

Experience and Perceptions of Nigerian Undergraduate Dental Students to Virtual Learning during the COVID-19 Pandemic

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ABSTRACT

Background: COVID-19 outbreak impacted negatively on teaching globally with traditional face-to-face teaching mostly affected. **Aim:** This study evaluated the experiences and perceptions of Nigerian undergraduate dental students to virtual learning (VL) including perceived institutional challenges during the COVID-19 pandemic. **Subjects and Methods:** This was a cross-sectional survey of 346 dental students from all 13 Nigerian dental schools. Data collection was done using an open/close-ended online questionnaire. **Results:** The level of awareness and understanding of dental students to virtual learning was high (93.6%) and good (84.7%), respectively. About two-thirds (62.4%) of the students had a virtual learning classroom experience before the COVID-19 pandemic. Clinical students spent more time on the Internet and reported more confidence in the use of VL platforms than their pre-clinical counterparts during the lockdown ($p < 0.05$). More male students than their female counterparts felt that VL had less quality than traditional classroom teaching ($p < 0.05$). Similarly, male students showed more confidence in the use of VL online tools ($p < 0.05$). Institutional and self-perceived preparedness to VL was ranked low and moderate by the students, respectively. The high cost of data subscriptions, unstable Internet connectivity, and lack of other institutional facilities were perceived as challenges to effective VL by students. None of the identified variables predict effective VL. **Conclusions:** Experiences of dental students and their preparedness to VL were moderate. The high cost of Internet subscriptions, unstable Internet connectivity, and low institutional facilities were major challenges to students' VL. None of the socio-demographic factors could successfully predict effective VL.

KEYWORDS: Dental students, Experience and perceptions, Nigeria, Virtual learning

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INTRODUCTION

The coronavirus disease (COVID-19) outbreak that was first reported in Wuhan, China, in December 2019 impacted negatively on the teaching and social services across many tertiary institutions globally.^[1,2]

The traditional face-to-face teaching method that is often delivered in the classroom setting was disrupted across many countries during the lockdown. This setback revealed other alternative teaching models which have become more attractive and also gained significant momentum during the period.^[3] The first reported case of the COVID-19 disease in Nigeria on February 27, 2020, motivated many training institutions including

dental faculties to take to various teaching platforms to continue learning despite the lockdown.^[4]

One of such teaching methods is virtual learning conducted through online platforms which does not necessarily mean a change in the curriculum but signifies an enhanced medium of learning through the Internet.^[3-5] In the virtual learning (e-learning) model, teachers and learners are not physically together in terms of time or

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place but are connected through a system of networks by a computer or an electronic device.

According to Al-Riyami *et al.*,^[6] innovative methods such as virtual learning environments of delivering information have continued to attract growing interest in schools, colleges, and universities. Gungor^[3] and Govindasamy^[7] stated that both synchronous (teaching and learning occurring at the same time) and asynchronous (teaching and learning occurring at different times) online education including instructions delivered through electronic media such as the Internet, intranets, podcasts, mobile applications, blogs, video conferencing, extranets, and hypertext/hypermedia documents add to virtual learning experiences. Although there is an interesting debate on the exact definition of electronic learning (e-learning), it is generally accepted that learning content can be offered in various formats and electronically delivered through the Internet, personal computer, personal digital assistant (PDA), or CD-ROM.^[8]

A questionnaire-based study conducted at the University of Birmingham School of Dentistry in the United Kingdom identified the opinions and expectations of online program as a supplement to traditional teaching.^[9] The authors concluded that online courseware or training is a valuable and additional resource for students. Potomkovia *et al.*,^[10] also reported that online learning is an essential tool in evidence-based medicine because it is continually being developed and updated. Despite its advantages which include convenience, flexibility and cost-effective choices, learning at one's pace, quick and easy access to materials, the primary drawbacks to virtual learning are technical issues and student isolation.^[3] Some students miss the interactions in a regular classroom, whereas self-directed learners are more successful in virtual learning.^[11] These findings may be the reason for the integration of virtual education with classroom problem-solving sessions and other activities.^[12-14]

Virtual learning has continued to prove as a major mode of learning especially during the COVID-19 era. In Nigeria, virtual learning methods have never been evaluated as a regular form of learning or an alternative to traditional classroom learning in our dental schools, despite the high level of Internet usage among undergraduate students.^[15]

This view resonates with the observation of Dray *et al.*^[16] who stated that learners' preparedness to a virtual learning environment was rarely evaluated. In order not to stifle or truncate continuing education during the pandemic, VL became popular in many tertiary institutions.^[17]

To sustain an uninterrupted dental academic program in Nigerian dental schools during the COVID-19 pandemic period and even beyond, there is need for harnessing the

advantages of these other teaching methods including virtual learning or at least the embrace of a hybrid format.

This study, therefore, aimed to evaluate the experiences and perceptions of Nigerian undergraduate dental students to virtual learning (VL) including perceived institutional challenges during the COVID-19 pandemic. It is also presumed that the outcome of the study will advance online dental educational training in Nigeria.

MATERIALS AND METHODS

Ethical approval for the study was obtained from the Institutional Review Board of the Institute of Public Health, Obafemi Awolowo University Ile-Ife with protocol number IPHOAU/12/1572.

This was non-probability cross-sectional survey of 346 dental students carried out across all the 13 dental schools in Nigeria. The Taro Yamane's formula^[18] was used in calculating sample size.

$$n = \frac{N}{1 + N * (e)^2}$$

n = correlated sample size

N = population size (total number of dental students in Nigeria from year 1 to year 6)

$$N = 30 \times 6 \times 13 = 2340$$

e = margin of error = 0.05

$$n = \frac{2340}{1 + 2340 * (0.05)^2} \quad N = 342.$$

A total number of 346 students were recruited for the study.

Students were recruited through their students' bodies and associations in the universities. Class representatives were identified and selected from each faculty for the purpose of generating class list. Informed consent was obtained directly from all participants, and they were given the freedom to decline or withdraw from the study at any point in time. Every effort was made to protect participants' privacy by identifying them only by their initials. Confidentiality was observed in strict compliance with the approved study protocol. All data were transferred to a password-encrypted Google drive storage which was only accessible by one of the investigators. The Google form responses were linked to individual email addresses. Where two responses from the same email address were gotten, the second response from that same address was discarded to avoid multiple responses by respondents. No compensation was paid to the students.

The study instrument was a questionnaire (Google form) which was validated by a team of faculty experts for

content validity using content validity ratio for individual questions [CVR = (Ne- N/2)/N/2] and content validity index (CVI) for the average of the 28 questions, where Ne is the number of panelists indicating “essentials” and N is the total number of panelists. The reliability test (internal consistency) was determined using Cronbach’s alpha test (value of 0.86).

The questionnaire was made up of open and close-ended questions and comprised different sections. The first section (the biodata section) included the name of the university, the participant, their current level, age, and gender. The second section was used to evaluate participants’ general knowledge of virtual learning, while section three was used to assess undergraduate dental students on their general perceptions of VL, including the advantages and shortcomings of virtual learning. Section four was used to evaluate the undergraduate students’ self-preparedness for the virtual learning environment during the pandemic. Finally, section five assessed perceived challenges likely to be faced by the

various institutions during the setup of a virtual learning environment. Sections 3–5 of the questionnaire were ranked on a Likert scale 5 to 1 indicating “strongly agree” to “strongly disagree,” respectively.

Statistical analysis

Independent variables such as gender, school, age, and class levels were analyzed against dependent variables of dental students’ perceptions to virtual learning.

Simple descriptive statistics (means, standard deviation, and frequency) and inferential statistics Student’s t-tests were carried out to determine associations between the dependent and independent variables. Multiple regression was also carried out to determine the factors for effective virtual learning according to socio-demographic factors. SPSS software (version 23; IBM) was used for data analysis. Significance was set at *P* < 0.05.

RESULTS

The participants were drawn from the six levels of undergraduate dental classes with majority (21.7%)

Table 1: Distribution of dental students according to socio-demographic characteristics

Variable	Male	Female	Frequency	Percentage
Age group				
≤25	166	139	305	88.2
>25	28	13	41	11.8
Current year of study				
100 levels	34	41	75	21.7
200 levels	26	27	53	15.3
300 levels	48	20	68	19.7
400 levels	33	24	57	16.5
500 levels	17	29	46	13.3
600 levels	36	11	47	13.6
Institution				
University of Lagos	10	10	20	5.8
University of Ibadan	21	13	34	9.8
Obafemi Awolowo University	36	13	49	14.2
University of Benin	13	11	24	6.9
University of Nigeria	10	16	26	7.5
University of Port Harcourt	8	11	19	5.5
University of Maiduguri	14	3	17	4.9
Lagos State University	17	7	24	6.9
Bayero University	12	19	31	9.0
University of Jos	9	6	15	4.3
University of Calabar	16	22	38	11.0
University of Medical Sciences, Ondo	19	12	31	9.0
Afe Babalola University	9	9	18	5.2
Generational age of dental faculties				
First generation. (>six decades)	67	60	127	36.7
Second generation. (≤four decades)	61	56	117	33.8
Third generation (≤two decades)	66	36	102	29.5
Total	194	152	346	100.0

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from 100 levels. While there were 194 (56.1%) males, 305 (88.2%) were 25 years of age and below. One hundred and twenty-seven (36.7%) of the students were from the first-generation universities [Table 1].

Table 2: Dental students' awareness and participation in virtual learning before COVID-19

Variable	Frequency	Percentage
Knowledge of the term "Virtual learning"		
Yes	324	93.6
No	22	6.4
Understanding of virtual learning teaching method		
Adequate	293	84.7
Not Adequate	53	15.3
Participation in a virtual classroom experience		
Yes	216	62.4
No	130	37.6
Most convenient communications device in virtual learning		
Mobile phone	57	16.5
Desktop computer	27	7.8
Laptop and tablets	262	75.7
Knowledge of the possibility of virtual learning without the Internet		
Yes	19	5.5
No	327	94.5
Total	346	100.0

The level of awareness of virtual learning was high among Nigerian undergraduate dental students (93.6%); they also showed an adequate understanding of correct synonym of the term "virtual learning" (84.7%). Furthermore, about two-thirds (62.4%) of the students had a previous virtual learning classroom experience. Generally, the most suitable devices available for virtual learning were laptops and tablets as indicated by about three-quarters (75.7%) of students as seen in Table 2.

Table 3 shows the level of students' perception of virtual learning during the COVID-19 period. Generally, the perception of virtual learning to fully replace classroom learning was ranked moderate on a Likert's scale of 1–5 across all participants. There was a significant difference between the amount of time spent on the Internet during this COVID-19 pandemic, with clinical students spending more time than their pre-clinical counterparts ($p < 0.05$).

Using Student's *t*-test, clinical students showed more confidence in the knowledge and skills needed to manage the software for virtual learning than pre-clinical students ($p < 0.05$). More male students than their female counterparts believed that virtual learning was lower in quality than traditional classroom teaching ($p < 0.05$).

Table 4 shows undergraduate dental students' perception of virtual learning during the COVID-19 according to educational level and gender.

Table 3: Dental students' perception of virtual learning during COVID-19, according to educational level and gender

Variables	Pre-clinical mean±SD	Clinical mean±SD	<i>P</i>	Male mean±SD	Female mean±SD	<i>P</i>
Promotion of virtual learning during the lockdown	3.94±0.92	4.11±1.02	0.131	3.97±0.98	4.07±0.93	0.347
Increased time spent on the Internet due to the COVID-19 pandemic	4.43±0.78	4.61±0.57	0.018*	4.48±0.66	4.55±0.74	0.334
Adequate knowledge and skill of software management in virtual learning	3.91±0.87	4.13±0.84	0.022*	4.08±0.82	3.91±0.91	0.061
Confident in using Google or Yahoo to search for information for virtual learning	4.28±0.76	4.29±0.79	0.894	4.28±0.72	3.59±1.04	0.957
Confident in asking questions during online discussions	3.63±0.99	3.80±1.04	0.127	3.80±0.97	3.80±1.04	0.051
Easy access to the Internet for online study	4.09±0.90	3.99±0.99	0.334	4.10±0.90	3.98±0.99	0.228
Cost of data subscription for online meetings	4.56±0.69	4.46±0.83	0.217	4.45±0.82	4.60±0.65	0.076
Virtual learning is of a lower quality than classroom learning	3.55±1.16	3.53±1.21	0.922	3.72±1.10	3.32±1.24	0.002*
Students' academic performance is promoted by virtual learning	2.75±0.97	2.63±0.99	0.248	2.74±1.01	2.64±0.95	0.386
Preparedness in changing from traditional classroom to virtual learning	3.01±1.12	3.09±1.23	0.546	3.02±1.17	3.07±1.16	0.682

Student's *t*-test; $P > 0.05$; * $P < 0.05$

Table 4: Dental students perception of virtual learning during COVID-19 according to educational level and gender

Variables	Pre-clinical mean±SD	Clinical mean±SD	<i>P</i>	Male mean±SD	Female mean±SD	<i>P</i>
Getting things done on time in a virtual learning environment	3.52±1.03	3.49±1.06	0.800	3.50±1.01	3.51±1.08	0.953
Ability to use Zoom/email to communicate effectively in a virtual classroom	3.72±0.34	3.83±0.92	0.259	3.87±0.84	3.64±1.02	0.020*
Willingness to dedicate time for virtual learning	3.94±0.77	3.95±0.84	0.867	3.98±0.73	3.90±0.88	0.368
Openness/motivation to learn in a virtual classroom	3.96±0.83	4.07±0.80	0.221	4.05±0.74	3.97±0.92	0.373
Confidence in using Microsoft Office tools for virtual learning	3.69±1.06	4.03±0.82	0.001*	3.89±0.93	3.76±1.03	0.184
Not distracted by other online activities while learning online	2.77±1.21	2.67±1.23	0.488	2.81±1.19	2.62±1.25	0.149

Student *t*-test; $P > 0.05$; * $P < 0.05$

Table 5: Dental students’ perception of institutions’ to virtual learning according to educational level and gender

Perception of institutions’ preparedness during COVID-19	Pre-clinical mean±SD	Clinical mean±SD	P	Male mean±SD	Female mean±SD	P
Online learning is encouraged across all departments in my institution	3.12±1.13	3.49±1.06	0.054	2.95±1.09	3.11±1.17	0.215
Application of needed institutional changes for successful virtual learning	3.11±1.17	3.00±1.04	0.383	3.10±1.10	3.02±1.14	0.490
Development of institutional virtual learning curriculum different from classroom learning	1.80±0.40	1.87±0.33	0.075	1.80±0.39	1.86±0.34	0.113
The introduction of virtual learning may increase students enrolment	3.23±0.85	3.30±0.86	0.447	3.31±0.83	3.19±0.88	0.181
Virtual learning has proved to be an effective way of learning	3.24±0.87	3.32±0.88	0.429	3.31±0.86	3.24±0.90	0.445
Adoption of institution virtual learning programs will increase students satisfaction	3.00±0.97	3.05±0.93	0.607	3.07±0.94	2.97±0.97	0.334

Student’s *t*-test; *P*>0.05; **P*<0.05

Table 6: Students’ self-perceived challenges and institutional factors that may affect virtual learning during COVID-19 pandemic

Self-perceived challenges	Frequency	Percentage
Inability to focus due to the absence of a teacher’s physical presence	45	13.0
Lack of stable Internet connection	114	32.9
Cost of Internet connection	133	38.4
Distraction from surrounding outside virtual learning environment	33	9.5
Others	21	6.2
Institutional challenges	Frequency	Percentage
Lack of required infrastructure to set up virtual learning	170	49.1
Lack of skilled teachers who can disseminate in a virtual class	35	10.2
Lack of proper curriculum for virtual learning	46	13.3
The unwillingness of school authority to adopt the virtual learning system	71	20.5
Others	24	6.9
Total	346	100.0

The confidence level in the use of Microsoft Office programs [MS Word, MS Excel, and MS PowerPoint] to assist students’ participation in a virtual classroom was higher among clinical students than pre-clinical students, and this was statistically significant (*p* < 0.05). Similarly, male students were more confident in using online tools, including Zoom and email to effectively communicate with others in a virtual classroom than female students (*p* < 0.05). Generally, the students’ self-perception to virtual learning was ranked moderately.

The students’ perception of willingness to engage in virtual learning program by their institutions is given in Table 5. According to the Likert’s scale, students’ ranking varied from low to moderate institutional preparedness for virtual learning. The least ranked Likert’s scale of 1.80 ± 0.39 and 1.80 ± 0.40 was reported across gender and educational level, respectively.

Table 6 shows the students’ perceived individual and institutional factors that may affect virtual learning during the COVID-19 pandemic. Undergraduate dental students perceived virtual learning as generally challenging because of the high cost of data subscription packages by Internet service providers, closely followed by unstable Internet connections. They also believed that their universities lack the basic infrastructures to effectively sustain a virtual learning classroom.

Table 7 shows the multiple regression analysis of the effect of socio-demographics (age, gender, educational level of students, and institution generational age) on virtual learning. None of the socio-demographic factors could serve as a predictor for effective virtual learning.

DISCUSSION

This virtual learning study was the first of its kind among Nigerian dental students, which was designed to elicit useful information to advance its possible applications in our dental educational training program. In this study, socio-demographics of respondents indicate that a majority of the undergraduate dental students were 25 years of age or below (88.2%). Although both male and female populations were well represented in this study with the male population slightly predominant, which shows that more males are likely to enroll for professional dental education.^[19]

The majority of the students were also in their first year at the university, and they equally make up the largest population of dental students across Nigeria. This number reduces as the students advance along the classes due to various academic reasons ranging from withdrawal and having to repeat a class. The majority of the students were also from first-generation universities which may be due to the increased national admission quota for this category of institutions.

Generally, the students showed adequate understanding of virtual learning and were equally aware of its availability, even though they had limited experience

Table 7: Multiple regression analysis of effective virtual learning according to socio-demographic factors

Variables	Standardized Coefficient B	T	Sig	F	P	95% CI for B	
						Lower bound	Upper bound
Constant		12.32	0.000	0.561	0.691		
Age group	-0.005	-0.030	0.976			-0.312	0.302
Gender	-0.058	-0.594	0.553			-0.250	0.134
Students' educational level	0.048	0.461	0.645			-0.156	0.252
Institutional generational age	-0.040	-1.028	0.305			-0.118	0.037

$F=0.561$, $P=0.691$, $R^2=0.007$, Adjusted $R^2=0.007$

using it as a form of learning method. This is because most of their online learning experiences were outside the university setting; mainly on social webinars or seminars and the majority prefer using laptops and tablets as means of communication in virtual learning. There are no studies till now available which compared the perceptions of learning methods including virtual learning among Nigerian undergraduate dental students. However, a related Saudi study^[20] found that dental students demonstrated positive interest in online learning but would prefer a combination of traditional and digital methods. Similarly, Ren *et al.*^[21] reported that about 70% of a Chinese population leaned toward the use of digital technology in learning.

Students' preference for virtual learning as a replacement for classroom teaching was at an average level. This could be due to students' little exposure to virtual learning and their preference for regular interaction associated with the traditional classroom setting as stated by Grimes.^[11] It could also be attributed to the clinical nature of the dental profession which requires a lot of hands-on and clinical practice leading to academic and clinical competence.

As a result of the COVID-19 pandemic, there was an increase in the time spent on the Internet by Nigerian dental students due to restriction in movement and the need to remain constantly informed.

In this study, the preference for virtual learning was influenced by the level of training of the dental students. Clinical students were more favorably disposed to virtual learning than their pre-clinical colleagues. As expected, the clinical students showed more confidence in the knowledge and skills needed to manage software facilities for virtual learning than their pre-clinical counterparts. This may be related to their having more profound knowledge and experience in dental education and is more suitably adapted to change in the method of delivery and reception of lectures.

This is consistent with the report by Gungor *et al.*^[3] who observed that younger students have difficulty in following and understanding online lessons because

of inadequate background knowledge in the field. It is however different from Sirtongthaworn *et al.*^[22] and Teo *et al.*^[23] who reported that younger students tend to adapt more to virtual learning.

The male students perceived online learning as lower in quality and may not likely improve students' performance in contrast to the perception of their female counterparts who appeared to be more interested in adopting this mode of learning and were more prepared to resume online learning activities within the pandemic period.

Apart from the theoretical training, dental education requires didactic clinical practice with the acquisition of psychomotor skills which could not be easily acquired through virtual learning. Perhaps this could be attributed to the male students' perception that virtual learning will not increase students' performance.

As stated by Cook,^[24] virtual learning provides an intuitive character in learners, and this was highlighted in the study as students' confidence in asking questions in an online class was above average. This was further supported by the physical absence of teachers and fellow students, making students able to express themselves confidently.

In this study, students' preparedness to commence virtual learning was reasonably above average on the Likert's scale 1–5, an indication that they were interested in continued learning and participation in academic activities, even though it involved a whole different learning experience from which they were familiar. This is consistent with the study carried out at the Hamadan University of Medical Sciences, Iran, that showed an average level of preparedness for virtual learning among students.^[25] The Iranian study also showed a significant difference between the level of preparedness of students and their teachers at the university.^[25]

Virtual learning cannot be effective without paying due attention to its users' preparedness and the right attitude to the technology.^[26] Male participants showed more confidence in using these virtual learning tools, which is consistent with the general perception that the male

gender participates more in information technology than the females,^[27] especially in our local community here in Nigeria.

Generally, there was a low students' perception of institutions' ability to embark on virtual learning program in all the 13 dental schools, and this was attributed to the low resource-driven nature of many Nigerian universities as well as lack of specialized curricula to cater for this learning method. On the part of our students, the high cost of Internet subscription packages and the unstable Internet connectivity across the country proved to be a challenge to their preparedness for virtual learning; hence, their negative thoughts about virtual learning. This is in consonant with the report by Al-Riyami *et al.*,^[6] who found that students were adversely affected by Internet bandwidth for virtual learning. Swarts and Wachira^[28] reported that in Tanzania, the increased utilization of mobile devices, improved Information and Communication Technologies (ICTs), and decreased costs of Internet access have great benefits to learning and delivery of education through social networking sites and mobile network devices in the country's resource-limited higher institutions of learning.

Kluge and Riley^[29] also mentioned that reliable Internet service is needed to access the virtual learning environment. On the contrary, McDonald^[30] stated that virtual learning methods have been known to reduce the cost of learning and provide an efficient and standardized way to deliver content.

With the low institutional uptake of virtual learning program in Nigerian dental faculties during the COVID-19 period, dental students regard the institutional adoption into their curriculum would be an effective method of learning and would increase learning satisfaction.

One limitation of this study is that it is difficult to measure changes in the students' perception because data were collected at a single point in time. The preponderance of 100-level students in the study population due to non-probability nature of the sampling technique could have influenced the outcome. Similarly, separate evaluation of pre-clinical and clinical dental students would have given a clearer view of students' learning experience and perception at different educational levels.

CONCLUSIONS

The general experience and the preparedness of Nigerian undergraduate dental students to virtual learning during the COVID-19 pandemic were moderate. However, there

was a low perception of institutions' ability to embark on virtual learning.

The high cost of Internet subscription packages and unstable Internet connectivity were perceived as major challenges to virtual learning among the students.

None of the identified variables could serve as a successful predictor in virtual learning.

Declaration of subjects' consent data availability statement

The authors certify that they have obtained all appropriate students consent forms and the data that support the findings of this study are available on request from the corresponding author upon reasonable request.

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Conflicts of interest

There are no conflicts of interest.

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