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RESEARCH ARTICLE

Dental Students and Faculty Perceptions of Teaching Methods: Traditional Classes, Online Virtual Classes, and Recorded Lectures

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Abstract:

Background:

Rapid advancement in technology has provided alternatives to traditional classroom teaching. Such instructional methods have gained increasing importance during the COVID-19 pandemic when physical classroom attendance was not possible. The study evaluated faculty's and students' perceptions concerning the online virtual classes and recorded lectures as compared to traditional classes delivered at the College of Dentistry, King Saud bin Abdulaziz University for Health Sciences.

Materials and Methods:

Surveys were developed and distributed to 34 faculty members and 186 students. Perceptions about virtual classes, recorded lectures, physical attendance, the effectiveness of different teaching methods, and overall experience were evaluated. Descriptive statistics were presented using frequencies and percentages. The Chi-square test compared the students' and the faculty members' responses. The level of significance was set at $\alpha = 0.05$.

Results:

Thirty-one faculty members and 149 dental students participated, and the overall response rates were 91.2% and 80.1%, respectively. While there was a general agreement on the usefulness of making recorded lectures available, a statistically significant difference ($p < 0.001$) was found between students' and faculty members' views on making classroom-lecture attendance optional (67.1% of students and 12.9% of the faculty agreed/strongly agreed). Statistically significant differences ($p < 0.001$) were found between the students and faculty members concerning the effectiveness of recorded lectures and attending online virtual classes as an alternative to classroom attendance.

Conclusion:

Overall, students were more accepting of technology than faculty members as a substitute for traditional classroom teaching. For a more efficient and satisfactory learning experience, both teaching methods should be considered in a blended-learning module.

Keywords: Dental education, Dentistry, Students, Teaching methods, E-learning, COVID-19.

Article History

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1. INTRODUCTION

In this era, where most college students were born in a time of rapid technological advancements, one may question whether the traditional classroom-based lectures still play a

role in students having an effective and satisfactory learning experience. Dental schools around the world are increasingly providing online educational resources to their students, whether as a supplement or as a substitute for traditional face-to-face learning that takes place in a classroom environment. Some of the commonly used resources are e-learning or Learning Management Systems (LMS), web-based courseware and lecture recording technologies [1 - 3]. Dental education is unique in that it requires students to acquire knowledge,

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clinical skills and professional behaviors in order to become competent and safe health professionals [2, 4]. Hence, the undergraduate dental curriculum is designed to prepare students to achieve this by integrating theoretical learning with preclinical and clinical training [5]. Didactic teaching plays a major role in the acquisition of knowledge during early (preclinical) years of dental school; however, hands-on training and clinical practice become more important during the later (clinical) years of dental education for gaining skills and behaviors [2, 4, 5]. While online and e-learning tools can be useful for didactic learning, they can be challenging for pre-clinical and clinical learning [2].

The literature presents varying views regarding how students and faculty accept alternative learning strategies as compared to traditional lectures and how these impact students' learning and their academic success. Online learning is becoming more appreciated by students because of its convenience and flexibility, offering access to educational materials anytime and anywhere [6 - 8]. Several studies have evaluated dental students' perceptions regarding web-based delivery of didactic material for different courses in undergraduate curricula [7, 9 - 12]. These studies reported students' positive attitudes and satisfaction concerning web-based learning. Moreover, students believe that viewing recorded lectures either in audio or video formats of the materials that are given in a classroom setting aids their performance, concomitantly reducing academic anxiety and improving the quality of their learning experience [13 - 15]. It also lowers students' stresses, especially when reviewing the recorded materials of unattended lectures [16, 17].

Despite the seemingly positive students' perceptions toward the availability of recorded lectures and other learning materials, it is still a matter of ongoing debate at the teaching institutions and faculty level. Accessibility to such educational resources requires expensive software in addition to the cost of technical support and training of faculty members, as some of them are unfamiliar with such technologies, consequently unwilling to include them in their teaching, while others are concerned about copyright issues, or that such resources may encourage students' unexcused absenteeism, subsequently impacting students' academic performance [18, 19].

The COVID-19 pandemic has resulted in drastic changes in all life aspects, including the delivery of higher education [20 - 23]. Preventive measures taken by governments, including social distancing and schools' closure, had precluded face-to-face teaching and led to the switch to remote education either by giving students access to previously recorded lectures or by conducting online virtual classes [20 - 23]. Understanding the perception of students and faculty members toward various instructional method will allow us to identify opportunities for optimizing training and facilitating the effective use of these technologies.

The aim of this study was to evaluate students' and faculty members' perceptions toward the online teaching methods (virtual classes and recorded lectures) implemented during the COVID-19 pandemic for the didactic part of the curriculum, and compare them to lectures given in traditional classrooms during the pre-pandemic period.

2. MATERIALS AND METHODS

2.1. Overview

The dental curriculum in Saudi Arabia is composed of six years of study followed by a one-year of internship training program. At King Saud bin Abdulaziz University for Health Sciences (KSAU-HS), the dental curriculum comprises two stages: pre-professional and professional. The pre-professional stage is a two-year program offered by the college of science and health professions which mainly consists of several English language courses, natural science subjects, and other courses. The professional stage of the curriculum is offered by the college of dentistry and consists of four years of study (D1-D4). The first two years (D1 and D2) mainly focus on the acquisition of basic knowledge and skills related to the practice of dentistry. The main instructional methods are lectures and practical sessions offered in the simulation and preclinical laboratories, along with some clinical sessions that are offered in the later stages of the D2 level. The later years of the curriculum (D3 and D4) are mainly clinical in nature. Along with that, other instructional designs also exist, such as lectures, case-based seminars, and group discussions. The representation of the didactic part of the curriculum tapers down as students progress through each year of study, and it is as follows; D1 (0.75), D2 (0.59), D3 (0.47), and D4 (0.10).

The College of Dentistry at KSAU-HS has early adopted digital technologies to enhance undergraduate DMD students learning and their educational development. This included the Blackboard learning management system and lecture capture technology using the MediaSite platform (<https://mediasite.com>). Since fall 2015, all lectures given to undergraduate students in the DMD program were recorded unless a faculty member chose to opt out in advance, and subsequently, he/she was granted approval by academic affairs. The formats of lecture capturing include a video recording or audio recording over presentation slides. The lecture-capturing process is automated and managed by the IT department, thus no additional time is required by lecturers. The recordings are posted to students on the Blackboard together with other educational materials after the class. As per the College of Dentistry policies, lecture attendance is mandatory, and students are aware that they will not be eligible into the final exam if they failed to attend at least 75% of the lectures.

Before the COVID-19 pandemic, the didactic component of all courses was delivered using traditional classroom lectures. One week after the suspension of physical attendance of students at the university campus, the College of Dentistry implemented a virtual learning strategy using Blackboard Collaborate supporting the online virtual classroom environment. In several courses, pre-recorded lectures from previous years were posted to students on the Blackboard as a substitute for virtual live lectures. This option was selected by faculty members who preferred to use previous recordings of their lectures because there was no change in their learning materials.

2.2. Data Collection

The ethical approval for conducting the study was obtained from the Institutional Review Board at the King Abdullah International Medical Research Center-KAIMRC (RC20/275/

R). This questionnaire-based survey was conducted at the College in May 2020. The study sample consisted of dental students from the second and third DMD years (n = 186) and faculty members (n = 34). The data were collected using two electronic surveys developed by the research team, one for students and another one for faculty members; some questions have been adopted from published articles [24, 25]. The surveys were sent to the participants through Blackboard platform announcement. The student survey (eight closed-ended questions) focused on students' perceived benefits from attending traditional classes, online virtual classes, and lecture recording. Also, students were asked about their opinion on mandatory lecture attendance and whether captured lectures should be a supplement or substitute to attending live lectures. The faculty's survey (eight close-ended questions) explored faculty members' experience and concerns about online virtual lectures and lecture recording, and their opinion about utilizing such technologies as a substitute for traditional face-to-face lectures. The faculty survey was designed to match with the student survey where possible, so that faculty's and students' perspectives on specific issues could be compared. Participation in both surveys was optional, and the responses were kept anonymous. All participants provided their informed consent before completing the online questionnaire.

2.3. Statistical Analyses

All analyses were carried out using SAS version 9.4 (SAS

Institute, Cary, NC, USA). All variables, including demographic characteristics of participants and their perceptions toward different teaching methods, are presented as frequencies and percentages. The Chi-square test compared perceptions toward different teaching methods between students and the faculty. On the advice of the statistician, the five-point Likert scale items used in this survey were converted into three-point item scales by combining (strongly disagree & disagree) and (strongly agree & agree) and keeping (neutral) as it is. The level of significance was set at $\alpha = 0.05$.

3. RESULTS

3.1. Participants

Out of 186 dental students, 149 completed the survey with a response rate of 80.1% (73 males, 76 females). Of all, 61.7% of the participants were second-year dental students. Nearly half (49.0%) of the students had a GPA between 4.0 to 4.5 out of 5. The distribution of students' responses is presented in Table 1.

With respect to faculty members, 31 out of 34 participated in the survey with a response rate of 91.2% (13 males, 18 females). Faculty members' responses are presented in Table 2. The majority of them (74.2%) agreed to record their teaching materials and post them for students. The preferred recording format was voice-over PowerPoint slides (51.9%).

Table 1. Responses of dental students towards the perceived value of different teaching methods.

Statements		Responses N (%)				
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
-						
The availability of recorded materials is beneficial for your education		110 (73.8)	24 (16.1)	8 (5.4)	4 (2.7)	3 (2.0)
Given the availability of the recorded materials, classroom attendance should be optional		64 (42.9)	36 (24.2)	27 (18.1)	16 (10.7)	6 (4.0)
If the classroom-lectures are canceled, the availability of the recorded materials is adequate		68 (45.6)	57 (38.3)	9 (6.0)	12 (8.0)	3 (2.0)
Attending classroom-based lectures is an effective learning method		30 (20.1)	67 (45.0)	40 (26.8)	7 (4.7)	5 (3.4)
Attending virtual interactive online lectures is an effective learning method		49 (32.9)	68 (45.6)	24 (16.1)	8 (5.4)	0
Which statement best describes your perception toward recorded materials		Recorded material can be used as a supplement for attending lectures. 82 (55.0)			Recorded material can be used as a substitute for attending lectures. 67 (45.0)	
Benefits of viewing recorded materials when the lectures were given in classroom setting (choose all applicable answers)	Watch at any time of the day	Pause to check some information	Review the material for exam preparation	Convenient when attending a lecture was not possible	A better understanding of difficult topics	Less distraction compared to classrooms
	124 (83.2)	126 (84.6)	102 (68.5)	87 (58.4)	70 (47.0)	79 (53.0)
Reasons for attending classroom lectures when the recorded material are available (choose all applicable answers)	Attendance is mandatory	Out of routine	Get the opportunity to ask questions.	Social interaction with my colleagues	A better understanding of the studied material	
	79 (53.0)	25 (16.8)	89 (59.7)	69 (46.3)	54 (36.2)	

Table 2. Faculty members’ perception regarding the perceived value of different teaching methods.

Statements	Responses N (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
-					
The availability of recorded materials is beneficial for students’ education	14 (45.1)	11 (35.5)	3 (9.7)	2 (6.5)	1 (3.2)
The availability of recorded lectures affects students’ attendance in the classroom	11 (35.5)	13 (41.9)	3 (9.7)	4 (12.9)	0
Given the availability of the recorded materials, classroom attendance for students should be optional	1 (3.2)	3 (9.7)	1 (3.2)	11 (35.5)	15 (48.4)
If the classroom-lectures are canceled, the availability of the recorded materials is adequate	0	3 (9.7)	3 (9.7)	17 (54.8)	8 (25.8)
Attending virtual interactive online lectures is an effective learning method	0	4 (12.9)	5 (16.1)	18 (58.0)	4 (12.9)
-	Extremely difficult	Difficult	Neutral	Not difficult	Not difficult at all
How would you rate your experience with giving an interactive online session through blackboard	0	7 (22.6)	8 (25.8)	12 (38.7)	4 (12.9)
Which statement best describes your perception toward recorded materials	Recorded material can be used as a supplement for attending lectures. 29 (93.5)		Recorded material can be used as a substitute for attending lectures. 2 (6.5)		
Are you concerned about the copyrights of your lectures being recorded and posted on Mediasite	Concerned 11 (35.5)		Neutral 13 (41.9)	Not concerned 7 (22.6)	

3.2. Availability of Recorded Materials and Classroom Attendance

The majority of faculty members (80.6%) and students (89.9%) agreed that the availability of recorded materials is beneficial for the students’ education (Table 3). At the same time, over 77.0% of the faculty believed that the availability of recorded lectures will negatively impact students’ attendance of the classroom lectures (Table 2).

When faculty members and students were asked about their

opinion regarding the physical classroom attendance with the availability of recorded materials, there was a significant difference found in their responses ($p < 0.001$). Most of the faculty (83.9%) thought that lecture attendance should be mandatory, whereas more than half of students (67.1%) believed that the lecture attendance should be optional (Fig. 1, Table 3). Furthermore, 93.6% of faculty and 55.0% of students believed that recorded materials could be used only as a supplement to classroom attendance rather than its substitute ($p < 0.001$) (Fig. 2, Table 3).

Table 3. Students’ and faculty members’ perceptions of different education methods.

Statements	Levels	Faculty n =31	Students n = 149	p-value #
The availability of recorded materials is beneficial for students’ education	Agree	25 (80.6)	134 (89.9)	0.259
	Neutral	3 (9.7)	8 (5.4)	
	Disagree	3 (9.7)	7 (4.7)	
Given the availability of the recorded materials, classroom attendance for students should be optional	Agree	4 (12.9)	100 (67.1)	<0.001**
	Neutral	1 (3.2)	27 (18.1)	
	Disagree	26 (83.9)	22 (14.8)	
If the classroom lectures are canceled, the availability of the recorded materials is adequate	Agree	3 (9.7)	125 (83.9)	<0.001**
	Neutral	3 (9.7)	9 (6.0)	
	Disagree	25 (80.6)	15 (10.1)	
Attending virtual interactive online lectures is an effective learning method	Agree	4 (12.9)	117 (78.5)	<0.001**
	Neutral	5 (16.1)	24 (16.1)	
	Disagree	22 (71.0)	8 (5.4)	
Which statement best describes your perception toward recorded materials	Supplement to classroom lectures	29 (93.5)	82 (55.0)	<0.001**
	Substitute to classroom lectures	2 (6.4)	67 (45.0)	

Chi-square test.

** Statistically significant at $\alpha = 0.05$.

Students perceived several benefits of attending classroom lectures compared to recorded materials, such as having an opportunity to ask questions, mandatory attendance allowing social interaction with their peers, and a better understanding of learning materials. The most common reasons for viewing the recorded lectures were the ability to pause to check some

information, watch it at any time of the day, review the material in preparation for exams, convenience when attending lectures is not possible, less distraction compared to classroom-based lectures and facilitating a better understanding of difficult topics (Table 1).

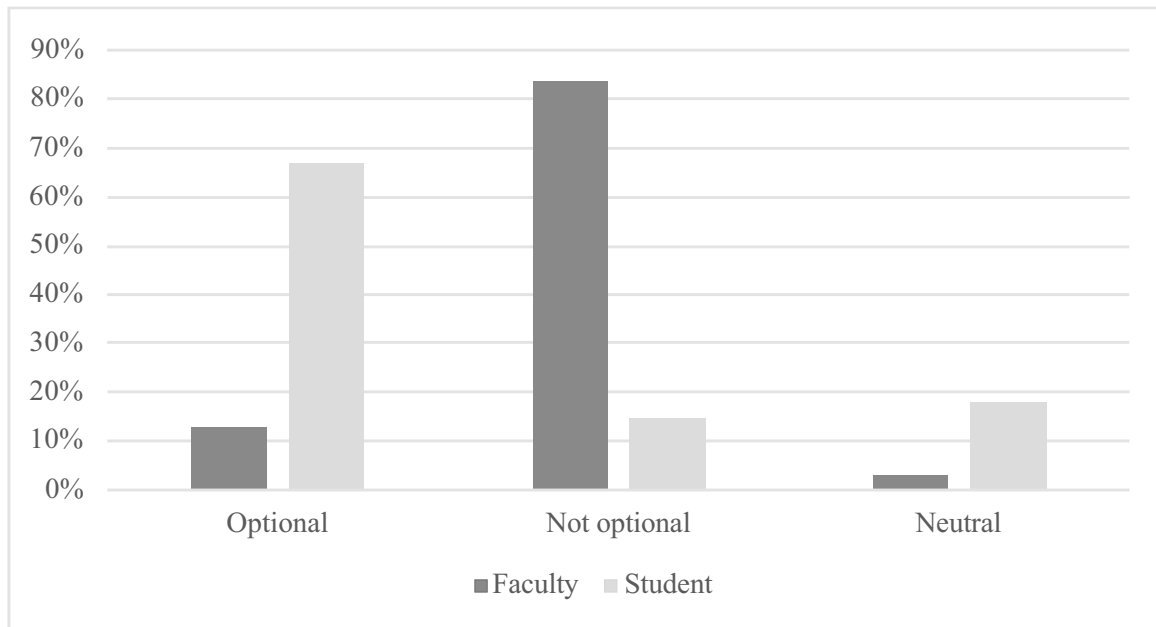


Fig. (1). Perception towards physical classroom attendance (faculty vs. students).

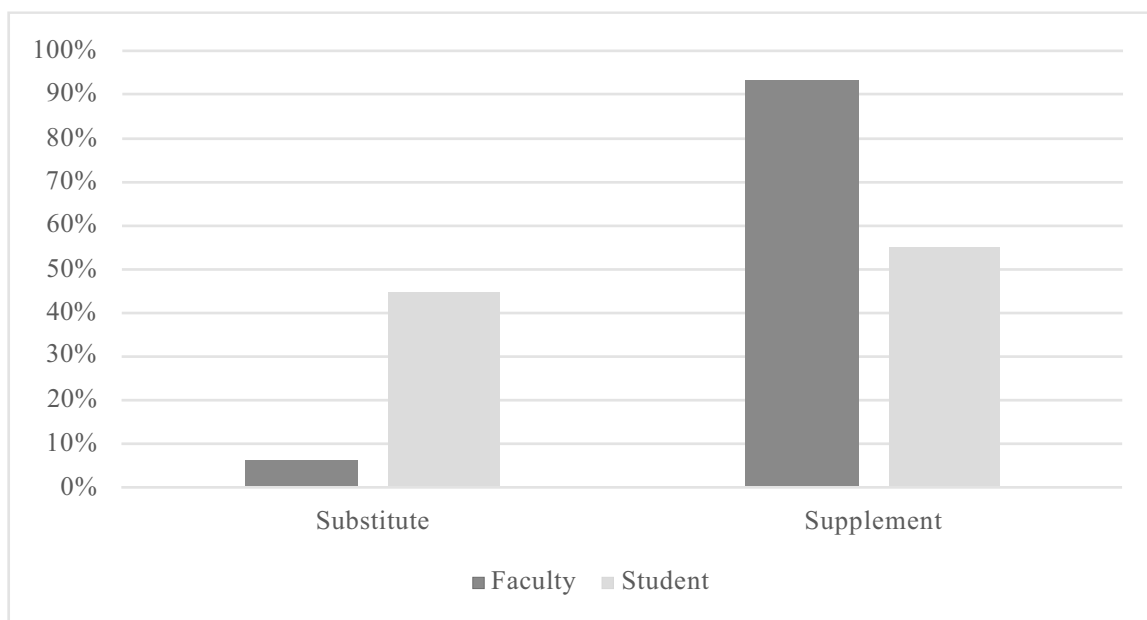


Fig. (2). Perception towards lecture recording (faculty vs. students).

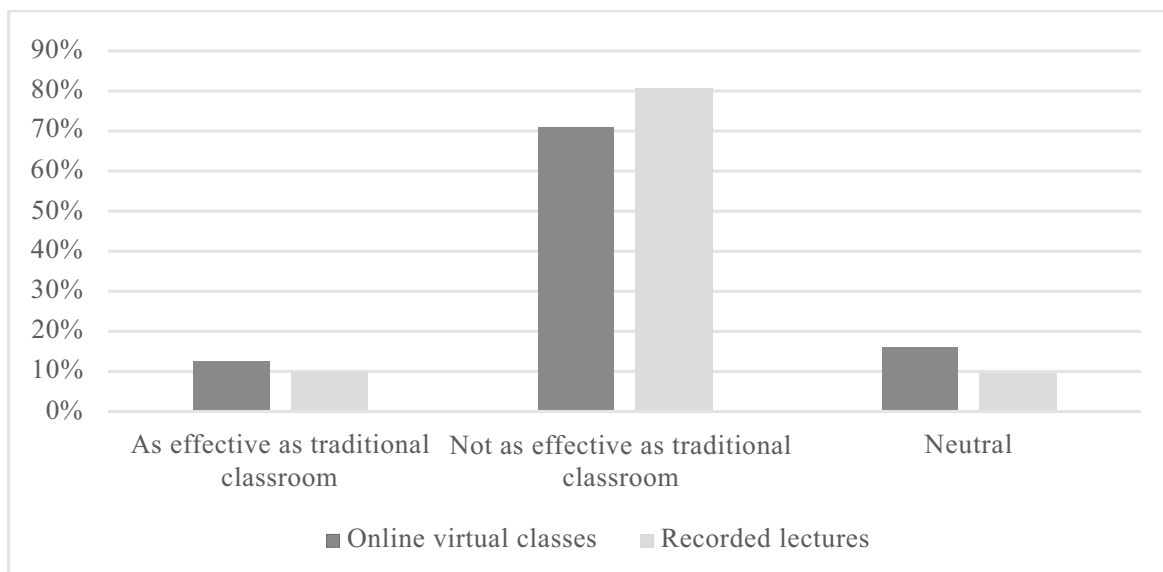


Fig. (3). Faculty perceptions toward the effectiveness of online virtual sessions or recorded lectures vs. classroom traditional lectures.

3.3. Effectiveness of Online Virtual Classes and Recorded Lectures when Traditional Classroom Lectures were not Available

Only seven faculty members (22.6%) described giving online virtual classes as a difficult experience, however, over 70.0% of them thought that interactive online sessions were not as effective as classroom face-to-face lectures (Fig. 3). On the other hand, students' responses were significantly different from the faculty's ($p < 0.001$), as more than 78.0% of the students believed that receiving virtual-interactive lectures was an effective learning method (Table 3).

Although 80.7% of the faculty members thought that giving students access to previously recorded lectures is not an effective learning strategy, about 84.0% of the students agreed or strongly agreed that viewing previously recorded lectures was an effective learning strategy, particularly when the classroom lectures had to be canceled ($p < 0.001$) (Fig. 3, Table 3).

4. DISCUSSION

The purpose of the current study was to assess the perceptions of dental students and faculty members regarding the online virtual classes and recorded lectures and to assess their opinions about utilizing such technologies as a substitute for traditional face-to-face classes.

Lecture recording is becoming increasingly popular in higher education and dental education is no exception. In the present study, the majority of students agreed (73.8% "strongly agree" and 16.1% "agree") that lecture recording is beneficial to their learning. This is in agreement with Kalludi *et al.*, who reported that most dental students believe that viewing the video podcasts after live lectures helps them understand physiology [15]. Allen *et al.* found that a high percentage of dental students preferred lecture podcasts over written transcripts as learning aids [16]. Despite that the students

support lecture recording, more than half the students in the current study did not want this to substitute traditional classroom lectures, which is in agreement with previously published studies [3, 26, 27]. Interestingly, more than four-fifth of the students agreed that recorded course materials serve as an adequate substitute for traditional classroom lectures. This finding suggests that students did not favor traditional classroom lectures for gaining more knowledge, but they see their value as an opportunity to ask questions or for social interactions in the classroom. Cardall *et al.* reported that, for medical students, the most frequent reasons behind attending classroom lectures *versus* viewing video-recorded lectures were lack of motivation to view recorded lectures, show professionalism, socialize with classmates, in addition to the belief that they were making most of their tuition money when attending face-to-face classes [28].

When it comes to faculty members, our study found that the majority of faculty agreed to record their lectures and believed that recorded lectures are a valuable supplement to live classroom lectures. However, they also felt that the lectures' recording impacted students' classroom attendance. This belief contrasts previous studies, which found that medical students' decision to attend lectures was unrelated to lecture recordings' availability [28, 29]. Zazulia *et al.* suggested that medical faculty and students perceive lecture attendance differently, *i.e.*, faculty tends to view lecture attendance as an integral part of students' education and professional socialization while students view it as a tool for learning course materials [29]. In the present study, there was a difference between students and faculty regarding mandating lecture attendance when lecture recordings are available. The majority of students believed that lecture attendance should be optional in contrast to the faculty's view. This substantial difference could be attributed to generational differences. Current dental students are late Millennials or Generation Z who are labeled "Digital Natives" because they are well versed with technology; consequently, they expect its integration into

their education [30]. Those digital natives prefer self-learning rather than being taught in a traditional classroom lecture [30]. On the other hand, faculty did not have access to electronic resources when they were students, thus attending classroom for them was the only way to access the learning materials. Consequently, they most likely interpret student nonattendance as a lack of commitment or interest in the course.

College students' attendance is mandated by the Saudi Ministry of Education, and if a student's absence rate exceeds 25% in any course, it results in suspension from the final exam. This requirement has not been updated after the introduction of digital technologies to the educational system. Although attendance in dental education is necessary to acquire laboratory and clinical skills, we think didactic materials can be delivered with more flexibility using web-based technologies. In light of the findings of our study, dental educators and institutions should consider optional lecture attendance. However, its effect on students' academic performance should be carefully monitored.

Our study showed positive perceptions of students toward online virtual classes and viewing previously recorded lectures as an alternative to classroom attendance for didactic learning during the COVID-19 pandemic. Consistent with recently published studies, dental students reported general satisfaction toward the theoretical component of the courses being delivered through online virtual classes during the pandemic [31, 32]. However, it is important to remember that hands-on training is a critical component of dental education besides didactic learning. Van Doren *et al.* reported that students were unsatisfied with their preclinical and clinical learning that was conducted virtually during the pandemic [32]. Integrating tools in online teaching, such as videos of dental procedures, virtual case discussions, treatment plan sessions, and exercises on a typodont to improve hand skills at home, could help facilitate remote learning for the preclinical curriculum. Nevertheless, there is no remote substitute for patient treatment and one-to-one supervision to acquire clinical skills and professional behaviors in the clinical curriculum.

A question has been raised regarding the likelihood that universities will reduce their tuition fees as students' experience in the university had been affected by shifting from face-to-face learning into merely online distance learning [33]. Thus, it is noteworthy to mention that the students in the current study are undergoing a tuition-free program supported by the government; this might explain students' positive attitudes toward viewing previously recorded materials without interacting with the lecturer when classroom lectures need to be canceled.

The majority of faculty members felt comfortable with the technology and found it not difficult to conduct virtual classes. On the other hand, faculty members thought that both virtual classes and viewing previously recorded materials were not as effective as traditional classes. This, at least to some extent, could be attributed to the unexpected transition from physical face-to-face learning to a virtual classroom environment without a period of familiarization and adaptation. Suppose the courses were designed from the beginning to be delivered online or using the blended learning method (combined classroom with online learning). In that case, the faculty's

perception of the effectiveness of online-based learning might be different.

Our study demonstrates an overall positive perception of both students and faculty towards integrating technology in teaching of the didactic material. Despite some concerns of the faculty, virtual classes and lecture recording can be implemented more efficiently and subsequently integrated into courses that comprise the didactic component exclusively, when there is a shortage of teaching faculty, or when faculty has conflicting scheduling hours. Moreover, these technologies can be utilized in a blended-learning module that combines traditional classes with online training. For example, certain difficult topics that require special instruction could be presented in the traditional classroom, while other content could be delivered via an online route (recorded lecture or instructional videos). Also, this could potentially reduce the total number of contact hours during the training when students and faculty are required to be physically present.

One limitation of the current study is that we examined individual perceptions, *i.e.*, subjective opinions, which do not necessarily translate into better or worse learning outcomes. A future study focusing on the learning outcomes and students' academic performance regarding different teaching methods is needed to determine the real rather than the perceived benefits of online education. Another limitation is that our study was performed in a single dental school; thus, our findings cannot be generalized to other dental schools. Future multi-institutional studies are needed to confirm or refute the current findings.

CONCLUSION

Dental students were more accepting than faculty of remote online education (including attending online virtual classes and viewing previously recorded lectures) when physical class attendance was not possible due to the COVID-19 pandemic. Both students and faculty members found the availability of recorded-lecture materials to be a valuable learning resource. However, faculty members showed some resistance and concern in allowing students optional attendance because they believe that viewing recorded lectures cannot serve as a substitute to attending a traditional classroom. Hence, taking both students' and faculty's perspectives into consideration, a future blended-learning module can be implemented to properly utilize resources in order to facilitate students' more efficient and satisfactory learning experience.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The ethical approval for conducting the study was obtained from the Institutional Review Board at the King Abdullah International Medical Research Center - KAIMRC, Saudi Arabia (RC20/275/R).

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Written informed consent was obtained from all participants prior to data collection.

AVAILABILITY OF DATA AND MATERIALS

The data used to support the findings of this study are available from the corresponding author [H.A] upon request.

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None.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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Declared none.

REFERENCES

- [1] Schönwetter DJ, Reynolds PA, Eaton KA, De Vries J. Online learning in dentistry: An overview of the future direction for dental education. *J Oral Rehabil* 2010; 37(12): 927-40. [http://dx.doi.org/10.1111/j.1365-2842.2010.02122.x] [PMID: 20726942]
- [2] Field J, Cowpe J, Walmsley D, Eds. *The profile of undergraduate dental education in europe*. Dublin: Association for Dental Education in Europe 2017.
- [3] Zandona AF, Kinney J, Seong W, Kumar V, Bendayan A, Hewlett E. Should lecture recordings be mandated in dental schools? Two viewpoints: Viewpoint 1: Lecture recordings should be mandatory in U.S. Dental schools and viewpoint 2: Lecture recordings should not be mandatory in U.S. Dental schools. *J Dent Educ* 2016; 80(12): 1468-73. [http://dx.doi.org/10.1002/j.0022-0337.2016.80.12.tb06235.x] [PMID: 27934673]
- [4] Field JC, Walmsley AD, Paganelli C, *et al*. The graduating european dentist: Contemporaneous methods of teaching, learning and assessment in dental undergraduate education. *Eur J Dent Educ* 2017; 21(Suppl. 1): 28-35. [http://dx.doi.org/10.1111/eje.12312] [PMID: 29205776]
- [5] Field J, Spencer R, Johnson I, Cure R. Professional standards in dental education. *Br Dent J* 2020; 228(11): 875-81. [http://dx.doi.org/10.1038/s41415-020-1640-5] [PMID: 32541751]
- [6] Reynolds PA, Rice S, Uddin M. Online learning in dentistry: The changes in undergraduate perceptions and attitudes over a four year period. *Br Dent J* 2007; 203(7): 419-23. [http://dx.doi.org/10.1038/bdj.2007.896] [PMID: 17934433]
- [7] Grimes EB. Student perceptions of an online dental terminology course. *J Dent Educ* 2002; 66(1): 100-7. [http://dx.doi.org/10.1002/j.0022-0337.2002.66.1.tb03503.x] [PMID: 12358096]
- [8] Greg P, Rob P, Maree G, Margot M, Karen W, David G. Web-based lecture technologies: Highlighting the changing nature of teaching and learning. *Australas J Educ Technol* 2010; 26(6)
- [9] Pilcher ES. Students' evaluation of online course materials in fixed prosthodontics: A case study. *Eur J Dent Educ* 2001; 5(2): 53-9. [http://dx.doi.org/10.1034/j.1600-0579.2001.005002053.x] [PMID: 11683214]
- [10] Eynon R, Perryer G, Walmsley AD. Dental undergraduate expectations and opinions of Web-based courseware to supplement traditional teaching methods. *Eur J Dent Educ* 2003; 7(3): 103-10. [http://dx.doi.org/10.1034/j.1600-0579.2003.00281.x] [PMID: 12846818]
- [11] Corrêa L, de Campos AC, Souza SC, Novelli MD. Teaching oral surgery to undergraduate students: a pilot study using a Web-based practical course. *Eur J Dent Educ* 2003; 7(3): 111-5. [http://dx.doi.org/10.1034/j.1600-0579.2003.00291.x] [PMID: 12846819]
- [12] Kavadella A, Tsiklakis K, Vougiouklakis G, Lionarakis A. Evaluation of a blended learning course for teaching oral radiology to undergraduate dental students. *Eur J Dent Educ* 2012; 16(1): e88-95. [http://dx.doi.org/10.1111/j.1600-0579.2011.00680.x] [PMID: 22251359]
- [13] O'Callaghan FV, Neumann DL, Jones L, Creed PA. The use of lecture recordings in higher education: A review of institutional, student, and lecturer issues. *Educ Inf Technol* 2017; 22(1): 399-415. [http://dx.doi.org/10.1007/s10639-015-9451-z]
- [14] Traphagan T, Kucsera JV, Kishi K. Impact of class lecture webcasting on attendance and learning. *Educ Technol Res Dev* 2010; 58(1): 19-37. [http://dx.doi.org/10.1007/s11423-009-9128-7]
- [15] Kalludi S, Punja D, Rao R, Dhar M. Is Video Podcast Supplementation as a Learning Aid Beneficial to Dental Students? *J Clin Diagn Res* 2015; 9(12): CC04-7. [http://dx.doi.org/10.7860/JCDR/2014/14428.6944] [PMID: 26816884]
- [16] Allen KL, Katz RV. Comparative use of podcasts vs. lecture transcripts as learning aids for dental students. *J Dent Educ* 2011; 75(6): 817-22. [http://dx.doi.org/10.1002/j.0022-0337.2011.75.6.tb05110.x] [PMID: 21642528]
- [17] Bacro TR, Gebregziabher M, Fitzharris TP. Evaluation of a lecture recording system in a medical curriculum. *Anat Sci Educ* 2010; 3(6): 300-8. [http://dx.doi.org/10.1002/ase.183] [PMID: 20954266]
- [18] Azab E, Saksena Y, Alghanem T, *et al*. Relationship among dental students' class lecture attendance, use of online resources and performance. *J Dent Educ* 2016; 80(4): 452-8. [http://dx.doi.org/10.1002/j.0022-0337.2016.80.4.tb06103.x] [PMID: 27037453]
- [19] Dommett EJ, Gardner B, van Tilburg W. Staff and student views of lecture capture: A qualitative study. *Int J Educa Tech High Educa* 2019; 16(1): 23. [http://dx.doi.org/10.1186/s41239-019-0153-2]
- [20] Wu DT, Wu KY, Nguyen TT, Tran SD. The impact of COVID-19 on dental education in North America-Where do we go next? *Eur J Dent Educ* 2020; 24(4): 825-7. [http://dx.doi.org/10.1111/eje.12561] [PMID: 32654328]
- [21] Bennardo F, Buffone C, Fortunato L, Giudice A. COVID-19 is a challenge for dental education-A commentary. *Eur J Dent Educ* 2020; 24(4): 822-4. [http://dx.doi.org/10.1111/eje.12555] [PMID: 32542796]
- [22] Quinn B, Field J, Gorter R, *et al*. COVID-19: The immediate response of european academic dental institutions and future implications for dental education. *Eur J Dent Educ* 2020; 24(4): 811-4. [http://dx.doi.org/10.1111/eje.12542] [PMID: 32394605]
- [23] Machado RA, Bonan PRF, Perez DEDC, Martelli JÚnior H. COVID-19 pandemic and the impact on dental education: Discussing current and future perspectives. *Braz Oral Res* 2020; 34e083 [http://dx.doi.org/10.1590/1807-3107bor-2020.vol34.0083] [PMID: 32609144]
- [24] Leadbeater W, Shuttleworth T, Couperthwaite J, Nightingale KP. Evaluating the use and impact of lecture recording in undergraduates: Evidence for distinct approaches by different groups of students. *Comput Educ* 2013; 61: 185-92. [http://dx.doi.org/10.1016/j.compedu.2012.09.011]
- [25] Daud A, Bagria A, Shah K, Puryer J. Should Undergraduate Lectures be Compulsory? The Views of Dental and Medical Students from a UK University. In: *Dent J (Basel)*. 2017; 5(2)
- [26] Kunin M, Julliard KN, Rodriguez TE. Comparing face-to-face, synchronous, and asynchronous learning: Postgraduate dental resident preferences. *J Dent Educ* 2014; 78(6): 856-66. [http://dx.doi.org/10.1002/j.0022-0337.2014.78.6.tb05739.x] [PMID: 24882771]
- [27] McCann AL, Schneiderman ED, Hinton RJ. E-teaching and learning preferences of dental and dental hygiene students. *J Dent Educ* 2010; 74(1): 65-78. [http://dx.doi.org/10.1002/j.0022-0337.2010.74.1.tb04856.x] [PMID: 20061532]
- [28] Cardall S, Krupat E, Ulrich M. Live lecture versus video-recorded lecture: are students voting with their feet? *Acad Med* 2008; 83(12): 1174-8. [http://dx.doi.org/10.1097/ACM.0b013e31818c6902] [PMID: 19202495]
- [29] Zazulia AR, Goldhoff P. Faculty and medical student attitudes about preclinical classroom attendance. *Teach Learn Med* 2014; 26(4): 327-34. [http://dx.doi.org/10.1080/10401334.2014.945028] [PMID: 25318026]

- [30] Mohr KA. Mohr., E. S., Understanding generation Z students to promote a contemporary learning environment. *J Empow Teach Excell* 2017; 1(1): 9.
[<http://dx.doi.org/10.15142/T3M05T>]
- [31] van der Hoeven D, Finnerty G Jr, Halpin R. Converting an in-person case-based small group discussion course to a virtual platform. *J Dent Educ* 2020.
[PMID: 32589793]
- [32] Van Doren EJ, Lee JE, Breitman LS, Chutinan S, Ohyama H. Students' perceptions on dental education in the wake of the COVID-19 pandemic. *J Dent Educ* 2020.
[<http://dx.doi.org/10.1002/jdd.12300>] [PMID: 32623715]
- [33] Burki TK. COVID-19: Consequences for higher education. *Lancet Oncol* 2020; 21(6): 758.
[[http://dx.doi.org/10.1016/S1470-2045\(20\)30287-4](http://dx.doi.org/10.1016/S1470-2045(20)30287-4)] [PMID: 32446322]

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