Effectiveness of e-learning in the delivery of medical and dental education in a tertiary institution in Nigeria

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Abstract

Background: Following the gradual shift from classroom learning to more remote settings using Elearning platforms, it has, therefore, become necessary to investigate the effectiveness and perceptions of students about online learning in respect of medical and dental education. This study aims, therefore, to determine the effectiveness of e-learning in the delivery of medical and dental education.

Methods: A cohort study involving two groups of final-year medical and dental students at the University of Port Harcourt was performed. One group received 30mins online lecture while the other received 30mins physical lecture and their respective performances were assessed afterwards. A self-administered questionnaire was employed to collect additional data including sociodemographic, effectiveness of e-learning, perceptions of e-learning and classroom learning, and problems associated with online learning and classroom learning. The collected data was analyzed using SPSS version 27 software for Windows. Significance level was set at p < 0.05.

Results: Eighty-six final-year students; 74 (86.05%) medical and 12 (13.95%) dental students participated in this study. There were 34.88% males and 65.12% females, The group that had onsite lecture had a mean performance score of 2.93 while the online cohort had a mean score of 2.15. Independent samples t-test showed a statistically significant association t(84) = 3.332, p < 0.05. The classroom cohort was associated with a statistically significant more effective learning.

Conclusion: On-site learning was more effective than an on-line learning. The respondents also had a better perception of learning in the classroom compared to learning on-line.

Keywords: E-learning, classroom learning, medical, dental, education

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INTRODUCTION

The COVID-19 lockdown in the year 2020 led to the temporary suspension of all physical

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educational activities and this led to the increasing focus on transitioning to electronicbased learning. Electronic-based learning, also called E-learning, refers to the use of an electronic device or an electronic means to learn from a distance such as the Internet, Videotapes, Television etc.¹ It was defined as the use of multimedia technologies and the internet such that the quality of learning and access to resources and services is improved and limitless.² E-learning can occur entirely online in virtual settings or a hybrid of virtual and in-person settings known as "blended learning."²

A broad range of programmes and procedures intended to provide instruction via electronic devices, such as CD-ROMs or satellite transmissions for video conferences, are commonly referred to as e-learning. ³ Other examples are web-based training, computerbased training, and on-line learning. Elearning, then, is the application of technology to enhance classroom engagement in a positive setting using tools like interactive multimedia, CD-ROM, the internet, and others. ³ it is accessible from any location at any time as long as a computer and an internet connection is present.

Various forms of e-learning have been identified, usually based on the learning method, method of delivery, tools for education and the online course platform used.⁴ The following are types of e-learning systems in use; Computer Managed Learning (CML), Computer Assisted Instruction (CAI), Synchronous Online Learning, Asynchronous Online Learning, Fixed E-Learning, Adaptive E-learning, Linear E- Learning, Interactive E-Learning, Individual E-Learning, Collaborative E-learning.⁴

E-learning allows students to study at their own pace, engage in collaborative learning activities, and promote active learning. These features contribute to the enhancement of higher-order thinking abilities, thereby facilitating improved retention of information. Consequently, superior learning outcomes and the attainment of academic goals are achieved. E-learning also bridges the gap between the classroom and the external world, formulating individualized learning plans, augmenting skill sets, and ensuring the economic viability of the future workforce. ⁵ It proves advantageous in several dimensions, addressing the diverse needs of students, providing support for individuals with disabilities, engaging learners who encounter difficulties in traditional educational settings, offering opportunities for gifted and talented individuals to advance their education. and cultivating independent learning skills through professional learning experiences. ⁶ Notably, e-learning aids older learners in surmounting learning challenges arising from physical limitations and the complexities associated with adult responsibilities, facilitating self-directed study their own pace and personalized at learning. ⁷ It also facilitates seamless integration into the workforce and enhances interpersonal interactions during teaching and administration within Higher Education Institutions (HEIs).⁸

However, some impediments to E-learning have been reported in the literature. ⁹ These impediments were categorized into a fourdimensional conceptual framework: comprising technological, content, individual, and contextual concerns. Similarly, challenges including the necessity for self-discipline and accountability to sustain motivation in online learning environments, ¹⁰ act as barriers to continuous learning in these settings. The following have been identified as barriers to elearning: detrimental study habits, students' feelings of isolation, insufficient peer engagement and learning, delayed teacher responses to problems, particularly in asynchronous contexts, and standardized instructional materials limiting students' adaptability.¹⁰ Previous research ¹¹ further identifies demotivating factors, such as students' sense of isolation, difficulties in navigating online courses, unclear instructional tasks, encounters with irrelevant materials, and technical difficulties, as potential impedance towards students' acceptance of e-learning. Impediments such as limited Internet access, bandwidth constraints, and instructors' unavailability in discussion forums pose challenges to integrating elearning in underdeveloped nations.¹²

Medical and dental colleges also explored methods to deliver successful e-learning to ensure uninterrupted education for clinical students during challenges such as lockdowns.^{13,14} However, clinical medical and dental students faced particular challenges because of their training, which relies heavily on face-to-face interactions. Activities such as clinical clerkships, presentations, and clinical rotations were difficult to substitute through online methods. ¹⁵ A previous study conducted to evaluate the perception of clinical medical and dental students at the University of Ibadan about the effectiveness of the online mode of study for learning, revealed that, although the students identified some benefits of online learning, the general perception was that the on-line teaching method was not effective for learning generally speaking. ¹⁶

The objectives of this study, therefore, were to determine the effectiveness of e-learning in the delivery of medical and dental education, to compare the effectiveness of e-learning with traditional classroom learning methods of delivery of medical and dental education, to compare the perceptions of medical and dental students about e-learning and traditional classroom learning methods and to compare the participants' perceived problems of elearning and traditional classrooms learning methods.

MATERIALS AND METHODS

Study design and study setting

The study was a cohort study carried out at the University of Port Harcourt, Rivers State, Nigeria. The University is about 15km away from the Port Harcourt city, along the East-West Road in Obio/Akpor Local Government Area of Rivers State.

Study participants

Participants for this study were medical and dental students in their sixth year (600 level) in the Faculties of Clinical Sciences and Dentistry respectively.

Study independent variables

The study had two independent variables: 1. perception towards online learning and 2. perception towards physical classroom learning.

Participants were asked about their perception of online learning by asking:

"Do you have experience with attending online classes in the past (before COVID-19)", "Do you have the proper equipment needed for an online class", "Do you have a good interaction with your lecturer during an online class",

"Do you have interactions with your classmates in an online class".

Each of these questions had two responses: 1. Yes, and 2. No

Also, participants were asked about their perceived problems associated with online learning. The responses include: 1. "Poor internet connection"; 2. "Lack of data subscription"; 3. "Poor electricity supply"; 4. "Absence of internet-enabled device"; 5. "Poor computer operating skills by lecturers".

A tick of the responses was an indication of participants' perceived problem with online learning.

Participants were also asked about their perception of physical classroom learning by asking the following questions:

"Do you prefer physical class to online class",

"Do you think physical classes require a lot of equipment",

"Do you understand better during physical classes"

"Do you enjoy the physical interaction with your lecturer in the classroom",

"Is your academic performance affected by learning only through physical classes".

Each of these questions had two responses: 1. Yes, and 2. No

Participants were asked about their perceived associated problems with physical classroom learning. The responses are: 1. "Insufficient seat in the classroom"; 2. "Crowded classrooms"; 3. "Lack of teaching materials"; 4. Inaudible lecturers; 5. Passer-by distraction.

A tick of the responses was an indication of participants' perceived problem with physical classroom learning

Study dependent variable

The study dependent variable was assessed based on the performances of the participants from the single best option evaluation done following the delivery of a lecture titled "Chest Injury". The lecture was delivered by the third author.

Instruments for data collection

The study used a self-administered, semistructured questionnaire as the primary tool for obtaining data.

Procedure for data collection

The study was conducted in a two-stage process; first stage involved distribution and answering of multiple-choice questions based on the lecture delivered by the third author, while the second stage involved the filling of the questionnaire. The participants were randomly divided into two groups; the first group (control group), listened to a 30-minute lecture using the conventional classroom teaching technique, whereas the second group (test group), had the same lecture through a Zoom Video conferencing platform for 30 minutes duration at the comfort of their residence. After the lecture, the two groups were given multiple-choice questions to answer based on the lecture. Each participant's answer was assessed and scored after the scripts were turned in. The participants were then administered the questionnaires.

Data analysis

Data collected was analyzed using IBM Statistical Product and Service Solution (SPSS) version 27 software for Windows (IBM Corporation, Armonk, New York, USA). Exploratory analysis was conducted to ensure data consistency. Categorical variables (gender, age group, course of study) were expressed in frequency and percentages. Numerical variables were presented using means and standard deviation. The results were presented in the form of tables and figures. Levene's F test was used to test the assumption of homogeneity of variance and independent ttest was used to test the association between mode of lecture delivery and effectiveness of learning. All statistical significances were assumed at p values < 0.05.

RESULTS

Ninety-three final-year medical and dental students were recruited into the study; but only 86 participants completely filled the questionnaire, representing a 92% response rate.

Socio-demographic distribution of the study participants

This study comprised 86 participants, 34.88% (30/86) males and 65.12% (56/86) females, with a M: F of 1:1.87. The mean age was 25.00 ± 2.63 years. Dentistry students were 12 (13.95%), while the Medicine and Surgery students were 74 (86.05%).

Mean performance scores of the participants

The mean performance score of the participants from the single best option multiple choice assessment done following each of the onsite and online lecture delivery: The class room cohort had a mean score of 2.93 ± 1.02 , while the on-line cohorts had a mean score of 2.15 ± 1.11 .

Comparison of the effectiveness of elearning to classroom learning methods among the participants

To test the Null hypothesis that there is no significant difference in the effectiveness of elearning compared to classroom learning methods in the delivery of medical and dental education, an independent sample *t*-test was performed. As seen in the table below, the assumption of homogeneity of variances was tested and satisfied via Levene's F test, F(84)= 1.636, p = 0.204. The independent samples *t*-test showed a statistically significant association, t(84) = 3.332, p < 0.05 between mode of lecture delivery and effectiveness of learning. Thus, the classroom cohort was associated with a statistically significant more effective learning process than the online cohorts. Cohen's d was estimated at 0.720, with a 95% confidence interval ranging from 0.281 to 1.156, which shows a medium effect based on the Cohen's 1992 guidelines ¹⁷ (Table 1).

Perception of participants towards on-line learning

A mean scoring range of 1.00 to 1.5 indicates good perception while a mean range of 1.51 to 2.00 represents 2.00 and indicates poor perception. About 79% (79.1%) of the participants had good perception towards online learning whereas 20.9% had poor

perception of online learning (Tables 2a and 2b).

Table 1: Comparison of the effectiveness of e-learning to classroom learning methods among the participants

	Onlir cohoi	ne rts	Class coho	sroom rts	Leven test	e's	<i>t</i> -test			Cohen's d	95% Confie Interv	dence al
Variable	М	SD	М	SD	F test	Sig.	t	df	Sig.	D	LL	UL
Scores	2.15	1.115	2.93	1.023	1.636	.204	3.332	84	.001	.720	.281	1.156

Table2a:Perceptionofparticipantstowards on-line learning

		Frequency	Percent
Valid	1.00	68	79.1
	2.00 Total	18 86	20.9 100.0

Table 2b

Mean	Approxim ate Mean	Freque ncy	Percent
I have experience 1.16 with attending on- line class in the past (before COVID-19)	1.00	72	83.7
I have the proper 1.47 equipment needed for an online class	1.00	46	53.5
I have a good 1.29 command of computer operation skills	1.00	61	70.9
I can have a good 1.40 interaction with my lecturer in an online class	1.00	52	60.5
I can have 1.50 interactions with my classmates in an online class	1.00	43	50.0
I can take online 1.72 classes regularly	2.00	24	27.9
Practical sessions 1.83 can be taken in an online class	2.00	15	17.4
My academic 1.26 performance will be affected by learning only through online classes	1.00	64	74.4

Perception of participants towards classroom learning

A scoring range of mean 1.00 to 1.50 represents 1.00 and indicates good perception, while a mean range of 1.51 to 2.00 represents 2.00 and shows poor perception, 81.4% of the participants have good perception towards classroom learning, whereas 18.6% have poor perception of classroom learning. (Tables 3a and 3b)

Table	3a:	Perception	of	participants
toward	s class	sroom learnin	g	

	Frequen	cy	Per	cent	
Valid 1.00	70		81.4	4	
2.00	16		18.0	5	
Total	86		100	.0	
Table 3b			Appro ximate	Freque	en
	l	Mean	Mean	cy	Percent
I prefer physical online class	class to	1.07	1.00	80	93.0
Physical class rec lot of equipment	luires a	1.84	2.00	14	16.3
I understand bette physical classes	er with	1.07	1.00	80	93.0
I enjoy the p interactions with lecturer in the class	physical n my sroom	1.09	1.00	78	90.7
Practical sessions done in physical cla	can be ass	1.12	1.00	76	88.4
I can only take p classes	ohysical	1.65	2.00	30	34.9
My academic perfo will be affected learning only physical classes	ormance ed by through	1.78	2.00	19	22.1

Perceived problems with on-line learning among participants

Figure 1 shows that the majority (86%) of the participants considered poor internet connection within the school environment as the main problem associated with the use of on-line learning modalities. This is followed jointly by lack of data subscription and poor electricity supply (84%). poor computer operating skills by lecturers; lack of internet enabled device were jointly the least perceived problem (54%).



Figure 1: Perceived problems with on-line learning

Perceived problems with classroom learning

Figure 2 below shows that the majority of the participants identified inaudible lecturers as the most common problem associated with the classroom learning modality, with insufficient seats in the classroom being the least identified problem.



Figure 2: Perceived problems with classroom learning

Distribution of e-learning platforms used by the participants.

Figure 3 below shows that Chat GPT (94.2%), You tube (89.5%), and Kaplan Academy (86%) were the three topmost accessory e-learning platforms use by the participants respectively, asides the normal class schedules. Osmosis on the other hand is the least patronized (39.5%).



Figure 3: Distribution of e-learning platforms used by the participants

DISCUSSION

The study's findings showed that students who partook in the classroom learning session scored significantly higher than participants in the online learning session from the assessment carried out after the lecture. This may therefore indicate that classroom learning sessions are more effective than online learning, especially in the delivery of medical and dental education. The findings from this study, are similar to the findings from a previous study, ¹⁸ which showed higher performance among classroom learners than online learners. However, the finding in this study differs from that from a study conducted among dental students of Vishnu Dental college, India by Kumar et al ¹⁹ which showed online learning to be more effective in terms of assessment performance. The difference in the results between the study and the current study may be because of the difference in sample size and method employed, wherein the latter study used a longitudinal study method and a higher sample size.

Comparing the perceptions of medical and dental students towards learning online and traditional classroom learning settings in terms of e-learning, revealed that the participants believed in their ability to operate computers effectively to partake in e-learning. This finding is like the previous study,²⁰ where the

study participants showed the same confidence in their operational skills with computers. This similarity may be because both studies used a similar study population of undergraduate students of universities where good use of computer is essential as well as being in a technological era, where every student strives to be computer literate. Similarly in another study ²¹ the participants also agreed to have experienced a form of online learning before the COVID-19 pandemic, because of comparable advances in use of technology among both study settings prior to COVID-19. However, despite the positive perception of the participants towards e-learning, the majority of the respondents believed that partaking in on-line classes regularly will affect their academic performances. This finding is in tandem with that seen in a previous study ²⁰ where there was a general belief among the participants that certain learning sessions need to be done physically, such as practical demonstration of procedures. especially among the dental students.

In comparison with perception towards physical classes, the participants believed they understand topic concepts better with learning in classroom, similar to that seen in another Nigerian study, ²¹ this similarity in findings may be because of the Nigerian educational setting modeled in such a way that students have little or no exposure to e-learning settings throughout the stages of elementary and secondary education. Findings from previous study ²² showed that participants believed that interactions and communication is better with physical classes than on-line classes, this may be because of the general belief that communication is better with physical meetings among colleagues and peers rather than through virtual means.²³ This may also be attributed to the peculiar nature of the medical and dental program, where face-to-face interactions is required for activities such as clinical clerkships and clinical rotations, as these activities are difficult to substitute with online classes. The overall perception towards physical classes was higher than that for online classes which is in tandem with the findings seen in the previous study. ²⁴ The somewhat negative perceptions towards the online classes may stem from distractions from the home environments, social media usage and feelings of isolation that can occur from learning only online.

With regards to problems associated with elearning, poor internet connection was the most identified problem by the respondents, this was corroborated by a previous study. ¹² However, this finding was in contrast to the findings in other studies, ^{24,25} where lack of commitment, feeling of isolation and poor lecture engagement by both lecturers and students were seen as the most common problems associated with the use of e-learning platforms. These results may be different because of the peculiarity of Nigeria being a developing nation with limited internet facilities, especially in the university system. In another study conducted among Nigerian medical students, ²⁶ and at Ireland ²⁷ the most common identified problems with online learning were the lack of face-to-face interaction and clinical clerkships. This differences in the finding may be because of the difference in sample population. The previous study involved students from all levels of medical school, while the present study was conducted among final-year medical and dental students.

The most commonly identified problem associated with learning in the classroom setting, according to the respondents in this study, was inaudible lecturers in the classroom. This finding was however different from those found in other similar studies, ²⁸⁻³⁰ where lack sufficient classroom seats, teaching of materials and availability of classrooms respectively were identified as the most common problem associated with learning solely in a classroom environment. These findings may appear different from that of this study because of the peculiarity of the university environment, as responses were provided based on the challenges respondents faced in their schools. Sample population difference may have had an impact on these findings, as only final-year students were recruited for this study, which may not be a true reflection of problems or challenges faced by other class levels in the study setting.

This study had several potential limitations which could have affected its outcomes. These included the sample population, sample size, parameters studied, and confounding variables. The sampled population was final-year medical and dental students of the University of Port Harcourt only; students of other universities may have different perceptions, challenges or experiences. The relatively small sample size may limit the generalizability of the findings to the broader population of medical and dental students at the University of Port-Harcourt. Several factors that could influence the effectiveness learning method, such as students' comprehension levels, social factors affecting concentration, neurodivergent (e.g., conditions autism. Attentiondeficit/hyperactivity disorder (ADHD), and other medical conditions (e.g., hearing or visual impairments), were not controlled in the study. Confounding variables, such as the inconvenient timing of participant sessions, the impromptu nature of the study, and technical issues such as low volume, delayed access to on-line platforms, and static lecture slides, may have influenced the study outcomes.

CONCLUSION AND RECOMMENDATION

In this study, on-site learning was more effective than an on-line learning. The respondents also had a better perception of learning in the classroom compared to learning on-line. The most common problem associated with the use of online learning was the poor internet connection in the university, whereas the most common problem associated with the classroom learning was inaudible lecturers.

We recommend therefore that future studies using a larger sample size and a larger population of the entire medical and dental students, and possibly an interschool comparative study can be done to get a broader view on perceptions and challenges associated with e-learning utilization.

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Conflicts of interest

There are no conflicts of interest

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