

Dental Education With the COVID-19 Pandemic: Ghanaian Dental Students' Experience

Abstract

Introduction: Due to the COVID-19 pandemic, all Ghanaian tertiary institutions were closed down and resorted to online teaching. This posed a challenge for dental education due to requirements of clinical tutoring and patient handling. This study explored the experiences of dental students with the change in teaching methods during the pandemic with the aim of assessing their effectiveness and explore measures for their improvement. **Materials and Methods:** This was an online survey involving undergraduate dental students in the two dental schools in Ghana. An e-questionnaire was sent out to all the students, exploring their knowledge of and response to the pandemic and assessing the impact of measures implemented during the pandemic to assist them complete their education. **Results:** Two hundred out of 412 students participated in the study giving a response rate of 48.5%; however, completed responses were available for 195 students, 123 (63.1%) from the University of Ghana Dental School and 72 (36.9%) from the Kwame Nkrumah University School of Medicine and Dentistry. There were 106 (54.4%) females; 108 participants (54.4%) were pre-clinical students. One hundred and sixty-four (84%) respondents believed dental professionals had a higher risk of contagion because of proximity to patients during treatment and 115 (59.0%) reported being fearful of performing clinical procedures. The students demonstrated adequate knowledge of the disease and a positive attitude towards the required changes instituted because of the pandemic. They however, highlighted technical obstacles and distraction as some of their challenges. The quality of internet was acceptable, but the volume of data was inadequate to meet their needs. Also, though both Universities had their own recommended learning management systems, Zoom was the preferred online learning platform. **Conclusions:** Generally, the students demonstrated a positive attitude towards the required changes. A blended educational approach may continue to be ideal for dental education as we adapt to this pandemic. Innovative ways may need to be sought to improve the online experience and the University approved online learning management systems enhanced to make them more user friendly.

Keywords: *Clinical dental training, COVID-19, dental education, dental students, ghana*

Résumé

Introduction:

En raison de la pandémie de COVID-19, tous les établissements d'enseignement supérieur ghanéens ont été fermés et ont eu recours à l'enseignement en ligne. Cela a posé un défi pour l'enseignement dentaire en raison des exigences de tutorat clinique et de traitement des patients. Cette étude a exploré les expériences des étudiants en médecine dentaire avec le changement des méthodes d'enseignement pendant la pandémie dans le but d'évaluer leur efficacité et d'explorer des mesures pour leur amélioration.

Méthodes:

Il s'agissait d'une enquête en ligne impliquant des étudiants en médecine dentaire de premier cycle dans les deux écoles dentaires du Ghana. Un questionnaire électronique a été envoyé à tous les étudiants, explorant leurs connaissances et leur réponse à la pandémie et évaluant l'impact des mesures mises en œuvre pendant la pandémie pour les aider à terminer leurs études.

Résultats:

200 étudiants sur 412 ont participé à l'étude, ce qui donne un taux de réponse de 48,5%; cependant, des réponses complètes étaient disponibles pour 195 étudiants, 123 (63,1%) de l'École dentaire de l'Université du Ghana et 72 (36,9%) de l'École de médecine et de dentisterie de l'Université Kwame Nkrumah. Il y avait 106 femmes (54,4%); 108 participants (54,4%) étaient des étudiants précliniciens. Cent soixante-quatre (84%) répondants pensaient que les professionnels dentaires avaient un risque plus élevé de contagion en raison de la proximité des patients pendant le traitement et 115 (59,0%) ont déclaré avoir peur d'effectuer des procédures cliniques. Les étudiants ont démontré une connaissance adéquate de la maladie et une

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attitude positive envers les changements requis institués en raison de la pandémie. Ils ont cependant souligné les obstacles techniques et la distraction comme certains de leurs défis. La qualité d'Internet était acceptable, mais le volume de données était insuffisant pour répondre à leurs besoins. De plus, bien que les deux universités aient leurs propres systèmes de gestion de l'apprentissage recommandés, Zoom était la plate-forme d'apprentissage en ligne préférée.

Conclusions:

En général, les étudiants ont démontré une attitude positive envers les changements requis. Une approche pédagogique mixte peut continuer à être idéale pour l'enseignement dentaire alors que nous nous adaptons à cette pandémie. Des moyens innovants devront peut-être être recherchés pour améliorer l'expérience en ligne et les systèmes de gestion de l'apprentissage en ligne approuvés par l'Université seront améliorés pour les rendre plus conviviaux.

Mots-clés: *Éducation dentaire, COVID-19, Formation dentaire clinique, Étudiants en médecine dentaire, Ghana*

Introduction

Coronavirus disease 2019 (COVID-19), has rapidly developed worldwide, spreading to almost every part of the world including Ghana and is now a global pandemic. Ghana recorded its first two cases on the 12th of March, 2020 and has since seen a spread of cases around the country with changing trends in prevalence over the year. On March 15, 2020, the management of the University of Ghana suspended all lectures including clinical and practical teaching, following the confirmation of a case involving one of its students. The next day, the Ghanaian President also ordered an indefinite closure of all schools including universities with the rationale to minimize the transmission of the virus. Subsequently, many of the country's higher educational institutions began transitioning to online teaching and learning with the hope of completing lectures and examinations for the semester. This posed a huge challenge for dental education which requires clinical training involving direct patient care by students under faculty supervision, which is a key component of the dental curriculum.

The virus is transmitted through respiratory droplets such as coughing and fomites. Transmission through smaller droplet nuclei that propagate through air at distances longer than one meter is also possible with aerosol-generating procedures during dental treatment.^[1,2] It may also occur through the repeated exposure to saliva, respiratory tract secretions, and other contaminated body fluids, the viral load of which is reported to be very high in both symptomatic and asymptomatic patients.^[3-5] These features, plus the need for oral health workers and dental students to work in very close physical proximity to patients puts them at higher risk of contracting the infection. This therefore, necessitated the development of critical protocols and measures to reduce the risk of transmission. Most dental clinics in Ghana, limited their services, suspending routine dental treatment in the early phase of the pandemic and resorting to the provision of only emergency treatment while further understanding of the virus was being sought. Currently, with no proven effective specific antiviral therapy against SARS CoV-2, and a population with a very low vaccination rate, we find ourselves in a difficult situation in planning the way forward for dental education especially with the unpredictable course of COVID-19.

Ghana has two dental schools, namely the University of Ghana Dental School (UGDS) and the Kwame Nkrumah University

of Science and Technology School of Medicine and Dentistry (KSMD). With the institution of these directives, they closed down student clinics, suspending clinical training with barely a few months to the end of the academic year. This resulted in the creation of a completely virtual, online web-based teaching system. This was necessary given the highly infectious nature of the virus and also because these dental students were in the process of perfecting their clinical skills; placing them in a clinical setting where a pandemic was ongoing would place them at particularly high risk of contagion.

Apart from didactic lectures, tutorials and problem-based learning, dental education also consists of simulation laboratory courses and clinical patient-based skill training. Lectures and tutorials may easily be switched online using different systems available online such as: Zoom, Google meet and Google Classroom. Simulation laboratory courses however require demonstration by lecturers and a step-by-step assessment of skill requiring close contact between teacher and student. Finally, clinical skill training involves students actually managing patients under the supervision of their faculty, which will involve close contact between the student, the patient and faculty.^[6]

Several learning management systems (LMS) have been used for online education in Ghana. The University of Ghana which had earlier on adopted the Sakai LMS, an educational software platform designed to support teaching, research and collaboration, scaled up its use. Its uses included facilitation of document distribution, discussion, live chat, assignment uploads, and online testing. The Kwame Nkrumah University of Science and Technology (KNUST) also migrated to an online LMS known as the KNUST Virtual Classroom (V-Class) to complete the 2019/2020 academic year. With the transition to these web-based learning management systems, the Universities provided each student and faculty with 5GB of data per month to assist them with their learning. With the implementation of this new directive, however, no study has been carried out to explore the experiences and perceptions of dental students with this change. This is essential in designing effective strategies for the successful integration of online teaching. This study was therefore implemented to explore how dental students are coping with the measures taken to mitigate the COVID-19 pandemic in Ghana. It also aimed to assess the effectiveness of online teaching and explore measures for their improvement moving forward.

Materials and Methods

An anonymous online survey based cross-sectional study was carried out in May 2020 among dental students from the UGDS and the KSMD, with a total student population of 412 (192 from UGDS and 220 from KSMD). An electronic semi-structured questionnaire, was used to collect data on the respondents' socio-demographic characteristics, their knowledge of COVID-19 and its implications for dentistry, and finally assess the impact of the pandemic and the subsequent measures taken to curtail its spread on their education. It was designed using Google Forms and the online link circulated through emails and social media portals including WhatsApp, Facebook, and Twitter. Reminders were also sent through their class representatives over the period.

Ethical approval was obtained from the Ethical and Protocol Review Committee of the University of Ghana Dental School (CPDD/013/07/2020) and consent was sought from all participants before the survey was carried out.

The questionnaire

A 20-item questionnaire was pretested among 20 dental house officers who had just graduated a year before and administered online. It was divided into three sections, comprising questions on their socio-demographic information, their knowledge of COVID-19 and its implications for dentistry, and the effect of the pandemic and the subsequent measures taken on their education. Data collected included age, sex, and their current class and school. Other variables explored included their knowledge of the COVID-19 disease and their views on its impact on clinical work during the pandemic. The modes of online teaching used was explored along with their views on them. Submission of responses was recorded directly into the survey platform database and aggregated de-identified data was analysed using SPSS version 22 Software. Data was summarized using proportions and percentages for categorical variables and continuous variables were summarized by means and standard deviation. Charts were then made to visualize the data

Results

From a total of 412 dental students, 200 consented and responded to the survey resulting in a 48.5% response rate. Completed responses from 195 respondents were analysed. Their ages ranged from 18–35 years, with a mean of 21.8 ± 2.6 years. One hundred and six (54.4%) were females and 89 (45.6%) males. One hundred and twenty-two (62.6%) participants were from UGDS and 73 (37.4%) from KSMD; there were 108 (55.4%) pre-clinical and 87 (44.6%) clinical students [Table 1].

COVID-19 first came to their attention largely through the media (190, [97.4%]), other sources including colleagues (86, [44.1%]) and published literature (66, [33.8%]). Respondents believed the spread of COVID-19 occurred mainly through respiratory droplets (195, [100.0%]), aerosols (151, [77.4%]), and contaminated surfaces (190, [97.4%]).

Table 1: Socio-demographic characteristics of respondents

Characteristic	Frequency (n)	Percentage (%)
Sex		
Male	89	45.6
Female	106	54.4
Age Group		
<20	40	20.5
20-24	131	67.2
25- 29	22	11.3
30-34	1	0.5
35+	1	0.5
Dental School		
UGDS	122	62.6
KSMD	73	37.4
Stage of Training		
Clinical	87	44.6
Pre-clinical	108	55.4

One hundred and sixty-four (84%) of the respondents asserted that dental professionals/students were at a higher risk of contracting the disease when compared with other health workers. When these 164 students were asked for reasons, they stated proximity to the patient during dental treatment (164, [100%]), impossibility of patients wearing face masks during treatment (157, [95.7%]) and the very high virus transmission in saliva and in aerosols (117, [71.3%]).

Of the 87 clinical level students who participated, 70(80.5%) reported they were afraid of carrying out dental procedures during the COVID-19 pandemic.

With regards to preventing spread of COVID-19 infection within the clinic environment, 180(92.3%) judged human to human spread by respiratory droplets 180(92.3%) as the most plausible means of contracting COVID-19 at the dental clinic.

The students believed that specific measures like use of hand sanitizers (195, [100.0%]), reduction in the use of ultrasonic equipment or handpieces (66, [33.8%]), increased spacing in the waiting room (194, [99.5%]), reduced waiting time of patients (174, [89.2%]), rubber dam isolation of aerosol generating procedures (140, [71.8%]), use of barriers between patients (167, [85.6%]), patient education on COVID-19 (193, [99.0%]) and pre-procedure mouth rinses (131, [67.2%]) could prevent spread of the disease.

Educational experience during the covid-19 pandemic

One hundred and fifty-four (79.0%) respondents were involved with online classes. Of this number, 147 (95.5%) accessed it with their personal devices, while the 7 (4.5%) that did not have personal devices used shared devices.

The 5GB Internet data provided by the universities were accessed and utilized by 144 (93.5%) of the respondents involved in online classes. Of this number, 112 (77.8%) reported having fast internet access during online lessons; however, only 16 (11.1%) of these respondents felt that the data provided was enough to meet their needs.

The students used multiple modes to access online learning during this period. As shown in [Figure 1], Zoom was indicated by 152 (98.7%) students as the mode by which they carried out online learning. Other modes used included WhatsApp 108(70.1%), Sakai 88(57.1%), and KNUST V-Class 4 (2.6%). When students were asked what mode they preferred based on their experience with the different modes for online learning, Zoom was preferred by the majority 106(68.8%). Eighteen (11.0%) participants preferred WhatsApp, 15(10.0%) Sakai, and 15(10.0%) YouTube.

Providing feedback on their online learning experience, majority 148 (96.1%) reported having challenges with online learning. These challenges, highlighted in [Figure 2] were mainly technical ones that included network connectivity issues either from their end or from faculty. Forty-four (29.7%) of them also felt distracted by noise and by family and home activities during lessons.

Despite these challenges, 100 (64.9%) described the whole online learning experience as advantageous in terms of it having enabled teaching and learning to proceed during the closure of universities, compared with 20(13.0%) who saw no advantage at all in that regard. The remaining 34 (22.1%) were indifferent.

Discussion

Global healthcare systems are still reeling from the ongoing effects of the novel coronavirus pandemic and oral health providers, interns and trainees have not been spared its effects. The pandemic, as well as the public health measures adopted to contain it, have severely impacted every fibre of society. Standard modes of operating in oral healthcare delivery, and dental education, hitherto proven to be safe and effective, are being re-evaluated to meet up with the requirements of infection control. The implementation of these rapidly evolving recommendations for patient and practitioner safety requires up to date knowledge, attitudinal shifts, and a state of readiness to engage the new ‘normal’,^[7,8] a situation which seems to have been accepted by majority of the students.

Dental schools and dental students worldwide however, face a specific dilemma with regards to how training needs will be met, especially concerning clinical skills acquisition that demands close patient interaction. There is also the need to come to grips with newly proposed personal protective measures for themselves and clinic wide measures to reduce chances of infection spread. In Ghana, the dental students seemed well-informed on the Covid-19 disease and the measures taken to prevent its spread, with majority obtaining their information from media sources. This finding can be explained by the rapid propagation of Covid-19 messages through news media and by public health organisations worldwide. Media information campaigns have also been spearheaded by leading authorities in healthcare, like the WHO, which seem to have had a very positive impact. This is a positive finding since maintaining adequate and current knowledge will facilitate their quest to carry outpatient education and help in the implementation of measures to prevent spread of infection.

Though aerosol generation is not exclusive to dentistry, it is extremely common place and this potential to generate aerosol during most dental treatments led to the limiting of dental care to only essential procedures during the height of the pandemic. That and the proximity to patients who unfortunately can't wear face masks during treatment make the dental profession highly vulnerable to Covid-19. This was shared by majority of the respondents. This higher risk classification, together with the potential spread of Covid-19 through saliva,^[3] by infected patients and spread by asymptomatic patients,^[9] may explain why majority of respondents expressed fear over carrying out clinical procedures during this period. This is a finding shared by other students^[10] and even dentists.^[11] At the time of the study though, the disease was still evolving in Ghana with a lot of uncertainty on its course. There was no known substantive cure with no vaccine and this may have caused a lot of anxiety and fear. Moving on, with the pandemic still raging, dental schools may need to make psychological services available to those who may need them and also enhance emotional support systems for the students. Further research into the transmission

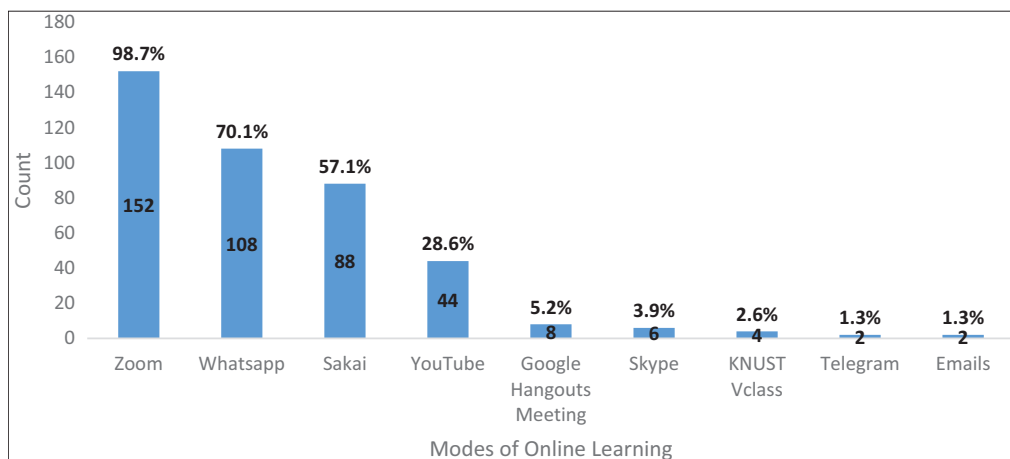


Figure 1: Modes of online learning (Multiple Response Data from 154 Respondents)

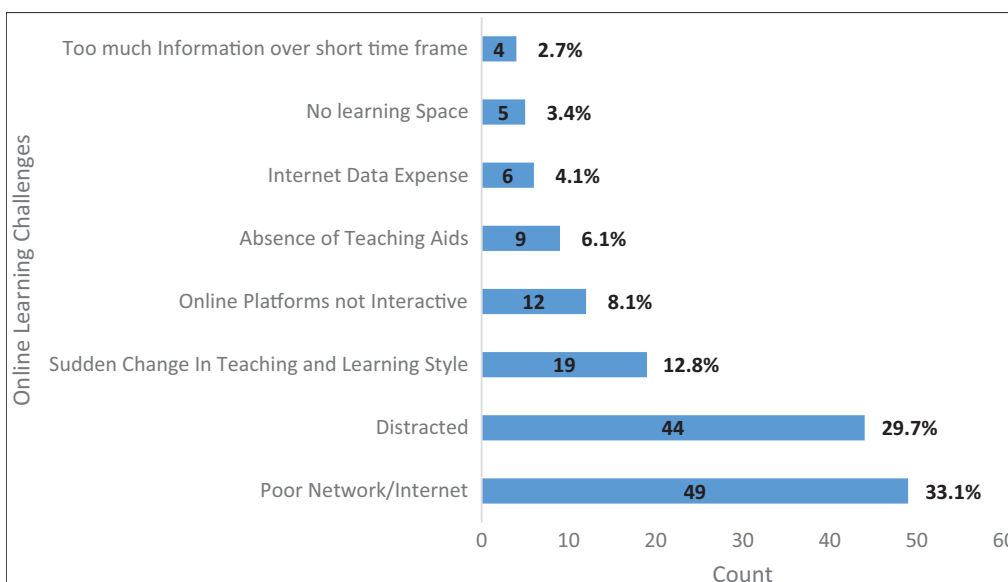


Figure 2: Challenges faced during online learning

of the virus and development of effective ways to mitigate it may also need to be carried out to give them more confidence in treating patients.

On their educational experience, majority reported taking part in online classes using personal electronic devices. A few however, did not have personal devices and were using shared devices. This could pose a challenge for these students since classes could be missed if the devices generally relied upon are not readily available. To mitigate this in the short term, the schools may need to procure devices to be borrowed for use by needy students. In the long term, however, newly enrolled students may need to be encouraged to procure electronic devices for online education as part of requirements for training.

At a time when students were at home and internet access was not guaranteed for all, the Universities provided 5GB internet data a month per student for their use. Majority accessed it, and reported that though fast, the data was not enough to meet their needs. For a lower middle-income country where some students may be grappling with financial constraints, the provision of internet data at a time like this is very commendable. However, to further ensure that some students are not disadvantaged and especially if we are to reduce inequalities in access to education, the Universities may need to increase the amount of data provided. Further studies may however, need to be carried out to assess how much data may be required to meet their needs. This is also highlighted in a study in South Africa, where Dube^[12] argues that while the South African government is promoting online learning as the only alternative in the context of COVID-19, this mode excludes some learners from teaching and learning, due to a lack of resources to connect to the internet.

Of the modes used to access online learning, Zoom was the most widely used and the most preferred mode of online learning, being preferred over any of the two LMS's instituted

by the Universities. A finding also observed among health sciences students engaging in e-learning.^[13] This may be due to the fact that Zoom is interactive, versatile and engaging with a user-friendly interface, and ease of integration with different hardware.

Martin *et al.*^[14] opine that interaction is crucial to student satisfaction with online courses and adding synchronous components (e.g. virtual classroom technologies) to online courses facilitates interaction. Live communication during the online learning process is important and provides students with the ability to receive immediate feedback, improving interaction. Pukkaew^[15] in assessing the effectiveness of internet-based distance learning through the V-Class platform recommended the integration of modern social media networking sites e.g. Facebook into the V-Class platform. This he proposes will improve communication and interactivity between instructor, tutor and students especially if they are in different places and time zones. The Universities may therefore need to consider incorporating a live mode to improve the interactivity in these LMS's to motivate students to learn and obtain immediate feedback from their instructors. Additionally, these online LMS's i.e., both Sakai and V-Class maybe a bit more complex than Zoom and will need regular training and orientation for both students and faculty for their effective use. Martin^[16] in a study comparing the usability of Moodle, Sakai and dotLRN noted that disappointment and frustration are common in eLearning due to poor features and usability issues. Usability has been described as a precursor of learnability, and the universities may need to take steps to prevent it being a barrier to learning, since it can impact motivation. Unfortunately, though both LMS's existed before the onset of the pandemic, most faculty and students had not perfected their use. Biney,^[17] in a study exploring the experiences of adult learners on using the Sakai LMS for learning in Ghana recommended that for it to be impactful,

regular orientation and training on the use of the LMS should be carried out. It should start early, and the duration extended. This recommendation may need to be acted on immediately especially as we seek solutions for education during the pandemic.

The Sakai LMS seemed to have fared better than the V-Class in the student's opinion in this study. Though one may implicate usability for this finding, further studies may need to be carried out to explore this. Another plausible reason may be that immediately the solely online teaching was rolled out, University of Ghana carried out series of online refresher training for faculty and staff. This was also done at KNUST but at a much later date and may have resulted in they already utilizing other means for teaching. This notwithstanding, some inherent properties in the LMS's themselves may influence its usability. A study carried out by Martin *et al.*,^[16] comparing Sakai with two other LMS, Moodle, and dotLRN, rated it as having better user control and freedom, consistency and standards, error prevention and help and documentation. It however performed the poorest on helping users recognize, diagnose, and recover from errors. Their challenges notwithstanding, these LMS's are more secure and fit for the purpose. Both Universities will therefore need to improve the capacity of both staff and students to use them and also make them more user-friendly and flexible to be able to achieve expected outcomes. Regular encouragement and motivation may also need to be carried out through regular orientation and provision of incentives for their use.

The students also highlighted their challenges with e-learning and they mainly included technical challenges and network connectivity problems, distraction, the lack of interactivity with online platforms and an absence of teaching aids. Attention is very critical if learning is to be successful, thus engaging the student's attention is often considered an essential feature of education. This sometimes proves challenging with online learning. Teachers may therefore need to use active learning approaches to effectively engage students and convey knowledge to them. Song *et al.*^[18] in a study assessing challenges with online teaching also observed that technical problems, a perceived lack of sense of community, time constraints, and the difficulty in understanding the objectives of the online courses were some of the challenges expressed by students. They also noted that learner motivation, time management along with the comfortableness with online technologies impact the success of the online learning experience. Zhao^[19] reported that among dental residents pursuing advanced dental education in Wuhan, streaming integrity was restricted by the stability of the internal network. They also noted that, the concentration of residents may have been affected by the surrounding environment, and the emotional connection between residents and faculty could have been weakened compared with traditional teaching. Since some of these challenges are inevitable, it may be important to psyche the students at the beginning of the course and let them understand that some of these challenges will occur. This will help ease the stress and help them make back-up plans.

These challenges notwithstanding, majority described the whole online learning experience as advantageous considering the situation.

Unfortunately, the online environment also presents challenges for faculty who now have to acquire a lot of technological competency and proficiency^[20] in addition to their regular academic workload to make it successful. This was evident with this study when some of the students reported the absence of teaching aids as some of their challenges with online learning. Faculty may therefore need to familiarise themselves with advanced IT productions and adapt quickly to the change in learning mode to make it easier for their students. Sawar *et al.*^[21] in a study among Pakistani dental students report that students generally expressed an overall dissatisfaction toward teachers' ability to deliver online lectures with ease. This they attributed to the urgency and haste with which the teachers were required to acclimate themselves with online learning technology. The transition to virtual learning from physical teaching especially for a very practical subject like dentistry where clinical skills training and internship training are a vital part poses a huge challenge for both students and faculty and both will need to adapt to the change. The Universities may need to cease assuming that all teachers are able to execute online learning and train them or conduct workshops to equip teachers on the way to handle on line learning. Iyer *et al.*^[22] believe that technology in teaching and learning should be employed when appropriate and adequate training of faculty in remote teaching has been carried out. This notwithstanding, the students generally rated their online experience positively, suggesting the pandemic might offer dental schools' opportunities to leverage technology in new ways to enhance dental education.

The clinical skills training aspect of dentistry in the midst of the pandemic, however, remains a challenge due to the proximity and close contact required between the student, the patient and faculty. Some countries have resorted to using simulation laboratories and tele-dentistry.^[6] A lot of investment will however need to be made to provide new and improved educational tools of virtual reality. This is an investment Ghana may need to make to ensure quality dental education.

Conclusion

The emergence of COVID-19 has brought new challenges and responsibilities to institutions providing dental education, resulting in a lot of changes. Ghanaian dental students demonstrated current and adequate knowledge of the Covid-19 pandemic including guidelines designed to protect practitioners and patients against the spread of Covid-19. As potent agents for patient education during this pandemic and beyond, their positive attitude towards required practice changes will benefit the dental profession now and in the future. Even though they were adapting to the newly introduced online modes of teaching and learning, they highlighted specific challenges with this method. Addressing these challenges will improve the online learning experience of the students.

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Conflicts of interest

There are no conflicts of interest.

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