-learning facilities.
5. There should be constant supply of electricity to tertiary institutions or generating plants as alternatives, for effective use of e-learning facilities in case of power failure.

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