Rapid transition to online teaching during COVID 19: Students' and Teachers' Perceptions in a Pioneer Caribbean Dental School

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Abstract

Background: The sudden advent of the COVID pandemic resulted in the closure of schools and universities in Trinidad, limiting face to face interactions and removing dental students from the clinical environment in The University of the West Indies. The dental school was challenged to complete the final year teaching with a rapid transition to online teaching. This study examined students' and teachers' perceptions of the effectiveness of emergency remote online teaching.

Method: An online cross-sectional survey was administered on the perception of the online learning environment and challenges experienced and effectiveness of strategies used. Overall thirty-three dental students and eleven clinical academic teachers participated. The questionnaire was emailed to the participants for data collection and they responded by using a Likert scale. Reliability of the questionnaire was determined. Chi-squared (χ^2) tests were applied for determining the perceptions of students and teachers towards online teaching. Frequencies and percentages were also computed.

Result: Cronbach's alpha of the students' and teachers' questionnaire was calculated at 0.838 and 0.801 respectively. The majority of students (60.6% - 89.5%) perceived that online teaching strategies, have enhanced their clinical reasoning and critical thinking skills in clinical practice, felt motivated to learn, liked learning in their own space, at their own pace and found it easy to adapt. Nearly two-third students (63.6%) were happy to recommend continued use of online strategies. However, the majority (87.9%) perceived it to be somewhat or not effective at all in acquiring clinical skills. The challenges experienced were problems with connectivity to the internet (87.9%) while (48.5%) had experienced distraction during remote teaching. All χ^2 values were found to be statistically significant (either $P < 0.01$ or $P < 0.05$). The majority of teachers (72.7% - 92.9%) perceived that they created an enthusiastic online environment, effectively communicated with the students, engaged students in clinical reasoning and critical thinking and gave formative feedback. Teachers were equally divided on whether or not they prepared students to practice clinical skills.

Conclusion: Students' perceptions are similar to teachers' perceptions in both are positive to the online teaching strategies but both groups reflected concerns over the acquisition of clinical skills.

Background

The epidemic of coronavirus disease 2019 (COVID-19) originated in Wuhan, China last December [1] and in January, 2020 the Chinese Centre for Disease Control announced a novel coronavirus (SARS-COV-2) as the causative pathogen for COVID-19 [2]. The disease was declared a global pandemic on March 11th, 2020 by the World Health Organization (WHO) [3] and has spread to many countries in the last few months. Trinidad & Tobago, a twin-island state in the Caribbean, was no exception. On March 12th the first COVID-19 case was diagnosed and on March 15th the government of Trinidad & Tobago mandated the closure of schools which included Universities and the School of Dentistry, The University of the West Indies (UWI). This had an immediate impact on teaching and the delivery of the dental curriculum.

The public health measures of hand hygiene, social distancing and wearing a mask in public were implemented by the Ministry of Health (MOH). The borders were closed on March 22nd to non-nationals and with the uncertainty of the infection, many dental students who came from abroad took the opportunity to return to their homes before the borders were closed. On March 30th the country went into a national lockdown of non-essential services and dentistry was considered an essential service. In the US the Occupational Safety and Health administration classified dentists in the very high-risk category because of the potential for exposure to coronavirus through aerosol-generating procedures (AGPs) [4] and the Centre for Disease Control (CDC) issued guidance for Dental Settings [5] which the local Dental Council of Trinidad & Tobago (DCTT) used to issue best practice guidelines for dentistry in the country.

Introduction

The effect of the immediate closure of the UWI dental school in March 2020 meant the halt to face to face didactic teaching, preclinical teaching and direct clinical patient care. Dental education now faces a serious challenge between balancing safeguarding the health of staff, students and patients while following local, national or international guidelines. The biggest challenge has been to postpone direct patient care [6]. A survey of the 67 dental schools in the USA showed that most dental schools have suspended clinical care except for dental emergencies that are seen by faculty or residents [6]. Worldwide, one of the earliest reports to emerge on the impact of COVID-19 on dentistry was from China [7] which discussed the emerging and future challenges faced at The School and Hospital of Stomatology, Wuhan University. Dental students were not required to return to classes and were learning online. Emergency clinical care continued with staff and protocols were developed for dental care which included patient evaluation and triage, temperature checks, preoperative mouth rinses, 4-handed dentistry, use of rubber dams and high volume evacuators to minimize splatter and aerosol. The use of appropriate personal protective equipment (PPE) including gloves, gowns and goggles or face shields as well as particulate respirators such as N-95 masks (authenticated by the National Institute for Occupational Safety and Health or FFP2- standard masks set by the European Union). Dental professionals including dental assistants are at high risk of contagion due to the exposure to saliva, blood, and aerosol/droplet production during the majority of dental procedures [8] and in the dental school setting dental education in this COVID-19 pandemic must be carefully considered.

A survey of 69 of the 153 European dental schools also reported having very limited clinics providing only emergency dental treatment or urgent non-delayable treatment provided by senior staff or postgraduates. Undergraduate students were involved in only non-clinical activities. Non-clinical teaching was moved to online mode [9]. Brazilian and Australian experiences have also been reported. Brazil has over 500 dental schools and the second-highest infection rate after the USA at the time of writing. Face to face classes were suspended as well as clinics and online teaching was implemented. There is currently an extensive discussion on protocols for the return to face to face activities and the challenges of securing PPE for staff and students [10]. In contrast, Australia has 12 dental schools and introduced strong regulations early on related to social distancing, travel restrictions and testing and tracking of infected patients. All

clinical and preclinical activities were suspended from mid-March and moved to online activities utilizing platforms such as Microsoft Teams and Blackboard Collaborate ULTRA [10].

The UWI School of Dentistry which started in 1989, is the only one in Trinidad [11] and is only one of two dental schools in the English-speaking Caribbean. It is one of the six undergraduate programs offered by the Faculty of Medical Sciences at the St Augustine Campus of the University of the West Indies. Given the national mandate to shut schools in March 2020 due to COVID-19, clinics of the dental school were halted and pre-clinical laboratory teaching also. There was then a rapid implementation of online teaching strategies to assist faculty via a series of workshops put on by the Centre for Excellence in Teaching and Learning (CETL) at the UWI from March through April. There was a steep learning curve for faculty to come on board from mostly face to face teaching, with didactic, preclinical laboratory classes and clinics to shifted to online teaching using the UWI's online platform called myeLearning, a moodle-based platform, utilizing Blackboard Collaborate. Zoom and Schoology online platforms were also used as adjuncts. All didactic teaching moved to emergency remote online teaching and clinical teaching as well via case-based learning including the use of videos. Assessments were also conducted online in the form of written reports and computer-based examinations. This pandemic has brought challenges worldwide to universities and specifically whether the faculty can deal with the existing technology and if they had enough infrastructure or resources to facilitate online teaching from home immediately as computers and IT equipment at home may be in heavy demand by other members of the family at home working or studying [12].

With the sudden advent of the COVID pandemic and the need to limit face to face interactions and remove students from the clinical environment, the School of Dentistry, UWI was challenged to complete the final year teaching with rapid implementation of online lectures and clinical skills training via case-based learning and clinical videos. This study will examine student and teacher perceptions of the effectiveness of emergency remote online teaching at the School of Dentistry, Faculty of Medical Sciences at the St. Augustine campus of the University of the West Indies.

Methods

Research Design

To realize the study aims, an online cross-sectional survey approach was adopted and the participants were asked to complete an online questionnaire created using Google Forms.

Participants

All students and teachers who participated in online clinical skills teaching for final year programmes at the Faculty from March – June 2020 formed the study population recruited through convenience sampling technique. This paper reports on the findings from students and teachers of the School of Dentistry.

Study Instrument

Study instruments for student and clinical teacher were designed based on literature and practical issues experienced because of the sudden transition to online teaching during COVID 19 pandemic. The first part of the questionnaire collected data on demographic details of respondents, teaching strategies used during emergency remote teaching for both students and teachers. The student perception of the recently completed online teaching was evaluated under the domains such as Online Learning Environment and Challenges experienced using 4 point Likert scales as follows: attributes from strongly disagree (score of 1) to strongly agree (score of 4). Further, the effectiveness of online teaching strategies in term of remembering understanding, acquiring, supplementing, self-study of clinical skills and preparing for OSCE/clinical clerkship examinations was assessed on a 4-point scale: Not Effective at all (Score of 0) Somewhat Effective (Score of 1), Effective (Score of 2) to Very Effective (Score of 3).

The teacher perception of completed online teaching was evaluated under the domains such as Online Learning Environment and Technical Support experienced using 4 point Likert scales as follows: attributes from strongly disagree (score of 1) to strongly agree (score of 4).

Data Analysis

The data was entered into the Statistical Package for the Social Sciences (SPSS) version 24.0 (IBM Corporation, Armonk, NY, USA). Mean and standard deviation (SD) were calculated for the data on the age of students and teachers and year of experience on online teaching for teachers. Cronbach's Alpha was calculated to establish the reliability of the instruments used. Specifically, percentages, median, interquartile range, and chi-square test of goodness of fit were used to determine if the distribution of frequencies of responses in each item were sufficiently different to reject the null hypothesis that the distribution was due to chance. The critical value used to reject the null hypothesis was $p \leq 0.05$ and $p \leq 0.01$. The information collected from open-ended questions were collated and presented thematically. It is to be noted that the 4-point teacher perception scale is was reduced to two-point Strongly Agree - Agree (%) and Strongly Disagree - Disagree (%) because 100.0% cells have expected frequencies of less than 5.

Ethical Approval

Ethical approval was obtained from the Institutional Review Board, The University of the West Indies, Faculty of Medical Sciences, St Augustine Campus, Trinidad (CREC-SA.0434/07/2020).

Results

Students

A total of 33 dental students in final year participated in the study which is a response rate of 94.3%. Among these participants 31 (93.9%) were female and 2 (6.1%) were male. The ages ranged from 23-35 years old with a mean age of 25.45 ± 3.23 . The Cronbach's alpha of the questionnaire was found to be 0.838 which is a high acceptable level of reliability.

Table 1: Online Teaching Strategies Experienced by Students

What online teaching strategies did you experience during the period of emergency remote teaching?	No (%)	Yes (%)	Total	Chi-Squared (χ^2)	P-value
Clinical videos (recorded at the UWI)	30 (90.9)	3 (9.1)	33	22.091*	.000
Clinical videos (recorded by others e.g. YouTube videos)	23 (71.9)	9 (28.1)	32	6.125*	.013
Online simulations	18 (56.3)	14 (43.7)	32	.500	.480
PowerPoint presentation	1 (3.0)	32 (97.0)	33	29.121*	.000
Demonstration of skills by lecturer	24 (72.7)	9 (27.3)	33	6.818*	.009
Virtual ward rounds/clinic visits	32 (97.0)	1 (3.0)	33	29.121*	.000
Discussion of clinical cases	0 (0)	33 (100)	33	This variable is constant. χ^2 cannot be performed.	

*Values are statistically significant ($p < 0.01$).

The online teaching strategies experienced by the students are shown in Table 1. The vast majority of strategies used were discussion of clinical cases and the use of Powerpoint presentation, followed by online simulations and clinical videos recorded by others. All χ^2 values in Table 1 were found to be statistically significant except Online simulations by others ($p < 0.01$).

Student perception of the effectiveness of online teaching strategies

The Table 2 reveals that a majority of students (87.7% - 63.6%, with Median = 3, IQR = 1 or 0) perceived that lecturers created a stimulating online environment, were skilful at online delivery, communicated effectively during online delivery, helpful in giving formative feedback and more so students were feeling connected with them. The Table 2 further reveals a majority of students (89.5% - 60.6%, with Median = 3, IQR = 1) were of the view that online teaching strategies have enhanced their clinical reasoning skills, prepared them for critical thinking in clinical practice, motivated to learn when engaging in online teaching of clinical skills, enjoyed the online teaching strategies, liked learning in their own space, enjoyed working their own pace and found it easy to adapt to online teaching.

Further Table 2 reports, in terms of the challenges the students experienced, only a few respondents had issues with availability of a computer or smartphone, adequacy of time to complete learning objectives and poor quality of media used by lecturers. However, the vast majority (87.9%, with Median = 3, IQR = 1)

had problems with connectivity or internet and while a little less than half (48.5%, with Median = 3, IQR = 1) had experienced some sort of distraction during remote teaching. Nearly two-third students (63.6%, with Median = 3, IQR = 1) were happy to recommend continued use of online strategies in the teaching of clinical skills. All χ^2 values in Table 2 were found to be statistically significant ($P<0.01$).

Table 2: Student perception of the effectiveness of online teaching strategies

Item	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)	Total	Chi-Squared (χ^2)	P-value	Median (IQR)
Online Learning Environment								
The lecturer created an enthusiastic/stimulating learning environment	NR	21 (63.6)	11 (33.3)	1 (3.0)	33	18.182*	.000	3 (1)
I felt my lecture was skilled at online teaching	1 (3.0)	24 (72.7)	6 (18.2)	2 (6.1)	33	41.788*	.000	3 (1)
Lecturers were effective in communicating during online delivery	3 (9.1)	26 (78.8)	4 (12.1)	NR	33	30.727*	.000	3 (0)
Lecturers were helpful in giving formative feedback	3 (9.1)	25 (75.8)	5 (15.2)	NR	33	26.909*	.000	3 (1)
I felt connected with my teachers	NR	23 (69.7)	7 (21.2)	3 (9.1)	33	20.364*	.000	3 (1)
I feel the online teaching strategies have enhanced my clinical reasoning skills	1 (3.0)	19 (57.6)	9 (27.3)	4 (12.1)	33	22.636*	.000	3 (1)
I feel the online teaching strategies prepared me for critical thinking in clinical practice	1 (3.0)	22 (66.7)	9 (27.3)	1 (3.0)	33	35.727*	.000	3 (1)
I practised clinical skills on persons, pets or dummies at home	1 (3.0)	1 (3.0)	17 (51.5)	14 (42.4)	33	26.030*	.000	2 (1)
I feel motivated to learn when engaging in online teaching of clinical skills	2 (6.1)	19 (57.6)	7 (21.2)	5 (15.2)	33	20.212*	.000	3 (1)
I enjoyed the online teaching strategies	3 (9.1)	22 (66.7)	3 (9.1)	5 (15.2)	33	30.879*	.000	3 (1)
I liked that I could engage in learning in my own space	12 (35.3)	17 (51.5)	4 (12.1)	NR	33	7.818*	.000	3 (1)
I enjoyed working a my own pace	16 (47.1)	14 (42.4)	3 (9.1)	NR	33	8.909*	.012	3 (1)
I found it easy to adapt to online teaching	3 (9.1)	19 (57.6)	10 (30.3)	1 (3.0)	33	24.091*	.000	3 (1)
Challenges experienced								
Unavailability of computer/smartphone	NR	6 (18.2)	21 (63.6)	6 (18.2)	33	13.636*	.001	2 (0)
Problems with internet/connectivity	8 (24.2)	21 (63.6)	2 (6.1)	2 (6.1)	33	29.182*	.000	3 (1)
Distractions during remote classes	3 (9.1)	13 (39.4)	16 (48.5)	1 (3.0)	33	19.727*	.000	2 (1)
Not enough time to complete learning objectives	1 (3.0)	4 (12.1)	25 (75.8)	3 (9.1)	33	45.909*	.000	2 (0)
Poor quality of media used by lecturers	NR	4 (12.1)	27 (81.8)	2 (6.1)	33	35.091*	.000	2 (0)
Overall Satisfaction								
I would recommend continued use of online strategies in the teaching of clinical skills.	7 (21.2)	14 (42.4)	11 (33.3)	1 (3.0)	33	11.485 ^b	.009	3 (1)

*Values are statistically significant (p<0.01).

Student perception of the effectiveness of online teaching strategies for Clinical skills

Table 3 shows, when questioned specifically about the use of online strategies in remembering, understanding and supplementing clinical skills with about two-thirds (66.7%-69.7%, with Median=1, IQR=1) perceived it to be only somewhat effective or not effective at all. The majority (87.9%, with Median = 0, IQR = 1) perceived it to be somewhat or not effective at all in acquiring clinical skills. In terms of the online strategies preparing them for their final clinical clerkship examination over three-quarters perceived it to be only somewhat effective (42.4%) or not effective at all (33.3%, with Median=1, IQR=2). All χ^2 values were found to be statistically significant (either $P < 0.01$ or $P < 0.05$) as indicated in Table 3 except for student perception of the effectiveness of online teaching in preparing for OSCE/Clinical clerkship examinations.

Table 3: Student perception of the effectiveness of online teaching strategies for Clinical skills

Item	Very Effective (%)	Effective (%)	Somewhat Effective (%)	Not Effective at all (%)	Total	Chi Squared (χ^2)	P value	Median (IQR)
Online Learning Environment								
Remember clinical skills	1 (3.0)	10 (30.3)	20 (60.6)	2 (6.1)	33	28.212*	.000	1 (1)
Understand clinical skills	1 (3.0)	9 (27.3)	20 (60.6)	3 (9.1)	33	26.515*	.000	1 (1)
Acquire clinical skills	NR	4 (12.1)	12 (36.4)	17 (51.5)	33	7.818**	.020	0 (1)
Supplement clinical skills	1 (3.0)	10 (30.3)	19 (57.6)	3 (9.1)	33	24.091*	.000	1 (1)
Self-study of clinical skills	7 (21.2)	7 (21.2)	18 (54.5)	1 (3.0)	33	18.273*	.000	1 (1)
Prepare for OSCE/clinical clerkship examinations	NR	8 (24.2)	14 (42.4)	11 (33.3)	33	1.636	.441	1 (2)

**Values are statistically significant ($p < 0.05$). *Values are statistically significant ($p < 0.01$).

Teachers

A total of 11 clinical teachers responded out of 15 which represents a response rate of 73.3%. The age range was 31- 52 years old with a mean of 43.91 ± 6.964 and 81.8% were male. The teachers were from a range of disciplines (Restorative Dentistry, Oral Diseases and Paediatric Dentistry) and had varying levels of years of teaching experience from 2 – 26 years with a mean of 15.18 ± 7.846 . The majority (81.8%) had formal training in online delivery before COVID-19. The Cronbach's alpha of the questionnaire was found to be 0.801 for the questionnaire.

Teachers' perception of the effectiveness of online teaching strategies

The teaching strategies employed by the teachers are given in Table 4 and in addition breakout room discussions, polls and asynchronous assessments. Only the PowerPoint χ^2 was found to be significant in Table 4 ($p < 0.01$). The teachers' perceptions of the effectiveness of online teaching strategies are given in

Table 5. Given the smaller numbers of teachers and responses the categories of strongly agree and agree were grouped and disagree and strongly disagree were also grouped for analysis. Overall the majority of teachers (72.7%-92.9%, with Median=4, IQR= 3 or 1 or 0) perceived that they created an enthusiastic online environment, effectively communicated with the students, engaged students in clinical reasoning and critical thinking and gave formative feedback. However, teachers were equally divided (50%, with Median=2.5, IQR=3) on whether or not they perceived that they prepared students to practice clinical skills. Also, 45.5% (with Median=4, IQR=3) did not feel connected with their students. Although the majority of teachers (72.7% - 81.4%, with Median = 4, IQR = 3 or 1) felt they had a conducive home environment, were adequately equipped and confident to deliver online teaching, nearly two-thirds did not perceive it be easy to adapt to online teaching (63.6%, with Median=4, IQR=3). (either $P<0.01$ or $P<0.05$) engaged my students in clinical reasoning, effectively gave formative feedback, confident in my ability to deliver online teaching, felt adequately equipped for online training

Table 4 : Teaching Strategies Employed by Staff

What online teaching strategies did you employ during the period of emergency remote teaching?	No (%)	Yes (%)	Total	Chi-Squared (χ^2)	P-value
Clinical videos (recorded at the UWI)	7 (70)	3 (30)	10	1.600	.206
Clinical videos (recorded by others e.g. YouTube videos)	4 (40)	6 (60)	10	.400	.527
Online simulations	6 (60)	4 (40)	10	.400	.527
PowerPoint presentation	1 (9.1)	10 (90.9)	11	7.364*	.007
Demonstration of skills by lecturer	7 (70)	3 (30)	10	1.600	.206
Virtual ward rounds/clinic visits	10 (100)	0 (0)	10	This variable is constant. χ^2 cannot be performed.	
Discussion of clinical cases	0 (0)	11(100)	11	This variable is constant. χ^2 cannot be performed	

*Values are statistically significant ($p<0.01$).

Table 5: Clinical teacher perception of the effectiveness of online teaching strategies

Item	Strongly Agree - Agree (%)	Strongly Disagree - Disagree (%)	Total	Chi-Squared (χ^2)	P-value	Median (IQR)
Online Learning Environment						
Created an enthusiastic/ stimulating learning environment	8 (72.70)	3 (27.3)	11	2.273	.132	4 (3)
Engaged my students in clinical reasoning	10 (90.9)	1 (9.1)	11	7.364*	.007	4 (3)
Engaged my students in critical thinking	8 (72.70)	3 (27.3)	11	2.273	.132	4 (1)
Effectively gave formative feedback	10 (90.9)	1 (9.1)	11	7.364*	.007	4 (0)
Felt connected with my students	6 (54.5)	5 (45.5)	11	.091	.763	4 (3)
Effectively communicated with my students during online delivery	8 (72.70)	3 (27.3)	11	2.273	.132	4 (1)
Prepared students to practice clinical skills	5 (50.0)	5 (50.0)	10	.000	1.000	2.5 (3)
Conducive home environment to deliver online teaching	8 (72.70)	3 (27.3)	11	2.273	.132	4 (1)
Easy to adapt to online teaching	4 (36.4)	7 (63.6)	11	.818	.366	4 (3)
Confident in my ability to deliver online teaching	9 (81.8)	2 (18.2)	11	4.455**	.035	4 (3)
Teaching online was enjoyable	7 (70)	3 (30)	10	1.600	.206	4 (3)
Felt adequately equipped for online training	9 (81.8)	2 (18.2)	11	4.455**	.035	4 (1)
Technical Support						
No or minimal connectivity issues	6 (60)	4 (40)	10	.400	.527	4 (3)
Safe and secure online teaching platform	10	NR	10	This variable is constant. χ^2 cannot be performed.		
Full technical support from the ICT staff	10	NR	10	This variable is constant. χ^2 cannot be performed.		
Overall Satisfaction						
Satisfied with online teaching of clinical skills	6 (60)	4 (40)	10	.400	.527	4 (3)

**Values are statistically significant (p<0.05). *Values are statistically significant (p<0.01).

Discussion

Prior to COVID-19, positive perceptions were reported by medical students to the use of online videos for clinical skills training [13]. Online strategies for clinical skills training have been shown to be effective adjuncts to face-to-face instruction in most medical education programmes [14]. Dental students' perceptions with regard to online learning were also positive [15]. The success of online learning depends on a number of factors such as ease of access for students and teachers, connectivity [16] and also the teacher expertise in online teaching and online content [17]. Despite the acceptance of online learning, it was not a major part of the dental curriculum in Trinidad. Our courses were not designed for online platform teaching and like many other dental schools in the same position, it is necessary to understand from the student perspective their views on this. Students' evaluation of their attitudes to online learning

is important for determining the success of any online learning system [18] and especially during this COVID-19 global pandemic.

In this study, students had positive perceptions of online teaching strategies delivered by the teachers in the dental school and felt connected to them. This is in agreement with other studies where positive perceptions were also reported amongst dental students before the COVID-19 pandemic [15,19,20]. However, this is in contrast to a recent study from Pakistan conducted on medical and dental students that showed overall 77% of students having negative perceptions towards e-learning during the lockdown and the majority preferred face to face teaching over e-teaching [21].

Most students in this study also found that online teaching strategies enhanced their clinical reasoning and critical thinking skills and would recommend continued use of online teaching. This was similar to findings from New York University College of Dentistry who concluded that e-learning may be used successfully in a dental school's curriculum to enhance students' learning especially in the clinical curriculum [20]. However, when it came to actually acquiring clinical skills 87.9% of our students found it to be not effective at all or only somewhat effective. This is in agreement with another study at Harvard School of Dental Medicine that also looked at students' perceptions on dental education during the COVID-19 pandemic. Most students felt that their didactic learning had not changed however a majority of students felt that their preclinical learning had worsened and similarly the clinical students also felt that their learning had worsened [22]. Dental students in Trinidad and at Harvard both have negative perceptions of the effectiveness of online teaching strategies when it comes to the acquisition of clinical skills in particular. Dentistry is unique in that it requires hands-on clinical training [22] and the suspension of direct patient care, which is a key component of the dental curriculum, is the biggest challenge in the COVID-19 pandemic [6].

The students' other main challenge was with connectivity/internet issues (87.9%) and this is similar to other studies where 82.1% of students felt unavailability of the internet was a learning barrier with high impact on them [23] and others that reported technical difficulties with low connection speeds and access [13,16]. Variability in student access to quality internet can compromise student achievements in remote learning, especially in developing countries [24].

The teachers also reported positive perceptions of the effectiveness of online teaching strategies in effectively communicating with students and engaging the students in critical thinking and clinical reasoning. Although the teachers felt confident and adequately equipped for online teaching, they still felt it was not easy to adapt to online teaching, despite over 80% of teachers having formal training in online teaching prior to COVID-19. However nearly half of the teachers did not feel connected to their students and only half perceived that they adequately prepared their students for clinical practice.

Students' perceptions are similar to teachers' perceptions in both being positive to the online teaching strategies but both groups reflected concerns over the acquisition of clinical skills. Manual dexterity and fine motor skills are skills that must be achieved by dental students and it is difficult to replace experience with patients with e-learning strategies [22,24]. Most dental schools in the US have suspended clinical

activity [6] and most European dental schools were considering postponing evaluation of clinical competency examinations and extending the programme dates rather than reduce the clinical requirements [9]. An important area moving forward would be the online use of dental simulation but it is a challenge in terms of resources [25] and expense [24] and also training pre-clinically on manikins is very difficult as the units are not portable to be used from home [24].

Students' perceptions differed to teachers' perceptions in that students felt more connected while teachers did not and also students felt it easy to adapt online while teachers did not perceive the transition to be easy. This could be due to the younger millennials (23-35 year olds) being more comfortable online than the older teachers (31-52 year olds).

When considering the impact of COVID-19 on dental education, reports on the current and future perspectives [7, 24 -27] all have raised varying aspects. As the COVID-19 global pandemic may continue for some time in the future and dental education may be interrupted from face to face activities, more e-learning strategies have to be utilised such as virtual patients with the simulation of real-life clinical scenarios as part of student training [26]. Also, virtual reality technology, which has been used in dental training for dental implants, maxillofacial and prosthetic surgery, may have to be developed for more mainstream use during the COVID-19 pandemic [25].

There are very few research studies in the literature of the students' perceptions on dental education during the global pandemic at present and the limitations in comparing to those may be due to differences in programme structure, learning environment, teachers' expertise in online teaching or culture [28].

Conclusions

Students' perceptions are similar to teachers' perceptions in that both are positive to the online teaching strategies but both groups reflected concerns over the acquisition of clinical skills. The effects of the pandemic are ongoing and may be long lasting. The challenge for dental education would be greater in developing countries like Trinidad to accomplish dental clinical training during a period of lockdown with limited resources. Non-clinical activities should be prioritized during the COVID-19 outbreak until clinical teaching can resume with an emphasis on student, staff and patient safety. While online teaching strategies have been found in this study to be well accepted by the students further research is necessary to examine if the required competencies are achieved.

Abbreviations

COVID-19: coronavirus disease 2019; WHO: World Health Organization; UWI: The University of the West Indies; CDC: Centre for Disease Control; MOH: Ministry of Health; DCTT: Dental Council of Trinidad & Tobago; PPE: personal protective equipment.

Declarations

Authors' contributions

SR devised the project and the main conceptual ideas. RR, SR and BS the survey instrument. SR, RR, NF, SS, PH and SG in data collection. BS and RR in data analysis. RR and BS drafting of the manuscript. All authors participated in the interpretation of data and revision of the paper. All authors read and approved the final manuscript.

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Ethics approval and consent to participate

Ethical approval has been granted by the Campus Ethics Committee of the University of the West Indies (CREC-SA.0434/07/2020) and all students and teachers provided written informed consent to participate in the study. **All methods were performed in accordance with the relevant guidelines and regulations**

Consent for publication

Not applicable

Availability of data and materials

The datasets of the current study available from the corresponding author.

Competing interests

The authors declare that they have no competing interests.

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