Original Article

Access this article online

Quick Response Code:

Website: www.jehp.net

DOI: 10.4103/jehp.jehp_1280_21

Attitude and perceptions regarding online teaching in dental undergraduate program during COVID-19 pandemic: A mixed method study

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Received: 29-08-2021
Accepted: 02-03-2022
Published: 28-09-2022

Abstract:

BACKGROUND: Transformation of education to virtual mode during COVID-19 pandemic was a major challenge for a clinical specialty like dentistry.

MATERIALS AND METHODS: A sequential explanatory mixed method was adopted with quantitative dominant design. A self-reported questionnaire on attitude and perceptions toward online learning were distributed among dental undergraduate students. The qualitative arm explored perceptions of online teaching among various stakeholders and thematic content analysis was performed.

RESULTS: A total of 141 responses were obtained, about 21% of them felt online classes to be highly useful and 78% felt it was moderately useful. About 80% of the students were satisfied with the online education. About 40% of participants felt internet connectivity was a frequent issue. The qualitative data analysis revealed five emergent themes of lecture content and delivery, instructional control, resource management, interaction, and evaluation exploring the perceptions of various stakeholders toward online learning and provided several insights.

CONCLUSION: Though online education cannot be compared to traditional education in a clinical specialty like dentistry, it does have its advantages and a portion of student learning can be conducted through this mode.

Keywords:

Covid-19, dental education, mixed method research, online learning

Introduction

The COVID-19 pandemic has transformed education rapidly by a shift to virtual mode of teaching. Dental education, which is predominantly a skill-based clinical training, had to be reformed, with the temporary closure of dental schools, clinics, and hospitals in response to the lockdown.[1] Remote teaching and evaluation of students were adopted, and this was a major challenge particularly in a clinical subject like dentistry.[2] One among the most important challenges in virtual education is the need to continuously adapt and adjust to the developments in technology and apply these to dental teaching practices. Dental education is mainly composed of three parts: the first is a Lecture/problem-based learning (PBL) where the focus is on theoretical aspects of dentistry. With the availability of different videoconferencing and education platforms, namely, ZOOM meetings, Google Classroom, Google meet,

How to cite this article: Ramanarayanan V, Karuveettil V, Ayoob A, Suresh R, Varma B, Janakiram C. Attitude and perceptions regarding online teaching in dental undergraduate program during COVID-19 pandemic: A mixed method study. J Edu Health Promot 2022;11:284.

and Skype, the transition was smooth. The second part is a simulation laboratory course. For this, traditionally, after demonstration by the instructor, the student practices using simulation models which require close contact between the instructor and student, and this is a challenge in the virtual mode. The third part is clinical skill training, which is the most important component of dental education. There will be close contact between the resident/intern doctor and the patient as well as the instructor, through which the trainee develops necessary skills to practice and handle patients independently. In the BDS curriculum, clinical training starts from their third year of study. In the first 2 years of study, the student completes his preclinical training in models. From the third year onwards until the completion of fourth year, the students treat patients strictly under the supervision of the faculty. Basic dental procedures like scaling, restoration, extraction, and replacement of teeth are undertaken by the BDS student. During internship, the students treat patients semiindependently and are encouraged to undertake advanced procedures like root canal treatment and complicated tooth removal under the guidance of the faculty. This three-way communication process and skill development is affected the most due to the prevailing pandemic situation.

The effects of the present online education scenario are profound and may forever change how future dentists are educated.[3] Understanding the "students' perspective" and incorporating their views is vital for administrators, instructors, and other policy makers as they reenvision dental education in a new reality. Students' appraisal of the study tools and value of online learning and evaluation of their attitudes are important factors that are essential to judge the success of any online learning system.[4]

Students and teachers are also influenced by other stakeholders like parents and administrative staff. Hence, it is essential to understand the dynamics of the online learning environments, the perceptions and preconceptions that exist, and how best to utilize the potential of the technology to overcome barriers to successful learning. Students need to be prepared for this changing demand related to online learning with respect to technology and learning. The shift from direct learning to virtual/remote learning in dental education has its own advantages and challenges. However, the literature regarding the same is limited to improving the learning experience and perform better evaluation.

The dental undergraduate students at a teaching institute in India were studied on their perception and attitudes about online learning, through a planned mixed method study. During the study, the perceptions of the faculty members, parents/guardians, and administrators were also explored regarding online education.

Materials and Methods

Study design and setting

A sequential mixed method explanatory study design was adopted for this study. [Figure 1] The quantitative arm was followed by the qualitative arm. Rationale for mixing of designs is for complementarity and development. Study setting was a dental school in the southern Indian state of Kerala. The institute offered both undergraduate and postgraduate courses in dentistry and had shifted to online mode of education due to the COVID-19 pandemic from May 2020. The study was initiated in April 2021 and was completed in 4 months.

Study participants and sampling

The study participants were dental undergraduate students (First year to final year BDS), parents, teachers, and administrators. The quantitative component of this study was conducted among the dental undergraduate students (first year to final year; both clinical and preclinical students) to assess their attitudes and perceptions regarding online education. The study was a census type survey where all BDS students were invited to participate in the study. The invitation was sent to the students through official communication channel of the dental school. This was followed by the qualitative arm which included a subset of students, teachers, parents, and administrators chosen by purposive sampling. An online invitation was sent to their individual mail through official communication channel of dental school. The data for qualitative component werecollected until data saturation, which is achieved when further data collection and analysis reveals no newthemes.[5]

Ethical considerations

Ethical approval was taken from the Institutional Review Board (ECASM-AIMS-2021-162 dated 23-02-2021), and an online informed consent was obtained from all participants.

Date collection tool and techniques

Quantitative arm

The study tool for the quantitative arm was a validated questionnaire developed by the Medical Education Unit of Amrita Institute of Medical Sciences.[6] The questionnaire was administered online through Google Forms. The questionnaire was a 20-item scale which explored the demographic details, preferences, attitudes, and satisfaction regarding online education. An open-ended question on their opinion to improve the online classes was also included to facilitate the development of themes for the qualitative study.

Based on the responses from the quantitative survey, the need to explore perceptions of different groups involved in student online learning was identified.

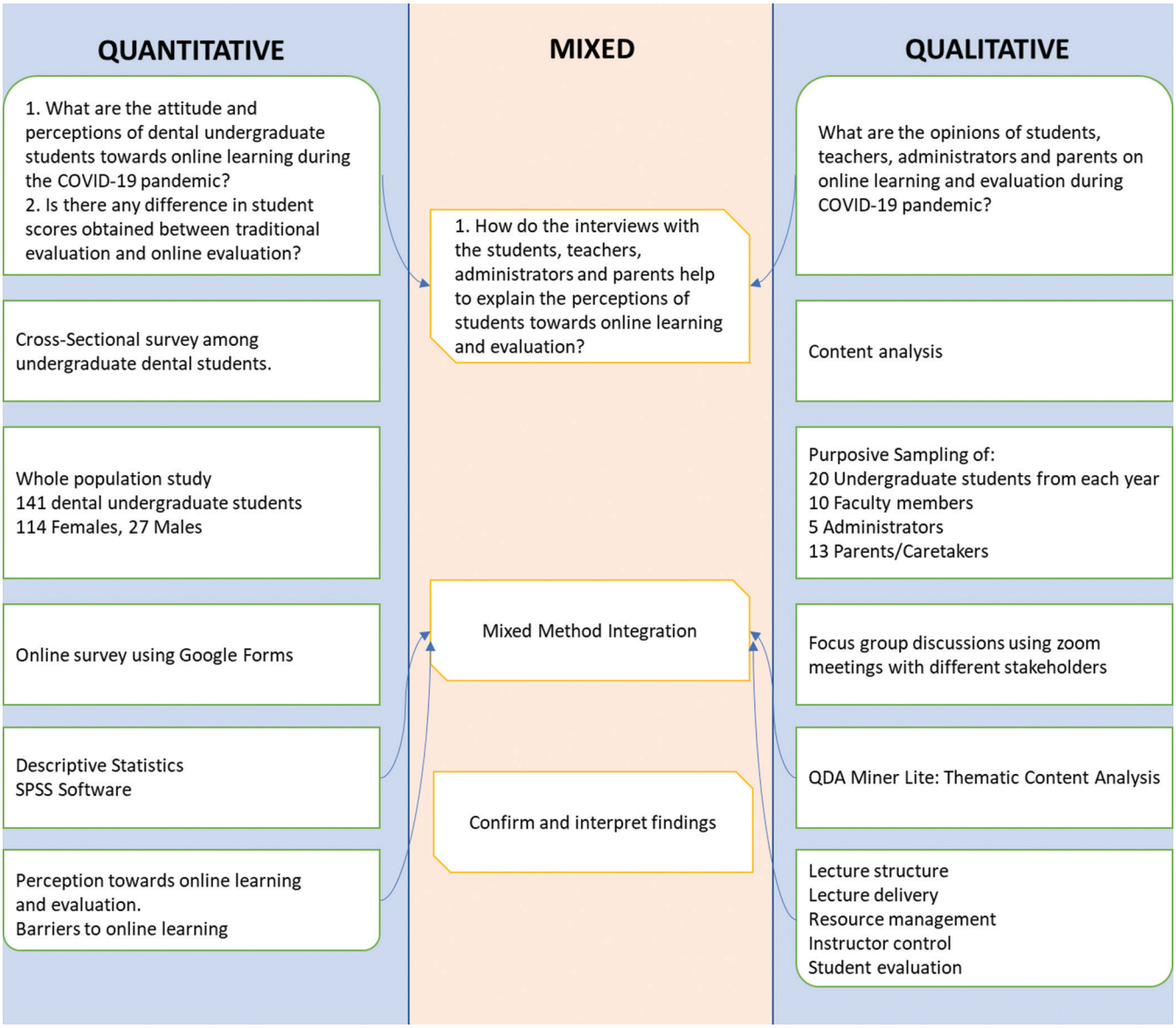

Figure 1: Mixed methods model using sequential explanatory design

Data analysis for quantitative arm

The obtained data were analyzed using SPSS Version 20 for Windows. Standard descriptive statistics were generated and reported in the form of frequency and percentages.

Qualitative arm

Following the quantitative arm, a qualitative arm was designed to explore the opinions of different stakeholders on online learning during COVID-19 pandemic. Purposive sampling was adopted to identify the participants for focus group discussion (FGD). Interviews were conducted in English language as per the preference of the participants. A total of Eight FGDs were conducted among undergraduate students (four), faculty members (two), parents/guardians (one), and administrators (one). The study tool was a semistructured interview guide prepared based on the results of quantitative study. The FGD was conducted online using Zoom platform, and the sessions were audio and video recorded. Each FGD had five participants except for FGD of parents, where 13 parents participated in the study. Each FGD was attended by study participants, investigators, and a note keeper, where each session lasted for about 45–60 min. Prior informed consent was obtained, and anonymity of data was promised.

Data analysis for qualitative arm

The qualitative data were converted into verbatim transcripts at the end of each session. New themes emerged, which were added to the guides for the subsequent FGD.Data collection was carried out till the achievement of saturation, which was the point at which no new themes emerged. Data were coded, categorized,

and themes were developed. Thematic content analysis was performed using QDA (Qualitative Data Analysis) Miner Lite Software. Data triangulation was done by two independent reviewers, and in case of any disagreement, a third reviewer was invited for consensus.

Integration of Mixed methods

The rationale for mixing the designs was complementarity and development. The quantitative data provided the themes to be explored for qualitative component, and both the results were reported and compared side-by-side.

Rigor

The quantitative tool of data collection was validated as a part of a previous study from the same institution.[6] For the qualitative component triangulation was performed by the collection of data from multiple sources (students, parents, faculties, and administrators). Coding, categorization, and development of themes were performed by two independent reviewers, and in case of any disagreement, an expert critique was invited to solve the same. Member checking was performed by sending the transcripts and study interpretations to students for approval, and suggested modifications were taken into consideration.

Results

Quantitative results

A total of 141 responses were obtained among which 81% were females. The distribution of study participants according to their year of study is given in Figure 2. Approximately 31% of participants belonged to final year, 29% belonged to third year, 26% in second year, and the rest in their first year of Bachelor of Dental Surgery course. About 80% of the study participants were aware about the concept of online classes prior to the year 2020 and approximately 75% were aware of any of the platforms for online learning. Recorded theory sessions were the most attended type of online learning, and YouTube (educational videos) was the most followed platform for online learning prior to 2020. After the introduction of online classes, most of the students (98%) attended lectures online followed by preclinical sessions (20%).

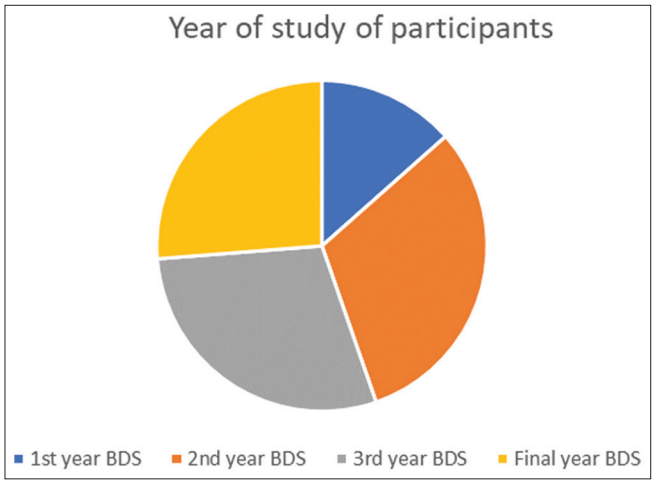

Figure 2: Distribution of study participants according to year of study

Table 1 gives the preferences of students toward various aspects of online classes. The preferred time for attending online classes from home was 8 am to 12 pm as opined by 68% of the participants and 10 am to 2 pm (29%). More than half of the study participants (56%) preferred a duration of 40 min for each online class (clinical and preclinical) and a 67% preferred a break of 15–20 min between classes. The preferred learning device was a laptop (72.3%) followed by a smartphone (22.7%).

Almost 95% of the study participants faced connectivity issues, 40% faced issues often. While 61% of study participants "sometimes" faced distractions at home, 31% never faced any such issues [Table 2]. Most study participants (72.3%) preferred seeing and interacting with the teacher during an online class.

In terms of interaction with classmates compared to attending classes alone at home, about 31% of them felt there was no difference, while the same number also felt it was not comparable. About 28% of them opined that it was worse.

About the online examination, 35% of participants felt that the concept was good and 20% of them felt it was not satisfactory. Comparison of online examination with

Table 1: Preference for online classes

Question	Response	*n* (%)
Preferred time	8 am to 12 noon	96 (68.08%)
	10 am to 2 pm	41 (29.07%)
	12 noon to 4 pm	4 (2.8%)
	2 pm to 6 pm	0 (0%)
Preferred duration of online lecture session	20 min	6 (4.3%)
	30 min	38 (27%)
	40 min	79 (56.02%)
	1 h	18 (12.8%)
Preferred duration of online practical session	20 min	6 (4.3%)
	30 min	37 (26.2%)
	40 min	76 (53.9%)
	1 h	22 (15.6%)
Preferred break time between classes	No break	4 (2.8%)
	10 min	27 (19.1%)
	15 min	56 (39.7%)
	20 min	38 (26.9%)
	>20 min	16 (11.3%)
Preferred device	Desktop	4 (2.8%)
	Laptop	102 (72.3%)
	Mobile	32 (22.7%)
	Tablet	3 (2.1%)

the traditional type in terms of effectiveness of testing knowledge showed that half of the participants felt it was equal, while 44% of the remaining felt it was inferior. About 60% of students faced connectivity issues but did not report of any other technical issues [Tables 2 and 3].

Based on their experience, close to 21% of the participants felt the online classes were highly useful, 7% felt it was least useful, and the rest felt it was moderately useful [Table 3]. On a query whether the participants would prefer to continue with online classes once the Covid-19 situation normalizes, 61% opined that in the negative. When the students were asked to rate their satisfaction of online classes on a scale of 1–10 (with 1 being not at all satisfied to 10 being highly satisfied), 80% of respondents gave a rating of 5 and above [Figure 3].

Qualitative results

Context defining

With the pandemic, the dental learning and evaluation was transformed into virtual mode in the dental school, with the students attending sessions from their homes. Faculty delivered the lectures through different online applications like Zoom meetings and Google Meet. Timetable was modified suitable to online lectures, and in-between breaks were allotted to the student considering their home environment. Preclinical training was undertaken with the aid of recorded videos and simulation models. Clinical training was suspended but case-based and problem-based learning strategies were developed to mimic the clinical scenario. A series of student evaluations was also conducted, where theoretical evaluation was performed by written exam. Protocols were in place for student monitoring to ensure a fair evaluation.

Based on the results from quantitative survey, focus-group guides were developed to probe into the mixed response on online learning among the present population. Preference for online education timing and devices, reasons for low student–student, student–teacher interactions were probed, and the difficulties faced by the student's during evaluation areexplored in-depth in the qualitative arm. Associated stakeholders (faculty, parents, and administration) were invited for the focus groups to elicit a better and deeper understanding to the observations. Additional themes also emerged during the FGDs.

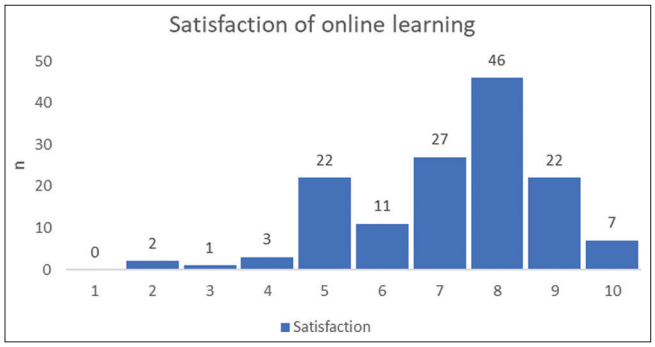

Figure 3: Satisfaction of online classes expressed on a 1–10 rating scale

Major themes

Lecture content and delivery

Certain modifications were needed in the lecture content to adapt to the online mode of learning. The lecture content was modified to problem-based questions and clinical case scenarios, thereby facilitating active discussion among students. Video demonstration was suggested to show machineries and procedures involved

Table 2: Perceived barriers to online learning and examination

Question	Response	*n* (%)
Do you face connectivity issues?	No	7 (5.0%)
	Sometimes	81 (57.4%)
	Yes	53 (37.6%)
Do you face distractions at home?	Always	2 (1.4%)
	Most of the times	9 (6.4%)
	Never	44 (31.2%)
	Sometimes	86 (61.0%)
Barriers faced during online examination	I had both connectivity and technical issues	21 (14.9%)
	I had neither connectivity nor technical issues	28 (19.9%)
	I had no connectivity issues but only technical issues	6 (4.3%)
	I had only connectivity issues but no technical issues	84 (59.6%)
	Not Applicable	2 (1.4%)

Table 3: Perceptions regarding online learning and online examination

Question	Response	*n* (%)
As compared to regular theory lecture, the importance of Power point as the teaching modality is	Equal	28 (19.9%)
	Less	5 (3.5%)
	Much more	75 (53.2%)
	Slightly more	33 (23.4%)
Attending an online theory lecture alone at home without the routine classmate interaction is comparatively	Better	13 (9.2%)
	Equal	45 (31.9%)
	Not comparable	44 (31.2%)
	Worse	39 (27.7%)
As per your experience so far, the concept of online teaching when compared to lecture hall teaching is	Highly useful	30 (21.3%)
	Moderately useful	101 (71.6%)
	Least useful	10 (7.1%)
In your opinion, the concept of an online examination is	Good	49 (34.8%)
	Not satisfactory	29 (20.6%)
	Outstanding	9 (6.4%)
	Satisfactory	54 (38.3%)
In your opinion, in terms of effectiveness of testing knowledge, how does an online examination compare with the conventional one?	Equal	71 (50.4%)
	Inferior	62 (44%)
	Slightly superior	8 (5.7%)

in dental practice. The duration of each lecture was to be decreased, and more revision classes were suggested for better learning. One of the major concerns of all the stakeholders including the parents of students were the lack of practical training. Dentistry being a skill-based course, students were missing the first-hand experience of demonstrations and practice of hand skills. Therefore, the balance between theory and practical learning was reported to be disturbed. Overall, there was an ambiguity around what sessions needs to be taught online and what is to be reserved to face-to-face learning.

"Balance between theory and practical's is very much disturbed." (*Dental Student Final year3)*

"If we have more case presentation, more of videos showing procedures so that we won't be losing touch with the clinical part." (*Dental Student Third Year 1)*

"For teaching to be virtual, we need to have proper guideline as what to teach online and what not to teach online." (*Dental Faculty 1)*

Lecture delivery

Power Point presentations were the commonly used method for delivering the lecture in both traditional learning and online learning. Because of the time schedule, the faculty reported to be more inclined to discuss the content of the presentation and felt they could not share their experiences or additional information with the students during online learning as opposed to traditional teaching. The faculty used multiple platforms like ZOOM, Google Meet, Jio Meet, etc., as per their preference, and there was a suggestion to use a common platform/centralized platform for lecture delivery by the students. Few of the advantages of online learning stated by students include better visibility of lecture content on the power point when viewed in their laptop when compared to projected slides. Ease of taking notes and better concentration was also reported. The pace of the lectures was reportedly faster in online education and the faculty opined that it was difficult to adjust the pace of lecture, as they could not effectively gauge the level of understanding of the students unlike in traditional classroom.

"Before seeing the Power Point used to be very difficult, now that we are much closer to the screen it is easier to take notes." (*Dental Student Final year 2)*

"We are more comfortable with the online time scheduling compared to our classroom schedule." (*Dental Student First Year 1)*

"I think the pace at which the chapters are covered is faster than when compared to classroom teaching." (*Dental Faculty 3)*

"When it comes to online mode, we are not able to see their faces, so sometimes we are finding it difficult to judge how much students have assimilated and adjust our pace of lecture accordingly." (*Dental Faculty 2)*

Resource management

The most important resource when it comes to online education is internet connectivity. The effectiveness of online classes is hugely dependent on seamless internet connection. Students residing in rural and remote areas where internet connectivity is comparatively less, and where power failures were frequent, reported their learning to be interrupted. Faculty also reported connectivity issues affecting the quality of the lectures. The students also reported their electronic devices getting heated up due to continuous day long classes, which also required higher data usage. There was suggestion from students and faculty to arrange a platform where the lecture videos could be recorded and accessed at student's convenience to overcome connectivity issues.

The coordination in lecture scheduling was reported to be satisfactory among all stakeholders. When analyzing the additional cost of education in the current setting, the students of this study population could afford laptop and data charges for the online learning. Regarding manpower management, faculty reported good coordination among themselves and there was no disruption of classes due to nonavailability of instructors. Technical support in facilitating online lectures and conducting evaluation needed to be improved, as there were no specialized technical team available to solve technical glitches. Training of faculty in latest educational platforms was suggested to improve the quality of online lecture delivery.

"In terms of connectivity issue, it's a huge factor in determining how efficient online classes are for students." (*Dental Faculty 5)*

"What we are lacking is the resources. Most of us must attend the classes on phone and attending the same for a full day from 9 to 4 is difficult. Our devices get heated up and sometimes it just hangs." (Dental Final Year Student 3)

"The co-ordination between the dental administration office, Departments and students was excellent." (*Dental Administrator 2)*

"We need training on what are the latest features available for lecture delivery, what are the common glitches that can happen during a lecture and how to overcome the same." (Dental Faculty 2)

Instructional control

Unlike classroom teaching where the faculty could personally monitor each student, online teaching did not provide this advantage. Though video conferencing

platforms were used for lecture delivery, the number of "faces" that the instructors could see live on their screens were limited. Therefore, despite students being instructed to keep their video turned on during sessions, individual monitoring was a challenge. One of the advantages of online learning was the possibility of parental monitoring, as students attended the classes from home. Majority of parents could monitor their learning and reported to be actively involved in facilitating a conducive learning environment for their wards. There was also a suggestion from the faculty to initiate small group learning to ensure proper and effective monitoring.

"I think parental involvement in education has improved a lot. We are seeing our wards attending the classes and we could monitor them." (*Dental Students' Parent 3)*

"Maybe smaller batches of students would make monitoring easier."*(Dental Faculty 7)*

When it comes to student engagement, parents and faculty reported that the students were enthusiastic to learn during the early days of online learning, but over time they could notice a decreased in interest toward learning. It was felt that home environment played a major role with some students finding it difficult to concentrate for a long time while being at home. To improve interaction, faculty resorted frequently asking questions and initiating discussions.

"We ask more questions in between to maintain their attention." (*Dental Faculty 8)*

"The student interest in learning has decreased as they are spending a long time on their laptops." (Dental Student Parent 9)

"I think since the students are present in their person space during online lecture it is very difficult to maintain their attention." (*Dental Faculty 3)*

Interaction

It was opined that a definite decline in student–teacher interaction was noted in the online mode of learning. Few of the techniques suggested by faculty to improve student–teacher interaction was to call out names of the students during the lectures and ask questions instead of nonspecifically asking questions, giving small breaks between sessions, or by giving questionnaires in between session. With online learning being relatively new in dental education, it was felt that feedback was very important to understand and improve the quality of education. There was no provision to record student feedback after each lecture, which the faculty felt needed to be adopted into the learning process. One of the advantages of online learning as reported by students include approaching the faculty even after working hours for clearing doubts. As most of faculty shared their personal contact numbers and emails with students, they found this to be effective in clearing their doubts.

"I think many of the students are very hesitant when it comes to asking doubts or giving any feedback during the lecture time as compared to the class." (*Dental Faculty 3)*

"So, I am a person who need extra push from the teacher." (*Dental Student Final Year 3)*

"Also, in college after 4'o' clock we do not have access to faculty, but now we can contact the faculty, any time after the college." *(Dental Student Second Year 2)*

According to multiple stakeholders, student–student interaction where group dynamics or discussions which bring about better student outcomes had decreased considerably during the online mode of learning. Some students who required additional support and encouragement from their peers in the form of group learning or "combined studies" reported to being affected. The faculty also noticed a decreased interaction among students during online group discussions where only few students participated actively.

"Group dynamics or discussions all those which actually brought up a better student in you has decreased." (*Dental Third Year 4)*

"I need an extra push from the study circle, and I am unable to participate in combined studies during this online learning." *(Dental Student Second year 1)*

Evaluation

Two of the major concerns while conducting a written online exam were connectivity issue and ensuring fairness of the exam. Students suggested viva voce, open book examination, or online MCQs for better evaluation. To ensure fairness of the exam, guidelines were developed wherein seating arrangements and instructions to report to the faculty, in case of network failure, were intimated. Students were finding it difficult to follow these guidelines due to connectivity issues. Evaluation of the papers by faculty was also timeconsuming as they had to grade the answer sheets viewing it digitally. There was also concern from all the stakeholders regarding an effective way to conduct practical examination, which was very difficult in the current scenario.

"Regarding online exams, I personally feel viva will be a good way to conduct the exam. The faculty asks the question, and the student has to immediately answer wherein there is no way a student can refer to book or anything." (*Dental Student Final Year 5)*

"Smaller assessment that can be evaluated immediately during the online session will be of more help." *(Dental Student Third Year 2)*

"Only thing is we could not conduct the practical exam because they are all skill based." *(Dental Administrator 1)*

"We are also beginners in online examination. Any examination there is a competition between the person who is trying to cheat and the invigilator. The odds are more towards the former in online examination." *(Dental Faculty 6)*

Meta-Inferences

Assessment of fit of quantitative and qualitative data in the domain of lecture content and delivery confirmed student preference for short lectures. Preference for laptops in quantitative arm was explained via focus groups among the students, to be a result of better visibility and ease of note-keeping. Distractions at home and connectivity issues were the major barriers to continuity of learning as confirmed in both arms by the students.Similarly, need for breaks were beneficial to improve interaction and concentration during lectures as suggested by student focus groups. Student–student interaction and student–teacher interaction received mixed responses, and this discrepancy was explored in the focus groups among students and faculty. The qualitative data from student focus groups revealed that the domain of interaction is very subjective and can differ from person to person validating the contradictory responses. In student evaluation, even though the quantitative data reported satisfactory scores for the evaluation process adopted, qualitative data revealed issues related to connectivity being a major hindrance to smooth conduct of online evaluation from student focus groups. Even though evaluation was found to be satisfactory for majority among quantitative survey, FGD revealed technical issues and questionable fairness of exam to be reasons for student and faculty being not satisfied with the online evaluation. Alternate methods of evaluation in the form of Multiple Choice Questions and viva voce were suggested by the student focus groups. [Figure 4]

Discussion

COVID-19 has been a watershed moment for dentistry.[7] Dental education among others also witnessed a radical change to cope up with the demands of engaging the students during the lockdown. Dentistry, typically a high-risk profession as far as spread of COVID-19 is concerned, was restricted to providing only emergency care to patients.[8] Dental schools across the globe had to be shut in response to the imposed lockdown, which disrupted the clinical experience of students and forced the schools to adopt virtual mode of teaching.[9] Being a skill-oriented profession, dental education relies on the traditional in-house training and the sudden shift to virtual mode was a challenge to dental educators.

The CDC issued guidelines for the reopening of higher educational institutions based on risk categories. Based on the risk profile, activities in dental schools could be considered involving "low risk," "more risk," and "high risk."[10] Hence, it was considered risky to reopen dental schools for in-house education when the pandemic was at its peak.

India has around 300+ dental schools which are dental safety net providers.[7,11] However, they had to be shut down and dental education was suspended from March 2020 in what could be termed as one of the biggest lockdowns a country has imposed. Within a few days into the lockdown, with no immediate end in sight of COVID-19, the apex body for dental education in India (Dental Council of India) called for the introduction of online teaching.

Several schools adopted various modes of virtual teaching. Most schools adopted delivery of lectures through online video conferencing platforms like Zoom, Google Meet, Microsoft Teams, and the like, while few other preferred online education platforms like Moodle.[2,8] This was also followed using virtual technology to conduct assessments and examinations.

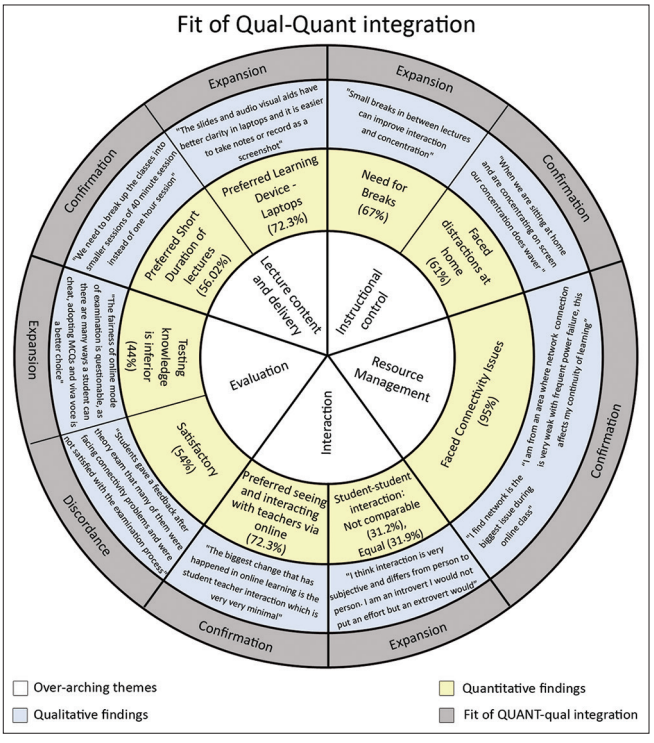

Figure 4: Comparison of quantitative with qualitative responses and fit of Quant-qual integration

This paradigm shift in mode of delivery of education was challenging for all stakeholders, which include students, educators, parents, and administrators. This study was conducted in one of the premier dental schools in the country as an in-house evaluation of virtual/online mode of education among the stakeholders. While there have been many studies published recently assessing the effectiveness of online dental education, majority of them have been quantitative in nature involving either students or educators. This study in addition to the quantitative appraisal of the attitude and perceptions of students toward online education also focuses on understanding the same from the perspective of various other critical stakeholders, namely, parents, educators, and administrators through a qualitative approach.

Most of the students in the present study (80%) were aware of online teaching platforms prior to the pandemic. A similar study isconducted among medical students in the same institution reported that 60.2% were had prior knowledge of online classes.[12] Another study in USA reports that almost 75% of students had completed at least onecourse online prior to the pandemic, suggesting that students were comfortable with the use of virtual technology.[9]

The institution adopted an online evaluation where the students attempted the examination under the continuous monitoring of educators through a camera. After the completion of the exam, the students were required to scan and mail the answer sheets to the dental schools. During the FGD, few students opined that while they faced network issues, they could not be monitored, and this raised a concern among the invigilators. The process of scanning the answer sheets and mailing it also took, which raised suspicion among the invigilators of any malpractice. One of the faculty admitted that the online monitoring and evaluation was not fool proof. There was a mismatch on perceptions toward online examination between quantitative and qualitative arm, where in-depth probing with follow-up questions led to students being more comfortable to share their thoughts on the sensitive topic of student examination and monitoring. Conducting a structured online examination is a challenge, and the use of proctored educational software is recommended. It is believed that online proctored examinations being monitored from a remote location with measures taking to ensure no fraud occurs provides effectiveness, efficiency, accuracy, and more importantly integrity in examinations.[13]

Another concern raised by students was the delay in receiving grades for the exams conducted. This could have probably happened due to the delay in "getting used to" the system of online paper evaluation and grading among the educators. There was also a call for conducting more viva voce sessions as a method of evaluation as it ensures more fairness. In a study conducted in Jordan, more than half of the students were not satisfied with online mode of evaluation compared to 20% in the present study.[14]

One of the emergent themes during the FGDs were the changes in lecture structure. Lack of practical training was a concern expressed by all including the parents. To mimic the clinical scenario, the lecture content was modified to involve problem-based learning and case scenario discussions especially among the clinical specialties. A study suggested to shift teaching strategies from didactic traditional teaching and recommended a combination of other methods, and students found videos to be the most effective followed by questions, PBL, discussion, case study lecture, power point presentation, quiz, group work, role play, and debate, successively, to change the direction from gaining knowledge for critical thinking and clinical reasoning and making the whole learning experience more interesting, interactive, and effective.[15] Dental training schools across the world have adopted dental mannequins or clinical simulators for preclinical activities and clinical training.[1] They, however, are very expensive and dental schools in India are yet to use this technology.

A major disadvantage to the shift to online mode was the connectivity issues. In a huge developing country like India, high-speed internet connectivity is not available in all regions. Internet connectivity and bandwidth issues have been reported routinely in literature.[12,16–19] However, educators reported that all technical support was available from the institution for conducting online classes.

Laptops were the preferred device for learning followed by smartphones in this study.Similar studies conducted on online education showed similar preference of laptop as a learning device followed by tablets and smartphones,[12,20] while a study conducted in Pakistan reported the use of smartphones as a popular device for online education.[21] Since students were already using laptop for their routine academic activities, parents did not report of any additional financial burden incurred as a part of online learning.

Instructor control is key to delivering lectures. Compared to face-to-face teaching, instructor control was compromised during online teaching because the educator could not monitor every student on screen. To overcome this problem and enhance student–teacher interaction, small group teaching was proposed by the faculty. Parent involvement in the education was higher during online teaching as students were confined to the comfort of their homes. Student–teacher interaction

and student–student interaction havebeen reported to be less in this study. This is a major drawback of online learning as stated by a nationwide survey in Chinese dental colleges.[22]

In the present study, close to 61% of the students responded in the negative when enquired about their preference to continue with online education post the pandemic. However, educators believed in future a combination (hybrid) of online and offline teaching needed to be developed and curriculum changes effected accordingly. Contrasting views were echoed among students and lecturers in Germany who strongly suggested continuation of online learning.[20]

To the best of our knowledge, this is the first study to have explored the perception of online education using a mixed methods approach. The strength of the study is in its inclusiveness of various stakeholders who are vital cogs in the wheel of education. For some domains/themes, contrasting views were obtained from various stakeholders contributing to the richness in data.

Limitation and Recommendations

Though the study has its limitation in being restricted to only a single institution, we feel the situation was similar among other dental schools at least within the country. Even though online education cannot replace traditional education in a clinical speciality like dentistry, it does have its advantages and in future a portion of student learning can be conducted through this mode.

Conclusion

The present study indicated that majority of students felt that online education was useful and were satisfied. Preference of time duration and breaks between classes varied among students. Online examination was one area which needed improvement. Engagement with all stakeholders like students, faculty, parents, and administration using a qualitative approach provided useful insights. The reported advantages of online education include learning from a comfortable environment, more time for leisure activities, and better pace of learning; limitations like technology constrains, lack of interaction were most reported. Training of faculty for adoption of latest advances in the learning management system and evaluation is suggested.

Acknowledgments

We would like to thank all the students, teachers, parents, and administrators who shared their honest experiences with online education. We would also like to express our gratitude to Medical Education Unit of Amrita Institute of Medical Sciences for their support to this study.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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