Perception of Nigerian Dental Students on the Effectiveness of Teaching Platforms Used for Orthodontics Lectures During the Covid-19 Pandemic

Etim SS[1], Arigbede AO[2], Awotua-Efebo EB[3]

Correspondence: *Etim SS*
Email: *udypride@yahoo.ca*

[1]Department of Orthodontics & Paediatric Dentistry, Faculty of Dentistry, College of Health Sciences, University of Port Harcourt, Port Harcourt. Rivers State

[2]Department of Conservative Dentistry and Prosthodontics, Faculty of Dentistry, College of Health Sciences, University of Port Harcourt, Port Harcourt. Rivers State

[3]Department of Curriculum Studies and Educational technology, Faculty of Education, University of Port Harcourt, Port Harcourt, Rivers State.

Key words: Orthodontics, COVID-19 pandemic, Effectiveness, Perception.

ABSTRACT

Objective: This research was to assess how Nigerian dental students perceived the effectiveness of the teaching platforms adopted by Orthodontic lecturers during the COVID-19 pandemic.

Methods: Data obtained were qualitative and they were analysed using a descriptive survey which involved 10 accredited Nigerian dental schools with clinical students during COVID-19 pandemic across the geo-political zones of Nigeria was carried out. One hundred and forty-five clinical students who had been taught Orthodontics before COVID-19 pandemic were surveyed using a three-Section Google forms semi-structured questionnaire, administered through WhatsApp and emails. Section A comprised socio-demographic variables, B centred on information on teaching platforms adopted for Orthodontics before and during COVID-19 pandemic), and C was about the perceived effectiveness of adopted teaching platform during COVID-19 pandemic. Data obtained were quantitative, analyzed using SPSS version 26. Hypothesis was tested using independent samples t-test at 0.05 significant level.

Results: The participants included 83(57.2%) males and 62 (42.8%) females, with mean age of 25.738 +/- 2.94 years. One hundred and forty two (97.2%) affirmed to having more face-to-face teaching before COVID-19 pandemic. The most popular online teaching platform adopted during COVID-19 pandemic was WhatsApp, 58 (40%). More than half of the participants, 99 (68.3%), had a positive perception towards the adopted teaching platforms. Most of them, 120 (82.7%), perceived the adopted platforms were effective in providing quality Orthodontic lectures, clinical skills and soft skills. More males 83 (57.2%) than females 62 (42.8%), perceived the platforms to be more effective with no statistical difference, while most, 120 (82.7%), accepted the adopted teaching platforms for orthodontics during COVID-19 pandemic.

Conclusion: Orthodontic learning occurred largely on-line during COVID-19 pandemic and the perception of the students was positive towards the effectiveness of the adopted teaching platform as most participants accepted the platforms.

INTRODUCTION

Dental students undergo Orthodontic training in their clinical years of study. Meanwhile, Orthodontics is the branch of Dentistry that is concerned with growth of the face, development of the dentition and the prevention and correction of occlusal anomalies[1]. Orthodontic treatment and education require close interaction with

patients, students, other dental specialists, and staff from maxillo-facial radiology and dental laboratory units. In addition, contact with biomaterials are also not uncommon during Orthodontic rehabilitation.

The emergence of coronavirus disease in 2019 (COVID-19) caused by severe acute respiratory syndrome corona virus 2 (SARS –COV-2), first named as the 2019-novel coronavirus, significantly caused a new world order despite its short history. The disease characteristically spreads rapidly causing high mortality, unplanned major health, and economic and social crises[2]. In the dental specialties, the recognized three main routes for the transmission of SARS-Cov-2 are as follows: inhalation of the virus through cough droplets, oral, nasal or eye membranes and direct contact[3]. Orthodontic services, thus, involve close contact with patients during assessment, investigations, aerosol generating procedures, and treatment of different forms of malocclusion and other mandibulo-maxillary defects through manipulations of brackets, elastic modules, buccal tubes, molar bands, and hand instruments in the patients' oral cavities. Exchange of impressions, casts, x-rays, and appliances among clinicians, students, and laboratory staff occur regularly during Orthodontic services and training, and this further exposes the different parties (patients, clinicians, support staff and students) to the dreaded infection.

However, face-to-face lecture delivery was stopped during the COVID-19 pandemic, and to meet up with the educational curriculum for the dental students, teachers decided to adopt technological means of lecture delivery. For dental education to continue, e-learning was the available option. The new teaching platforms included methods like Zoom, Google Classroom, Google meet, WhatsApp, Skype, and several Learning Management Systems. Now, though the pandemic has come and gone, it is necessary to find out what impact the new learning platforms adopted for lecture delivery during the COVID-19 pandemic had on the students in regard to their training in Orthodontics. The perception of the students about the teaching platforms adopted for teaching them Orthodontics during the COVID-19 pandemic will disclose whether those platforms were effective in the learning of Orthodontics or not .

Perception refers to a set of processes used to make sense of the stimuli that one encounters every second from every activity around us. While learning, we see, hear, touch, and feel things. There are also individuals' perceptual experiences as we all come in contact with the environment and interact with objects and other people, thereby forming recollections that can be later reflected on or imagined[4]. Zigman refers to this perceptual experience as the medium of life[4]. The null hypothesis for the study was that there was no significant difference between dental students with positive perception and those with negative perception on the effectiveness of the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic. The aim of this study, therefore, was to assess how students perceived the effectiveness of the teaching platforms adopted for learning and achieving the goal of Orthodontics as a course during the COVID-19 pandemic.

METHODS

This was a cross-sectional descriptive survey conducted among clinical dental students in Nigeria. Ten accredited dental schools in Nigeria having clinical students during the pandemic were surveyed. These dental schools are spread across all geo-political zones of Nigeria, except the North Central that did not have any Dental School. The breakdown of the spread is as follows: 3 dental schools in the South-South zone of Nigeria (University of Port Harcourt, University of Benin, and University of Calabar Dental Schools), 4 in the South West (University of Ibadan, University of Lagos, Obafemi Awolowo University and Lagos State University), one (1) in the South East (University of Nigeria), one (1) in the North West (Bayero University, Kano), and one (1) in the North East (University of Maiduguri).

All clinical dental students in the Nigerian dental schools were involved in the study as Orthodontics can only be taught at the clinical stage of dental training. The total number of clinical students taught Orthodontics during this period of the study was 197. New dental schools whose students had not entered the clinical phase at the time of the pandemic were excluded from the study. Students who were unwilling

to participate in the study and those who failed to submit the questionnaire after five reminders were also excluded. Data was collected using a self-administered, structured questionnaire. The information obtained from the participating students from the various dental schools that had students up to 500 and 600 levels were quantitative in nature.

The questionnaire used in this survey had 3 sections. Section A was designed to elicit details of the participants on socio-demographic variables (age and gender of the participants). Section B had 18 questions which sought to elicit information on the platforms that were adopted before and during COVID-19 pandemic in the teaching and learning of Orthodontics, as well as the perception of the dental students towards the adopted platforms that were used in teaching Orthodontics during COVID-19 pandemic using a 4-point Likert scale. Section C had 8 questions which sought to elicit information on the perceived effectiveness of the online lectures received in Orthodontics during COVID-19 pandemic using a 4-point Likert scale. The questionnaire was adapted from that used in a previous publication by Cheng et al[5] and modified to suit the environment where this survey was conducted and pretested among ten 600 level clinical dental students of University of Port Harcourt who were subsequently excluded from the study.

To calculate reliability of the study instrument, the same questionnaire was administered to the same set of students after two weeks using cronbach alpha reliability test. The acceptable coefficient score of 0.7 was obtained. The validated questionnaire was then administered to all the clinical dental students in Nigeria who were taught Orthodontics before and during the COVID-19 pandemic as a Google form through their WhatsApp and email addresses. In each of the Dental schools, a contact person – an Orthodontics lecturer, was appointed to assist in reaching out to the targeted participants. Completed questionnaires were sent directly to the researcher's mailbox for analysis.

A reminder was sent to those who failed to submit the completed questionnaire three days after sending the Goggle form through WhatsApp and email addresses. Those who did not respond after the first reminder were sent another reminder a week later. This was followed by three consecutive daily reminders to those who did not return the completed questionnaire and no more reminders thereafter. Respondents who failed to submit their properly filled questionnaire after the 5th reminder were excluded from the study. Thus, the completed questionnaires that were turned in, which were one hundred and forty-five in number during the period, were included in the study.

Data Analyses: IBM SPSS version 25 statistical software was used for data analyses in this study. Information obtained was analyzed using descriptive statistics: number count, simple percentage, mean and standard deviation. Null hypothesis was tested using inferential statistics; independent samples t-test at 0.05 significant level.

Ethical clearance was obtained from the Ethics and Research Committee of the University of Port Harcourt before proceeding with the study. The study was explained to the respondents in the questionnaire, and informed consent was obtained from only those who indicated to be involved in the study by ticking a consent column which was a required field.

RESULTS

A total of one hundred and forty-five participants took part in the study. Eighty three (57.2%) were males and 62 (42.8%) were females, with a mean age of 25.738 +/- 2.94 years. Over half, 92 (63.4%), of the participants belonged to the 23 to 27 years age group, followed by 42 (29%) who were in the 28 to 32 years age group.

Table 1: Socio demographic data (n=145)

Variable	n	%
Gender		
Female	62	42.8
Male	83	57.2
Age		
<18 - 22yrs	4	2.8
23 - 27yrs	92	63.4
28 - 32yrs	42	29.0
>32yrs	7	4.8

In the delivery of Orthodontics to the students before the COVID-19 pandemic, various teaching platforms were adopted in the Nigerian Dental Schools. The result

shows that the teaching and learning platforms adopted were basically face-to-face, though online and hybrid learning platforms were also used. Specifically, before the COVID-19 pandemic, one hundred and forty-two (142) dental students representing ninety-eight percent (98%) of the participants said face- to-face teaching platforms were adopted in learning Orthodontics before COVID-19 pandemic, while three participants representing two percent (2%) opined that face-to-face learning platforms were not adopted. One hundred and seventeen (117) dental students representing eighty-one percent (81%) of the participants responded that online platforms were not adopted before COVID-19 pandemic in learning Orthodontics as one hundred and sixteen (116) representing eighty percent (80%) of the participants indicated that hybrid platforms were not adopted before COVID-19 pandemic in learning Orthodontics in their schools. Only twenty-nine participants representing eighteen percent (20%) opined that hybrid learning platforms were adopted as shown on table 2.

Table 2: Participants and the teaching platforms used in teaching Orthodontics before the COVID-19 pandemic in Nigerian dental schools

Teaching Platforms	Adopted (%)	Not Adopted (%)
Face -to- Face	142 (98)	3 (2)
Online	28 (19)	117 (81)
Hybrid	29 (20)	116 (80)

For the teaching platforms adopted in teaching and learning of Orthodontics during the COVID-19 pandemic in the Nigerian dental schools, table 3 shows that these platforms were basically: Google Classroom, WhatsApp, Zoom, Google Meet, and physical learning (face-to-face). Precisely during the COVID-19 pandemic, less than half, 63 (43.4%), of the participants said they used WhatsApp to learn Orthodontics. This was followed by those who signified that they used Zoom, 32 (22.0%), and then those signifying they used none of the online methods, 28 (19.3%). Those who signified to using Google Classroom were eight (5.5%). Six (4.1%) of the participants signified that they had Orthodontics lecture via Google meet and physical lectures.

Table 3: Participants and the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic in Nigerian dental schools

Teaching Platforms Adopted	n	%
Google Classroom (Online Platform)	8	5.5
WhatsApp	63	43.4
Zoom	32	22.0
Google Meet	6	4.1
Other Online platform	2	1.4
Physical lectures	6	4.1
None	28	19.3

Concerning the perception of dental students towards the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic in Nigerian dental schools, the analyzed data provides information on the mean and standard deviation (SD) of the responses obtained from each participants using a four-point Likert scale. The scores of each person who ticked "agree" (3) and "strongly agree" (4) were added and the average was grouped as positive. The same thing was done for those who ticked "disagree" (1) and "strongly disagree" (2) and the average was grouped as negative.

Table 4 shows that 99 dental students with a mean score of 21.66 and a SD of 3.13 have positive perception towards the teaching platforms adopted in teaching Orthodontics

during the COVID-19 pandemic in Nigerian dental schools. On the other hand, the dental students with negative perception have a mean score of 14.15, with a standard deviation of 3.50. There is a difference in the two mean scores with a higher mean score being in favour of dental students with positive perception, showing that most of the students had a positive perception towards the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic in Nigerian dental schools. Independent samples t-test analysis showed a significant difference between students with positive and negative perceptions towards the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic, with significance value 0.000. The null hypothesis was therefore rejected.

Table 4: Dental students' perception towards the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic

	N		SD	Df	T	Sig.	P	Decision
Positive	99	21.66	3.13	143	12.93	.000	0.05	Reject Ho_1 P<0.05
Negative	46	14.15	3.50					

Regarding whether the teaching platforms adopted provided quality Orthodontics lectures during COVID-19 pandemic, table 5 provides information that 136 dental students with a mean score of 3.23, SD 0.635, have a perception that the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic in Nigerian dental schools were effective in providing quality lectures. On the other hand, the dental students with perception that the adopted teaching platforms were ineffective in providing quality lectures during the COVID-19 pandemic have a mean score of 2.11, SD 0.333. There was a difference in the mean scores, with a higher mean score being for dental students with perception that the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic in Nigerian dental schools was effective in providing quality lecture. In the test for the hypothesis, independent samples t-test analysis showed a significance level of 0.000 which means null hypothesis was rejected, since the P-value is less than 0.05.

Table 5: Dental students' perception of the effectiveness of the teaching platforms adopted in providing quality Orthodontics lectures during the COVID-19 pandemic

Perception	N		SD	Df	T	Sig.	P	Decision
Effective	136	3.23	.635	143	5.249	.000	0.05	Reject Ho_1 P<0.05
Ineffective	9	2.11	.333					

For students' perception on the acquisition of quality clinical skills, the analysis showed that 77 dental students with a mean score of 3.15 and a SD of .431 had a perception that the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic in Nigerian dental schools were effective in the acquisition of quality clinical skills. On the other hand, the dental students with perception that the adopted teaching platforms were ineffective in the acquisition of quality clinical skills during the COVID-19 pandemic were 68 in number, with a mean score of 1.69 and standard deviation of .465. The difference in the mean scores recorded between effectiveness and ineffectiveness showed that the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic was effective as shown on table 6. Independent samples t-test analysis to test the hypothesis revealed t-value as 19.66, a significance value reported as 0.000. This showed that a significant difference existed between students effective and ineffective perception as regards acquisition of quality clinical skills adopted through the adopted teaching platforms during COVID-19, which is less than 0.05, indicating the null hypothesis is rejected as shown on table 6.

Table 6: Dental students with perception of effectiveness of adopted teaching platforms in the acquisition of quality clinical skills and those with perception that it was ineffective.

Perception	N	r	SD	Df	T	Sig.	P	Decision
Effective	77	3.15	.4311	143	19.66	.000	0.05	Reject Ho_1 P<0.05
Ineffective	68	1.69	.4654					

DISCUSSION

The results of this study reveal that traditional, face-to face teaching platform was the norm in most schools for the delivery of Orthodontics lectures before the COVID-19 pandemic. Online and hybrid platforms were, to a little extent, adopted as teaching platforms for teaching Orthodontics before the COVID-19 pandemic in Nigerian dental schools. Most of the students strongly agreed that they had their didactic lectures, laboratory practical and clinical exposure through face-to-face interactions with their teachers. This is important since there are some forms of learning that will be difficult to acquire through e-learning platforms like soft skills as revealed by a previous study[6].

In this study, most of the respondents had no online Orthodontics lectures' experiences before the COVID-19 pandemic. This finding is similar to a previous Nigerian study[7] where 75% of medical schools were found not to have used e-learning platforms before COVID-19 pandemic. Most of the respondents also had no opportunity of having on-line video demonstrations in their schools before the COVID-19 pandemic, with less than one sixth having had the experience prior to COVID-19 pandemic. This corroborates the finding of a South African study[8] where less than 20% of the students had previous experience of online learning before the COVID-19 pandemic. These number of responses on reduced online exposures further emphasized the fact that face-to-face interaction were mostly the norm of transferring Orthodontics knowledge before the last pandemic. A fifth of the respondents stated that they had hybrid Orthodontics lectures before COVID-19 pandemic. This shows that a lot of work needs to be done to expand the use of online teaching platforms, though there was an increase in online use during the last pandemic. More than a third had used YouTube in their schools before the pandemic, and this report is good and should be improved upon moving forward.

During the COVID-19 pandemic, for the teaching of Orthodontics to continue, other teaching platforms other than face-to-face had to be adopted. The respondents stated that they had to use platforms like Zoom, WhatsApp, Google meet, and Google Classroom. WhatsApp happened to be the e-learning platform with the highest level of utilization indicated by the respondents, followed by Zoom. This is similar to the findings in a previous study[9] where WhatsApp was also a highly recommended medium used for on-line lectures during the COVID-19 pandemic before Google Classroom since the end users — lecturers and students — were more familiar with WhatsApp and found it easier to use compared to other online devices for learning. It had been reported that WhatsApp works well under poor network signal compared to other online devices[9] . This is very important for a developing country like Nigeria with myriad of network challenges.

It is pertinent to note that though Google Classroom was next to WhatsApp in the previous study[9], in this present study, it came as the third choice of device after Zoom. However, the finding in this study was in contrast with a previous study[10] where the Zoom app was the most popular tool for online classes. In addition, most of the respondents stated that the lectures they had during the COVID-19 pandemic were through online means. This report shows that the few respondents, (less than seventh of the participants) who did not have any of the e-learning devices were disadvantaged during the COVID-19 pandemic as they must have lost out in learning. The implication of this is that more enlightenment and training is required on the use of e-learning devices and resources to forestall similar

experiences in future. Most of the respondents consented to having on-line video demonstrations which still left those without the means at a disadvantaged state. This finding is in line with report of previous surveys[11,12], carried out among 153 dental schools in Europe by the Association for Dental Schools that revealed that non-clinical teaching was performed online in 90% of the schools and, also, most schools in the United States of America converted learning to remote instructions.

More than half of the respondents stated that they used YouTube e-learning resources in their schools. This finding is similar to a previous Malaysian study[13] where YouTube was the most used social medium for educational purposes. The report in this study about YouTube also corroborates reports by Newmann[14] that YouTube has cognitive benefits that makes it a choice for students, including its ability to be downloaded and shared among peers and being flexible and interesting to use[15].

Many of the respondents had a positive perception of the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic. This connotes that they see the various teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic in Nigerian dental schools in a positive light. This positive perception could mean that the students were able to comprehend what they were taught during that time and were comfortable with applying their learning into practice. This finding is however in contrast to a Pakistan study[16] where most of the students studied had negative perception about e-learning teaching platforms adopted in teaching them during the COVID-19 pandemic.

Most of the respondents in this present research indicated that the various teaching platforms adopted in teaching Orthodontics in the various Nigerian dental schools during the COVID-19 pandemic were effective in providing quality lectures. This could mean online mode of delivering Orthodontics lectures should be encouraged, not only during a pandemic but also for normal routine learning purposes which could afford better preparedness for this mode of lecture delivery in case of future pandemics.

Half of the respondents indicated that the teaching platforms adopted for them to acquire quality clinical skills during the COVID-19 pandemic in the Nigerian dental schools were effective. This finding is in contrast with previous studies[6,17] where it was stated that some skills cannot be effectively carried out by e-learning platforms. The participants may be focusing on one clinical skill or the other and not on a wide range of clinical skills as at the time the questionnaire was administered.

Though this study has revealed that face-to-face lecturing method was the norm before COVID-19 pandemic for the teaching of Orthodontics in the Nigerian Dental schools, during the COVID-19 pandemic, there was a reduction in the face-to-face Orthodontics lectures, technical (physical) practice, and exposure in the various Nigerian dental schools, and these were replaced by online teaching platforms. This was similarly seen in a previous study[18] where lectures and examinations were moved to the web in Dental schools in Egypt, lectures were recorded, and the videos made available online. The perception of the respondents on the teaching platforms adopted for the teaching of Orthodontics during the COVID-19 pandemic was more on the positive side, though some students had a negative perception about it, but the difference between the positive and negative perceptions was not statistically significant. Pertaining the effectiveness of the learning platforms adopted in teaching Orthodontics during the COVID-19 pandemic, most of the students perceived that the platforms were effective in providing quality lectures though some stated that the platforms were ineffective; nevertheless, the difference between the effective and ineffective perceptions was statistically significant. This finding was similar to a previous study[19] where e-learning was found to be effective in the teaching of cephalometry, a valuable investigative tool in Orthodontics. More respondents perceived the teaching platforms adopted for teaching of Orthodontics to be effective for the

students to acquire quality clinical skills during the COVID-19 pandemic, and there was a statistically significant difference between this and those who stated that the teaching methods adopted were ineffective for them to acquire quality clinical skills in Orthodontics during the COVID-19 pandemic. In view of this, this present study has given an opportunity for new approaches to be used concerning the teaching of Orthodontics as a course, as Greier et al in their study[20] had presented that certain course content may not be sufficiently put into a digital format.

CONCLUSION: This study has shown that in Nigerian Dental schools, most of Orthodontics training in the areas of lectures, clinical skills exposure and technical skills practice were mostly done face-to-face, especially before the COVID-19 pandemic. During the COVID-19 pandemic, certain adjustments were made to aid continuous dental education which necessitated the adoption of online learning methods such as WhatsApp, Zoom, Google meet, and Google Classroom. However, though learning occurred online — which was not as regular as it should be, the perception of the students was positive and the learning platforms adopted were generally accepted by most of the students and were also considered effective in providing quality Orthodontics lectures and acquisition of Orthodontics clinical skills. Further studies need to be done to find out if the online lectures which were used during the COVID-19 pandemic has continued in the Nigerian dental schools as this is important to avoid fire brigade approach in cases of future pandemics. The universities should also make it mandatory for both trainers and trainees to acquire skills on the use of online platforms for teaching to ensure that in the event of future pandemic, they can deliver lectures seamlessly. The learning environment should also be made conducive for e-learning, and data readily made available in various dental schools.

REFERENCES

1 Oxford handbook of Clinical Dentistry. (5th ed).

2 WHO, Coronavirus Disease (covid-19) Dashboard Retrieved on October 24, 2021 from http://covid-19.who.int.

3 Pan Y, Liu H, Chuc C, Lix L. S, Lu S. Transmission routes of SAR- CoV-2 and protective measures in dental clinics during the covid-19 pandemic. Am J Dent 2020; 33:129-134.

4 Zigman P. Theories of perception and recent empirical work. CUNY Academic works, 2018.

5 Cheng H., Lu S., Yen Y., Siew-Chaisakul P., Yen M et al. Dental education changed by covid-19: Student's perceptions and attitudes. BMC Med Educ 2021; 21 https://doiorg/10.1186/s12909-021-02806-5

6 Kumar, A. E-learning and blended learning in Orthodontic education. APOS Trends Orthod 2017; 7: 188-198.

7 Aishat TO, Oluwayemisi TF, Eniola, IA, Omolola OA, Oluwatobiloba, DO et al Challenges with medical education in the covid era. Pan Afr. Med. J. 2020; 37:223 doi: 10.11604/pamj 37.223.26418.

8 Chisadza C, Clance M, Mthembu T, Nicholls N, Yitbarek.. Online and face-to-face learning: Evidence from students performance during COVID-19 pandemic. Afr Dev. Rev. 2021; 33: 114-125.

9 Nur Agung, A S, Surtikanti, M W, OP, C A. Students' Perception of on-line learning during COVID-19 Pandemic: A case study on the English students of STKIP Pamane Talino. Soshum: Jurnal Social dan Hu 2020; 10: 225-235.

10 Kamal T, Khan M A, Hamad Z, Illiyan A, Das AK et al. Perception and challenges of virtual classes with Gender Digital Divide amidst and Post COVID-19 pandemic in Iraq: An empirical Analysis. Educ. Res. Int. 2023: 1-14.

11 Artese F. Covid-19 pandemic unveiling the opportunities and challenges in orthodontic training. Dent Press J Orthod 2020; 25: 7-8.

12 Iyer P, Aziz K, Ojcius DM. Impact of COVID-19 on dental education in the United States.

J Dent Educ 2020; 86: 718-722.

13 Ali M, Yaacob RA, Endut MN, Langove NU. Strengthening the academia usage of social media: An exploratory study. Journal of King Saud University. Comput Inf Sci 2017: 29: 553-561.

14 Neumann MM, Herodotou C. Young children and YouTube: A global Phenomenon. Child. Educ. 2020; 96: 72-77.

15 Wang HC, Chen CWY. Learning English from You Tubers: English L2 learners' self - regulated language learning on YouTube. Innov. Lang. Learn. Teach 2020; 14: 333-346.

16 Abbasi S, Ayoob T, Malik S, Memon SI. Perceptions of students regarding E-learning during COVID-19 at a private medical college. Pak J Med Sci 2020; 36: 57-61.

17 Susan H, Abeer A, Faleh S, Islam A, Ahmad E et al. Impact of COVID-19 pandemic on dental education: online experience and practice expectations among dental students at the University of Jordan. BMC Med Educ 2021; 21: 151.

18 Mohamed GH, Hala A. Dental Education in the time of COVID -19 pandemic: Challenges and recommendations. Frontiers in medicine infectious diseases-surveillance, preventive and treatment 2021 https://doi.org/10.3389/fmed 648899.

19 Ludwig B. Bister D, Schott T, Lisson J, Hourfar J. Assessment of two e-learning methods teaching undergraduate students cephalometry in orthodontics. Eur J Dent Educ 2016; 20: 20-25.

20 Greier K, Drenowatz C, Sappl A. Gender differences in perceptions and attitudes of on-line learning during the COVID-19 pandemic: A Cross-Sectional study in University students. EJ-EDU 2022; 3: 153-158.

APPENDIX 1

Questionnaire for learning of Orthodontics during the COVID-19 pandemic. Please you are invited to participate in this study designed to investigate how Orthodontics was taught and learnt in the various dental schools in Nigeria before and during the COVID-19 pandemic. Kindly tick your response or fill in the gaps where necessary. Please endeavour to answer all questions and be sincere with your responses. Rest assured that all information obtained here will be treated with utmost confidentiality. Thank you very much.

SECTION A	A	B	C	D	E
1 Age as at last birthday	Below 18yrs	18-22yrs	23-27yrs	28-32yrs	Above 32yrs
2 Gender	Male	Female			
SECTION B	Strongly Agree	Agree	Disagree	Strongly Disagree	
3 Before COVID-19, we were having face-to-face lectures in our school					
4 Before COVID-19, we were having technical practice and exposure in our school					
5 Before COVID-19, we were having clinical practice and exposure in our school					
6 Before COVID-19, we were having online lectures in our school					
7 Before COVID-19, we were having Video demonstrations in our school					
8 Before COVID-19, we were having hybrid lectures (combination of face-to-face and virtual learning)					

9 Before COVID-19, we were using YouTube and other online learning resources in our school	
10 Before COVID-19, we were being given subject areas to study on our own that would be discussed only during tutorials.	
11 Before COVID-19, we were having orthodontic training in children skills laboratory where subjects like assessment and clinical skills are taught and learnt using simulators.	
12 During COVID-19, we were having face-to-face lectures in our school	
13 During COVID-19, we were having technical practice and exposure in dental laboratory in your school.	
14 During COVID-19, we were having clinical practice and exposure in our school.	
15 During COVID-19, we were having online lectures in our school.	
16 During COVID-19, we were video demonstrations in our school.	
17 During COVID-19, we were having hybrid learning (combination of face-to-face and virtual learning).	
18 During COVID-19, we used You Tube and other online learning resources in our school.	
19 During COVID-19, we were being given subject areas to study on our own that would be discussed only during tutorials.	
20 During COVID-19, we were having orthodontic training in clinical skills laboratory where subjects like assessment and clinical skills were taught and learnt using simulators.	

APPENDIX 1: SECTION C

21 The quality of lectures you received before COVID-19 is very good	
22 The quality of clinical skills acquisition before COVID-19 is very good.	
23 The soft skills (Communication, Verbal, Interpersonal skills) you acquired before COVID-19 is very good	

24 The quality of lectures you received during COVID-19 is very good.					
25 The quality of clinical skills you acquired during COVID-19 is very good.					
26 The quality of soft skills (Communication, Verbal, interpersonal skills) you acquired during COVID-19 is very good.					
27 The quality of lectures you received before COVID-19 better than during COVID-19.					
28 The quality of clinical skills you acquired before C0VID-19 is better than during COVID-19.					
29 Which of the following were you using in your school before COVID-19 (Please tick as appropriate)	Google Classroom	Zoom	WhatsApp	Google Meet	Skype