

Dental Students' Perception of Integrating E-learning During COVID-19: A Cross-Sectional Study in a Saudi University

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Purpose: The aim of this study was to assess dental students' perceptions and overall experiences regarding e-learning at King Abdulaziz University, Jeddah, Saudi Arabia, during the COVID-19 pandemic.

Methods: This cross-sectional study was carried out from November 2020 through March 2021. A pre-structured, self-administered questionnaire was emailed to undergraduate dental students (second year through sixth year and dental interns). The final sample included 296 undergraduate dental students and interns. Univariate analysis was done to report the sample characteristics. Chi-square and Fisher exact with Monte Carlo were conducted to evaluate the preference of students regarding e-learning across characteristics of the study sample.

Results: The majority of students preferred to integrate e-learning into traditional classroom lectures, although 51.7% did not favor it for clinical subjects. More than half of the sample believed that e-learning allowed excellent interactivity with the instructors. A higher percentage of second-year students preferred traditional learning (71%) than students in other years who preferred a combination of both traditional and online learning (P-value < 0.001). The mode of learning is not associated with marital status, though 36.4% of married students prefer e-learning (P-value = 0.4). Most dental students considered e-learning a positive experience.

Conclusion: There were significant differences in the mode of learning preference between the preclinical and clinical years. Continuous monitoring of learners' needs, challenges, and outcomes is crucial to effectively evaluate e-learning in dental education.

Keywords: dental education, traditional learning, blended learning, dentistry, COVID-19

Introduction

E-learning is defined as the dissemination of information through various electronic media, including the internet, audio, video, etc. Dental education has implemented e-learning many years before the Coronavirus (COVID-19) pandemic.¹ Several factors should be taken into consideration to achieve and maintain the full benefits from e-learning, such as teacher expertise, student readiness, technology infrastructure, and reusable learning design.² Prior research showed that it is cost-effective, time-efficient, overcomes staff shortage, and students are able to improve at their own pace.^{3,4} A major advantage of e-learning is the easy and unlimited accessibility to the educational material.¹ Prior studies have found that e-learning was effective for dental students.⁵⁻⁸ The main potential barriers of e-learning are technical barriers, inapplicability of some subjects, and limited interaction.^{9,10}

Even with the advanced technologies, online learning has limitations as it lacks interactive discussions, one-to-one supervision, and hands-on experience.^{11,12} With health care going digital, including dental education, dental students should gain knowledge from both theoretical and clinical sessions to fulfill the required competencies.^{11,13} Combining online lectures and recorded demonstrations with traditional lectures and live demonstrations yielded overall positive experiences among undergraduate students.^{5,14,15} Nevertheless, the majority of students consider it as an addition, not a replacement, to traditional classes.¹⁶ Blended learning is a coherent design approach that will help students integrate the

strengths of both online and traditional learning to attain educational goals effectively and efficiently. Moreover, it supports innovative ongoing learning beyond the classroom.¹⁷

Before the present pandemic, the dental school at King Abdulaziz University (KAUFD) had not yet implemented a structured e-learning approach in all subjects. Each instructor and department had the option to decide whether to involve online lectures or recorded demonstrations. Therefore, after implementing the first structured virtual learning using Blackboard in both basic sciences subjects and clinical subjects, we aimed to measure dental students' insights and overall experiences regarding integrating the virtual learning using the Blackboard platform at KAUFD during COVID-19. This study will help the faculty in better constructing an educational environment for undergraduate dental students. We hypothesized that dental students had a positive overall experience with e-learning. The aim of this study was to investigate dental students' perception regarding e-learning experience at King Abdulaziz University Faculty of Dentistry (KAUFD) during COVID-19 pandemic.

Materials and Methods

Study Design and Participants

This study was reviewed and approved by the Institutional Review Board at KAUFD, Jeddah, Saudi Arabia (#242-04-21, September 22nd, 2020). A written informed consent was obtained from all participants before starting the study. This cross-sectional study was carried out from November 2020 through March 2021. We conducted a self-administered anonymous questionnaire to evaluate the perception of dental students regarding e-learning. The inclusion criteria included undergraduate dental students (second year through sixth year) and dental interns aged between 19–25 years at KAUFD. We excluded first year students attending the mandatory preparatory year before joining the dental college, and those with incomplete responses. An email was sent to each student with the link to the survey and detailed instructions for the study. Reminders were sent two weeks, and one month after the first email. Participation was voluntary and informed consent was obtained. Sample size calculation was done using Raosoft sample size calculator¹⁸ with a population size of 944 students and interns, 50% response distribution, 95% confidence level, and a 5% margin of error. The minimum required sample size for this study was 274 participants. Response rate was 31%. The final sample consisted of 296 participants.

Study Variables

Study variables included gender (male or female), year of study (second, third, fourth, fifth, sixth, interns), and grade point average (GPA) (4.5–5, 4–4.49, 3.5–3.99, 3–3.49, 2.5–2.99, and less than 2.5). The participants were also asked if they had any Blackboard experience before the pandemic [less than average experience (download materials), average experience (used to submit assignments, take exams, download materials), more than average experience (attend virtual classrooms, discussion, submit assignments, take exams, download materials), and never used Blackboard].

Questionnaire Design

The questionnaire was developed based on previous studies and tailored to the context of the present study.^{19–23} The questionnaire was pre-structured, and evaluated by two dental academicians to ensure the clarity of all aspects of the questionnaire. The questionnaire was pre-tested and piloted with 20 participants from the target population. The piloting assisted in some specific modifications to the wording of the questionnaires. The questionnaire was developed and distributed in English using Google forms and a link was sent to each student via email with detailed information and written instructions regarding the study. Two reminder emails were sent 2 weeks and 1 month after the first email. The cover page of the questionnaire explained the purpose of the study, assured confidentiality of information provided, and provided contact information of the principal investigator. The participation was completely voluntary.

The questions were divided into three main parts. The first part was personal and sociodemographic questions. The second part was fifteen (5-point Likert scale) questions. These questions were grouped into four domains: accessibility (four statements), quality of e-learning provided (three statements), self-reflection (three statements), and the overall experience (five statements). In the final part, participants were asked about their preferred mode of learning,

and to rate their overall experience regarding e-learning through the Blackboard platform from 1–5, where 1 is poor and 5 is excellent. The questionnaire is attached as an appendix to this paper (see [Appendix S1](#)).

Statistical Analysis

All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS), Version 20. Cronbach's alpha was used to measure the internal consistency of each domain in the second part of the questionnaire. All domains had a Cronbach's alpha > 0.7. Descriptive statistics, such as frequencies and percentages, were used to report the characteristics of the participants, as well as the perception of e-learning. Chi-square and Fisher's exact test with Monte Carlo were conducted to assess the preference and opinion of students regarding e-learning against characteristics of the study sample. The significance level was set at $P < 0.05$.

Results

Sample Characteristics

The sample characteristics are summarized in [Table 1](#). The majority of respondents were females (56.1%), in their internship year (25.3%), followed by 3rd year students (20.6%). Most of the participants were "A" students with a GPA ranging between 4 and 5 (87.9%), and single "not married" (96.3%). A total of 75 students had more than average Blackboard experience (25.3%), whereas 31 students had never used Blackboard (10.5%).

Perception of E-learning

Most of the students had a computer to use at home (94.2%), good internet connectivity (66.9%), and their home environment facilitated the e-learning process (71.6%). Around half of the sample agreed that e-learning allowed excellent interaction with the instructor (50.3%) and equal chances in assessments and exams (54.0%). On the other hand, 32.4% of the students thought that live demonstrations were more useful than procedural videos during lab sessions ([Table 2](#)).

Table 1 Characteristics of the Study Sample (n=296)

Characteristics	Frequency	Percentage (%)
Gender		
Male	130	43.9%
Female	166	56.1%
Year of Study		
2nd	31	10.5%
3rd	61	20.6%
4th	34	11.5%
5th	44	14.9%
6th	51	17.2%
Interns	75	25.3%
GPA		
4.5–5	176	59.5%
4–4.49	84	28.4%
3.5–3.99	31	10.5%
3–3.49	3	1.0%
2.5 and below	2	0.7%
Blackboard experience		
Less than average	98	33.1%
Average	92	31.1%
More than average	75	25.3%
Never used blackboard	31	10.5%

Table 2 Perception of E-learning by Dental Students [n(%)]

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Accessibility					
You have a computer that you can use at home.	233 (78.7%)	46 (15.5%)	11 (3.7%)	2 (0.7%)	4 (1.4%)
Your environment at home was helpful for e-learning.	128 (43.2%)	84 (28.4%)	52 (17.6%)	22 (7.4%)	10 (3.4%)
Internet connectivity was good.	90 (30.4%)	108 (36.5%)	67 (22.6%)	25 (8.4%)	6 (2.0%)
The online platform was easy to use.	112 (37.8%)	131 (44.3%)	45 (15.2%)	7 (2.4%)	1 (0.3%)
Quality					
E-learning allowed excellent interaction with the instructors.	59 (19.9%)	90 (30.4%)	82 (27.7%)	35 (11.8%)	30 (10.1%)
E-learning allows equal chances to students in online assessment and exams.	64 (21.6%)	96 (32.4%)	54 (18.2%)	51 (17.2%)	31 (10.5%)
E-learning improved the standardization of the lectures between males and females.	111 (37.5%)	104 (35.1%)	56 (18.9%)	19 (6.4%)	6 (2.0%)
Procedural videos were more useful than live demonstrations during lab sessions.	63 (21.3%)	61 (20.6%)	76 (25.7%)	38 (12.8%)	58 (19.6%)
Self-reflection					
You gained a decent amount of knowledge from e-learning.	71 (24.0%)	106 (35.8%)	78 (26.4%)	25 (8.4%)	16 (5.4%)
Materials posted on blackboard prior to lecture encouraged you to read and prepare for the lecture.	53 (17.9%)	65 (22.0%)	86 (29.1%)	58 (19.6%)	34 (11.5%)
Online lectures encourage you to attend classes.	68 (23.0%)	71 (24.0%)	80 (27.0%)	43 (14.5%)	34 (11.5%)
Overall experience					
Online classes are convenient.	107 (36.1%)	101 (34.1%)	49 (16.6%)	23 (7.8%)	16 (5.4%)
You prefer integrating e-learning with traditional learning in the future.	116 (39.2%)	76 (25.7%)	41 (13.9%)	41 (13.9%)	22 (7.4%)
You recommend e-learning in non-clinical subjects.	135 (45.6%)	73 (24.7%)	40 (13.5%)	30 (10.1%)	18 (6.1%)
You recommend e-learning in clinical subjects.	42 (14.2%)	40 (13.5%)	61 (20.6%)	56 (18.9%)	97 (32.8%)
Online lectures need more improvements.	91 (30.7%)	99 (33.4%)	82 (27.7%)	18 (6.1%)	6 (2.0%)

Nearly 40% approved that materials uploaded prior to class encouraged them to prepare for the upcoming lecture, while one third of the students thought the opposite (31.1%). Regarding the overall experience of e-learning, most students preferred integrating e-learning with traditional classroom lectures (64.9%). However, 51.7% of the students did not favor e-learning in clinical subjects (Table 2).

Preference of the Mode of Learning

While males prefer traditional learning (39.2%), females tend to be inclined toward e-learning (25.3%) (P-value < 0.001). Second-year students preferred traditional learning (71%) compared to students in other years where they preferred integrating traditional with e-learning (P-value < 0.001) (Table 3). There was a statistically significant difference in the mode of learning preference between the preclinical and clinical years. The majority of clinical year students (57.8%) prefer integrating both e-learning and traditional lectures, while 40.2% of those in the preclinical years prefer integrating both methods (P-value < 0.001). Only 17.6% of the clinical year students preferred traditional learning, while 40% of preclinical students preferred it (P-value < 0.001) (Figure 1).

Overall E-learning Experience Rating

The majority of students rated their experience “4” which means a good experience (44.3%), followed by rating “3” which means average experience (32.8%) (Figure 2).

Discussion

There was a paradigm shift in teaching from traditional classrooms to online platforms especially after the COVID-19 pandemic.²⁴ This transition in learning pedagogy was a different experience for both educators and learners.²⁵ Therefore, this study was intended to investigate the perception and overall experience of undergraduate dental students regarding e-learning at KAUFD, Jeddah, Saudi Arabia during.

Table 3 Preference of the Mode of Learning by Gender, Year of Study, GPA, and Blackboard Experience [n (%)]

Characteristics	Traditional Learning	E-learning	Integrating Both	No Preference	P-value
Gender					<0.001*
Male	51 (39.2%)	17 (13.1%)	60 (46.2%)	2 (1.5%)	
Female	25 (15.1%)	42 (25.3%)	95 (57.2%)	4 (2.4%)	
Year of Study					<0.001*
2nd	22 (71.0%)	4 (12.9%)	5 (16.1%)	0 (0.0%)	
3rd	18 (29.5%)	9 (14.8%)	32 (52.5%)	2 (3.3%)	
4th	6 (17.6%)	3 (8.8%)	24 (70.6%)	1 (2.9%)	
5th	6 (13.6%)	15 (34.1%)	21 (47.7%)	2 (4.5%)	
6th	19 (37.3%)	9 (17.6%)	22 (43.1%)	1 (2.0%)	
Interns	5 (6.7%)	19 (25.3%)	51 (68.0%)	0 (0.0%)	
GPA					0.01*
4.5–5	52 (29.5%)	29 (16.5%)	91 (51.7%)	4 (2.3%)	
4–4.49	13 (15.5%)	24 (28.6%)	46 (54.8%)	1 (1.2%)	
3.5–3.99	10 (32.3%)	4 (12.9%)	17 (54.8%)	0 (0.0%)	
3–3.49	0 (0.0%)	2 (66.7%)	1 (33.3%)	0 (0.0%)	
2.5 and below	1 (50.0%)	0 (0.0%)	0 (0.0%)	1 (50%)	
Blackboard experience					0.5
Less than average	23 (23.5%)	19 (19.4%)	55 (56.1%)	1 (1.0%)	
Average	22 (23.9%)	18 (19.6%)	51 (55.4%)	1 (1.1%)	
More than average	19 (25.3%)	18 (24.0%)	34 (45.3%)	4 (5.3%)	
Never used blackboard	12 (38.7%)	4 (12.9%)	15 (48.4%)	0 (0.0%)	

Note: *Statistically significant; significance level was set at $P < 0.05$.

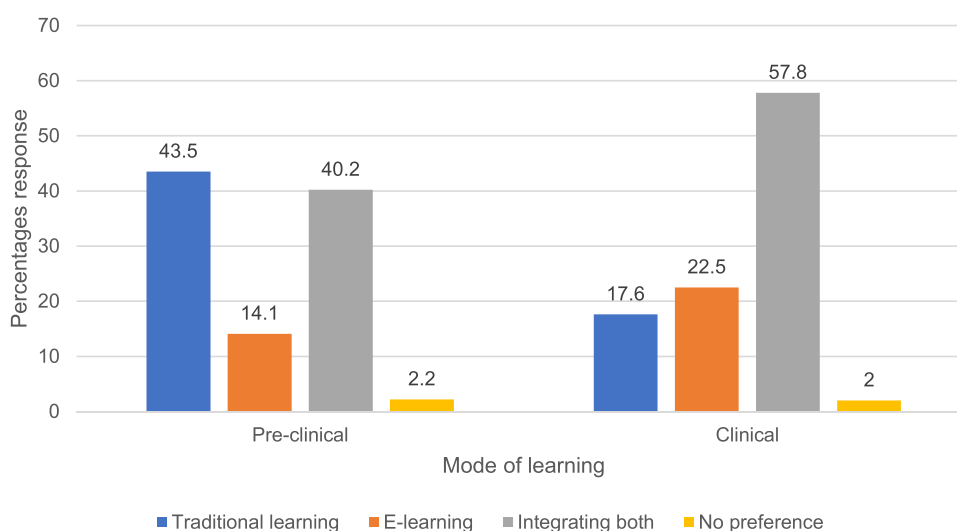


Figure 1 Mode of learning preference between the preclinical and clinical years.

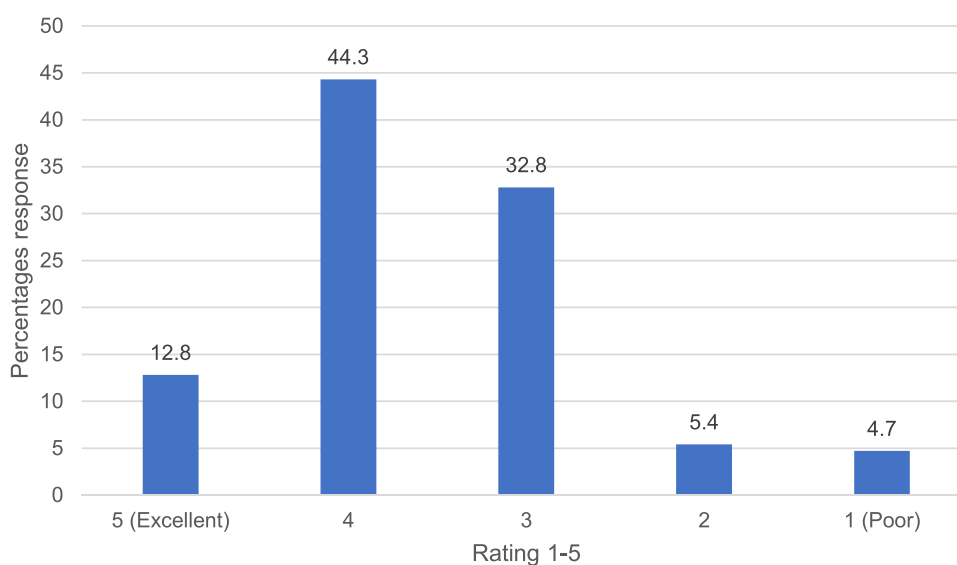


Figure 2 Ratings of students' experience regarding e-learning.

One of the essential factors of a learner's satisfaction and acceptance of the paradigm shift to e-learning is being familiar with the system.²⁶ Around 90% of our sample had some experience of using the Blackboard platform before the COVID-19 pandemic (regardless of the level of experience). This experience contributed to easy adoption and acceptance of the e-learning scheme as the majority of our students were satisfied with the overall experience. In contrast, the highest percentage of negative responses toward e-learning were found among students who never had any previous experience with online learning. These findings are in line with Samra et al²⁷ who also acknowledged bad experiences among dental students with none or less than average usage of any online platforms before the pandemic. This supports that preparation and familiarity with the system are fundamental factors for accepting and adopting e-learning as an alternative for face-to-face education. Another contributing factor to the effectiveness of e-learning as a pedagogical tool includes technology literacy and internet connection.²⁸ Fortunately, these factors were not found to be obstacles for our sample.

Most of the subjects uploaded the materials on the Blackboard before any given lecture (including handouts and narrated presentation) in order to ensure adequate delivery of information with better time flexibility and a sustained record for the students through the academic year. More than two thirds of our participants have agreed that this approach was helpful for them to prepare effectively before each class. Our findings are in agreement with Asiry¹⁴ who stated that online availability of the course content anytime and anywhere provoked a positive perception and responses among dental students. In our study, accessibility of the learning contents and opportunity to prepare before classes also motivated students' engagement during online classes as about half of the participants agreed that e-learning was more student-centered and allowed excellent interaction between students and instructors. Therefore, we infer that the online setting may be icebreaking for learner/educator interaction and encourage learners' participation. These desirable results in our study may promote better understanding for education stakeholders regarding the essential elements needed to maximize the benefits for the learners.¹²

Although dentistry is a practice-based specialty, incorporation of e-learning in dental education is no longer a question.¹² Therefore, we explored students' preferences regarding which educational approach (traditional classroom, e-learning, or blended learning) should be implemented in the future. In KAUFU, the dental curriculum is divided into preclinical (during 2nd and 3rd years) and clinical-oriented (during 4th, 5th and 6th years) courses. In regard to the academic years, the participants' inclination toward the learning method varied. Students in the preclinical years preferred the traditional learning method while their peers in the clinical years preferred a blended approach. Comparable findings were found among several studies conducted before and during the pandemic.^{14,29,30} These findings highlight the need for freshmen to build face-to-face relationships with instructors and colleagues before implementing e-learning. It may also be as a result of laboratory-based learning experiences being negatively affected.³¹ In our study, the majority of high and average achieving students voiced agreement for a blended approach. Ibrahim et al reported similar findings among medical students at KAU.²⁹ These findings can be justified by the extra time that can be saved for studying rather than spending time on transportation. In addition, online classes expose students to more distractions, which may have led them to opt for blended learning rather than e-learning. E-learning was more preferred among female students than male students, possibly due to the fact that females demonstrated greater self-regulation, persistence, and commitment to online learning.³²

The majority of our sample had a positive response toward their overall e-learning experience, thus, proposing the need for implementing intuitive e-learning in dental curriculum nowadays. Furthermore, continuous monitoring of learners' challenges, needs, and outcomes is obligatory to cope with the e-learning evaluation in the dental education system. It is also worth noting that e-learning has rapidly developed over the past two years, so student perceptions may differ from what they were when this study was conducted due to more familiarity with e-learning, as well as the development of more robust courses for students to learn remotely.³¹

This study has few limitations. This is a cross-sectional study conducted in one dental school, thus we cannot generalize our findings. Moreover, the response rate was somewhat low (31.4%), although two reminder emails were sent to the students. This is probably because we were not able to physically reach the students except during their clinical sessions where they were usually extremely busy. Additionally, due to the large proportion of high-performing students in the sample, there could be a volunteer bias. Convenient sampling technique was efficient, given the timing of the study when we could not reach students in person. On the other hand, this type of sampling has the disadvantage of not being able to generalize the results. In addition, it has the possibility of biased results as a result of overrepresentation or underrepresentation. In spite of the fact that closed ended questions may not cover all possible answers since we lack detailed information and insights from the respondents, they are easier to answer, provide measurable data, and are more likely to be answered than open ended questions.

Future studies to pinpoint the outcomes of the e-learning scheme on overall students' performances and to compare the findings with different dental schools and/or with other health specialties will assist in developing initiative educational strategies. Furthermore, investigating definite challenges and difficulties encountered with e-learning through longitudinal studies will enhance future directions and improvements in the dental education system. It is also suggested that dental school continue to invest in infrastructure of e-learning, even after the pandemic, to better understand effectiveness and acceptance of this method in the dental field. Future cohort studies comparing different dental schools will facilitate measuring the outcomes and help identify strategic initiatives.

Conclusion

Our study showed that dental students had a positive perception of e-learning, including accessibility, quality of e-learning, and self-reflection. There were significant differences in the mode of learning preference between the preclinical and clinical years. Continuous monitoring of learners' needs, challenges, and outcomes is crucial a prerequisite to effectively evaluate e-learning in dental education.

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Disclosure

The authors have no conflicts of interest to declare.

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