International Journal of Community Medicine and Public Health
Basudan AM et al. Int J Community Med Public Health. 2023 Jun;10(6):1971-1978
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20231670

Original Research Article

Dental e-learning before, during and after COVID-19 pandemic: a cross sectional study among Saudi dental students

Amani M. Basudan*, Abdulrahman M. Almubarak, Abeer S. Al-Zawawi, Fatemah M. Al-Ahmari, Hajer A. Aldulaijan, Hani S. Almoharib, Marwa Y. Shaheen, Nahid Y. Ashri

Department of Periodontics and Community Dentistry, College of Dentistry, King Saud University, Riyadh, Saudi Arabia

Received: 14 May 2023
Revised: 23 May 2023
Accepted: 25 May 2023

***Correspondence:**
Dr. Amani M. Basudan,
E-mail: abasudan@ksu.edu.sa

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Dental education has been shifting from face-to-face learning to e-learning, and this was profound during the COVID-19 pandemic. This study aimed to assess the overall experience and satisfaction of dental students towards e-learning in Riyadh, Saudi Arabia, before, during, and after the COVID-19 pandemic.
Methods: A cross-sectional questionnaire-based study was conducted between November 2022 and January 2023. The survey questionnaire comprised items for both qualitative and quantitative analysis of data. Non-parametric tests (Mann-Whitney U test and Kruskal-Wallis test along with Conover post-hoc analysis) were conducted to compare 'e-learning experience' and 'overall satisfaction', against the descriptive variables.
Results: The sample of 250 participants comprised 52.4% females, 71.6% were in the age group 22 to 25 years, 96.4% were Saudi nationals, and 29.6% were 4th-year students. Approximately 72.8% of them described their IT skills as average and 55.2% of them had participated in e-learning activities before the COVID-19 pandemic. E-learning for practical/clinical sessions before the COVID-19 pandemic lockdown, during the complete lockdown, after partial return following the lockdown, and after complete return following the lockdown are statistically significantly higher in participants who had participated in e-learning before the pandemic.
Conclusions: The present study ascertained the positive perceptions of dental students regarding e-learning as a preferred learning method. However, the students of the preclinical and clinical years have a varying preference between traditional face-to-face education and online learning.

Keywords: E-learning, Online education, Face-to-face learning, Dental education, COVID-19

INTRODUCTION

Dental education has evolved over a century to meet the growing knowledge needs and this was challenged during the recent COVID-19 pandemic.[1] The COVID-19 outbreak and lockdowns that followed posed a threat to the human community and had a substantial negative impact on different aspects of life, including education.[2] The rapid spread of this virus required infection control measures and physical distancing to prevent further spreading and help control the pandemic.[3] As a preventative measure, face-to-face learning at schools and universities were suspended worldwide. Online education and e-learning were embraced as an alternative by the education sector world over and in Saudi Arabia it was mandated through the Saudi Ministry of Education, as early as March 2020.[1,4] All Saudi universities, including medical and dental schools, expeditiously shifted to full-fledged e-learning systems,

leading to modification of teaching strategies for continued delivery of student courses.[5]

Contemporary didactic and practical teaching, within a dental school environment, plays a vital role in imparting knowledge, cognitive and psychomotor skills needed for the dental curriculum.[6] Dental clinical education through "face-to-face" learning is best taught through patient demonstration, as it helps master communication skills and enhances self-confidence in patient handling.[7] Over the last decade, e-learning has emerged as a popular mode of didactic and cognitive training, owing to its convenience, cost-effectiveness and time-efficiency. Even in medical and dental education, online teaching has gained prominence as it combines the benefits of limitless shared resources and ability of students to cope with the curriculum at their own pace.[8, 9]

Before COVID-19 pandemic, the concept of blended learning, a combination of face-to-face learning and e-learning, was introduced and used by many academic institutes globally, which also included Saudi Universities.[7,10] Nevertheless, the online platforms remained under-utilized due to the lack of absolute necessity.[10] While e-learning was seldom used for training psychomotor skills, the lockdowns due to COVID-19 pandemic signalled a paradigm shift in the way it was being used.[4,10] Although research has confirmed that e-learning is effective in dental schools, it is challenged by technical intricacies, participant suitability, hands-on experience, limited student interaction, internet quality and lack of digital skills.[9] It is therefore essential to understand if dental students were comfortable with the e-learning methodology and whether blended learning or traditional face-to-face learning was preferable.[5] It is imperative that the extensive nature of the dental curriculum requires ample hours of clinical training in addition to didactics. While previous studies have assessed the overall student impact of online education during the COVID-19 pandemic.[2,4,5,10,11] data pertaining to student perspectives on e-learning during different stages of the pandemic induced lockdown and more specifically its effect on didactic, practical and clinical dental education are not reported.

Therefore, the objective of our study was to determine the dental students' perception, in terms of overall experience and satisfaction, regarding e-learning approaches before, during, and after the COVID-19 pandemic lockdown at dental colleges in Riyadh, Saudi Arabia.

METHODS

Ethical statement, study design, setting and participants

Following approval from the Institutional Review Board (IRB Project No. E-22-6875) at Ethical Sub-Committee for Health Sciences Colleges Research on Human Subjects, King Saud University – College of Medicine, a cross-sectional questionnaire-based study was conducted among dental students in Riyadh, Saudi Arabia, during the time period from November 2022 to January 2023. A survey questionnaire comprising qualitative and quantitative data-analysis items was designed. Validity and reliability of responses was evaluated through a pilot sample (n=15). Queries arising after pilot survey were resolved in the final questionnaire, which was distributed randomly.

The final questionnaire had four parts which collected information as follows.

Part 1: demographic information (age, gender, year of study in dental school), IT skills study level of participants, and previous experience with e-learning platforms; part 2: information about advantages and disadvantages of e-learning, in the form of questions with multiple possible options; part 3: e-learning experience of participants, including theoretical, practical, and clinical exposure before, during, and after COVID-19 lockdown, in the form of questions with ordinal responses (never/rarely/sometimes/often/always); and part 4: overall satisfaction of participants towards e-learning before, during and after COVID-19 lockdown, in the form of questions with ordinal responses (excellent/very good/good/fair/poor).

The only inclusion criteria for the study was that students should have been studying in their respective dental schools for at least one year before the start of lockdown due to COVID-19. Students who did not undertake online study during the COVID-19 lockdown due to health concerns or as a result of break in study continuity, were excluded from the sampling frame. The sample size was estimated using 'G*POWER' open-source statistical software (Ver. 3.1.9.7, 2020). Assuming an effect size of 0.3 with alpha set at 0.05 and statistical power at 0.9, the desired sample size was estimated to be 240 participants.[12]

Data collection and statistical analysis

Collected data was tabulated and exported to statistical software (IBM SPSS Statistics Ver. 26, IBM Corporation, Armonk, NY, USA) for qualitative and quantitative analysis. All categorical descriptive variables (age groups, gender, academic level, IT skill levels, and previous participation in e-learning before the COVID-19 pandemic) were analysed for frequency and percentage. Non-parametric tests were conducted to compare mean ranks of "5-point" ordinal scale responses for 'online learning experience' and 'overall satisfaction', against descriptive variables. "Mann-Whitney-U test" was used for descriptive variables with two comparison groups (gender and previous participation in E-learning before the COVID-19 pandemic).

"Kruskal-Wallis test" was used when there were more than two descriptive comparison groups (age groups, academic level, and IT skill level). Conover post-hoc analysis was conducted for comparison between individual groups. A p value of <0.05 was used to report statistical significance.

RESULTS

Participants

The study participants (N=250) comprised 52.4% females, 71.6% within an age group of 22-25 years, 96.4% Saudi nationals, and 29.6% students from the 4th year. Descriptive data of all the participants are shown in Table 1. Similarly, participant responses pertaining to the different types of digital resources and learning platforms used in e-learning, and the advantages and disadvantages of E-learning are described in Table 2.

While blackboard (84.8%) and zoom (82.8%) were the most commonly used platforms for e-learning, the ability to study from home was perceived as the greatest advantage of online education (72.8%) and technical difficulties were seen as the biggest disadvantage (76.4%).

Table 1: Descriptive statistics of the participants (N=250), including demographic characteristics, information technology skill level and participation in e-learning before COVID-19 pandemic.

Descriptive variables	Frequency (%)
Age group (in years)	
≤21	26 (10.4)
22-25	179 (71.6)
≥26	45 (18.0)
Gender	
Male	119 (47.6)
Female	131 (52.4)
Nationality	
Saudi	241 (96.4)
Non –Saudi	9 (3.6)
Academic level	
3rd year student	43 (17.2)
4th year student	74 (29.6)
5th year student	57 (22.8)
Intern	31 (12.4)
Postgraduate	45 (18.0)
How would you describe your IT skills?	
Above average	41 (16.4)
Average	
Below average	27 (10.8)
Have you ever participated in any type of -learning before the COVID-19 pandemic?	
Yes	138 (55.2)
No	112 (44.8)

IT – Information technology

The construct of the MMA consisted of the following variables; pill count, recital dosage, regular clinic attendance, recall screen, self-report adherence, symptoms of hypo/hyperglycemia, and ETU/Hospital admissions. Table 2 demonstrates the results of the Man Whitney U test results for categorical variables; regular clinic attendance, recall screen, self-reported adherence, regular FBS, short-term glycemic control, symptoms of hypo/hyperglycemia, and ETU/Hospital admissions.

Table 2: Distribution of participants' responses towards the use of different type of digital e-learning, and their advantages and disadvantages (N=250).

Categories of responses*	Frequency(%)
Type of digital resources	
Blackboard	212 (84.8)
Google classrooms	83 (33.2)
Zoom application	207 (82.8)
Microsoft teams	161 (64.4)
Skype	16 (6.4)
Audio recorded PowerPoint	55 (22.0)
WebEx	6 (2.4)
GoToMeeting	6 (2.4)
Emails	92 (36.8)
Advantages of e-learning	
Accessibility of course materials	171 (68.4)
Self-paced	117 (46.8)
Ability to stay at home	182 (72.8)
Classes interactivity	30 (12.0)
Ability to record the content	162 (64.8)
Comfortable surrounding	147 (58.8)
Fast feedback	45 (18.0)
Time management	90 (36.0)
Disadvantages of e-learning	
Reduced interaction with the lecturer and colleagues	113 (45.2)
Technical problems	191 (76.4)
Poor learning conditions at home	52 (20.8)
Lack of self-discipline	87 (34.8)
Social isolation	68 (27.2)
Distractions	91 (36.4)

*Multiple responses

Dental e-learning experience of participants

Participants' responses towards their experience with e-learning for lectures, practical and clinical sessions were assessed on a five-point scale (never, rarely, sometimes, often, and always). Their responses were stratified based on the timing of e-learning exposure in relation to COVID-19 lockdown, either as before, during, after partial return or after complete return (Table 3). In terms of theoretical experience, participants never (33.2%) or rarely (32.0%) experienced e-learning before COVID-19 lockdown. On the contrary, during COVID-19 lockdown, participants underwent theoretical e-learning sessions most of the times (often – 8.4%; always – 76.4%). While this trend continued during partial return after COVID-19 lockdown, it showed evidence of moving back to pre-COVID scenario after complete return to normalcy post pandemic lockdown. The above findings are based on the participant responses, as shown in Table 3. Similarly, in terms of practical/clinical e-learning sessions, the response was "never, rarely or sometimes" both before COVID-19 lockdown (79.2%) and

after complete return (83.6%) from it. Although more than 50% of the participants agreed to undergoing practical/clinical sessions though e-learning during the complete COVID-19 lockdown, only less than 25% reported such similar session before COVID-19 or even after partial and complete return from lockdown.

Participants' satisfaction with e-learning

Based on pre-COVID-19 experience, majority of the participants ranked their satisfaction as either good (35.2%), fair (21.2%) or poor (20%). However, the satisfaction frequency showed an increasing trend when enquired about e-learning during COVID-19 lockdown (excellent/very good – 58.4%) and immediately after partial return from it (excellent/very good – 51.2%), as shown in Table 4.

Interestingly, there was a better frequency of satisfaction towards e-learning even after complete return from COVID-19 lockdown (excellent/very good – 44.4%), indicating a shift in perspective.

Table 3: Distribution of participants' responses towards their experience with e-learning before, during and after COVID-19.

Types of e-learning experience	Classification of response items - Frequency (%)				
	Never	Rarely	Sometimes	Often	Always
Theoretical experience					
Before COVID-19 pandemic lockdown	83 (33.2)	80 (32.0)	73 (29.2)	6 (2.4)	8 (3.2)
During complete COVID-19 pandemic lockdown	8 (3.2)	8 (3.2)	22 (8.8)	21 (8.4)	191 (76.4)
After partial returning following COVID-19 lockdown	15 (6.0)	5 (2.0)	87 (34.8)	90 (36.0)	53 (21.2)
After complete returning following COVID-19 lockdown	8 (3.2)	66 (26.4)	99 (39.6)	47 (18.8)	30 (12.0)
Practical and clinical experience					
Before COVID-19 pandemic lockdown	90 (36.0)	47 (18.8)	61 (24.4)	41 (16.4)	11 (4.4)
During complete COVID-19 pandemic lockdown	23 (9.2)	37 (14.8)	53 (21.1)	65 (26.0)	72 (28.8)
After partial returning following COVID-19 lockdown	63 (25.2)	64 (25.6)	60 (24.0)	42 (16.8)	21 (8.4)
After complete returning following COVID-19 lockdown	96 (38.4)	65 (26.0)	48 (19.2)	20 (8.0)	21 (8.4)

Effect of participant characteristics on theoretical experience with e-learning

Considering the age groups of participants, before COVID-19 lockdown, those older than 25 years had the greatest mean rank of responses. However, during the lockdown and after partial and complete return from lockdown, the mean rank of responses became higher among those between 22-25 years. Except during pre-COVID-19 lockdown, the age group significantly affected mean rank of responses ($p<0.05$) for theoretical e-learning experience, at all other times. Based on gender, female participants had higher mean rank of responses to theoretical e-learning experience, before, during and after COVID-19 lockdown, with statistically significant differences ($p<0.05$) observable only before COVID-19. Comparing the academic levels, statistically significant differences ($p<0.05$) in mean rank of responses were observed based on theoretical e-learning experience during COVID-19 lockdown and after return from lockdown. In the case of undergraduate academic levels, mean ranks were higher for 4th and 5th year students before, during and after lockdown. On the contrary postgraduate students responded with higher mean ranks only before and after complete return from lockdown. In line with their IT skill levels, the mean ranks of responses were always higher among those with above average IT knowledge, which was only statistically significant ($p<0.05$) when considered during the lockdown and after partial return from it. Interestingly, after complete return from lockdown, the mean rank of responses was higher in participants with both average and above average IT skill levels, indicating a probable perspective change due to greater exposure to e-learning. While, previous participation in e-learning before the pandemic signalled a significantly higher mean rank of responses before and after lockdown, the pandemic induced lockdown made e-learning statistically indifferent for both new and old users. (Table 5).

Effect of participant characteristics on practical and clinical experience with e-learning

Statistically significant differences in mean rank of responses ($p<0.05$) with respect to practical/clinical e-learning experience was observed in all age groups, before, during and after COVID-19 lockdown. While the mean ranks were highest in those aged 26 years or older, before and after lockdown, during the lockdown it was highest among participants less than 22 years. A similar trend in mean rank of responses to practical/clinical e-learning experience was observed based on academic levels, wherein the younger age group matched lower levels and the older age group the higher levels. Nevertheless, statistically significant difference in mean rank of

responses ($p<0.05$) with respect academic level was seen only after complete return from pandemic lockdown. In line with theoretical e-learning experience, female participants also showed better mean rank of responses for practical/clinical e-learning too. However, there were no statistically significant differences. While level of IT skills, did not seem to play a significant role in altering the mean rank of responses for practical/clinical e-learning, before, during and after COVID-19 lockdown, prior participation in e-learning activities significantly improved mean rank of responses ($p<0.05$) at all times surrounding the pandemic (Table 5).

Effect of participant characteristics on overall satisfaction with e-learning

Comparing the mean rank of responses for overall satisfaction with e-learning against age groups of participants, the greatest statistically significant mean rank ($p<0.05$) was observed among those younger than 22 years and after partial return from lockdown. Participants older than 25 years, had the lowest mean rank of responses for overall satisfaction, during COVID-19 lockdown and after partial return from it. Although not statistically significant, overall satisfaction with e-learning was higher among males than females, based on their greater mean rank of responses. With respect to the difference in mean rank of responses for overall satisfaction based on academic levels, statistically significant difference was observed only during the partial return from COVID-19 lockdown, wherein interns had a poor mean rank of response. Neither IT skill level nor previous participation in e-learning had a significant effect on the mean rank of responses for overall satisfaction, irrespective of the timing surrounding lockdown. (Table 6).

Table 4: Distribution of participants' responses towards their overall satisfaction with e-learning experience during different stages of COVID-19 lockdown (N=250).

Response items	Frequency (%)
Before COVID-19	
Excellent	19 (7.6)
Very good	40 (16.0)
Good	88 (35.2)
Fair	53 (21.2)
Poor	50 (20.0)
During complete COVID-19 lockdown	
Excellent	60 (24.0)
Very good	86 (34.4)
Good	70 (28.0)
Fair	15 (6.0)
Poor	19 (7.6)
After partial returning to campus following the COVID-19 lockdown	
Excellent	42 (16.8)
Very good	86 (34.4)
Good	66 (26.4)
Fair	32 (12.8)
Poor	24 (9.6)
After complete returning to campus following COVID-19 lockdown	
Excellent	46 (18.4)
Very good	65 (26.0)
Good	85 (34.0)
Fair	38 (15.2)
Poor	16 (6.4)

Table 5: Comparison of mean ranks of participants' responses towards their experience with e-learning before, during and after COVID-19 in relation to descriptive variables.

Descriptive variables	Mean ranks of theoretical experience items*				Mean ranks of practical and clinical experience items*			
	Item 1	Item 2	Item 3	Item 4	Item 1	Item 2	Item 3	Item 4
Age group (in years)								
≤21	102.19	132.9	129.46	79.87	128.12	160.29	140.54	126.75
22-25	127.47	136.06	138.59	129.97	118.46	120.26	118.34	117.1
≥26	131.13	79.2	71.16	134.1	151.98	126.24	145.31	158.19
P value	0.18	<0.001	<0.001	0.002	0.015	0.025	0.037	0.002
Gender								
Male	113.42	119.39	122.07	120.01	118.82	116.46	120.31	127.81
Female	136.48	131.05	128.62	130.48	131.56	133.71	130.21	123.4
P value	0.008	0.087	0.451	0.231	0.149	0.053	0.267	0.615
Academic level								
3rd year student	119.27	132.71	125.35	84,97	135.33	136.97	135.47	124.28
4th year student	113.85	143.9	142.34	121,43	112.59	114.35	114.45	114.83
5th year student	142.67	130.94	146.75	142.26	115.4	124.58	119.04	112.84
Intern	114.48	118.58	104.87	141.66	129.08	125.44	117.56	134.79
Postgraduate	136.46	87.37	85.24	138.57	147.67	134.09	147.79	153.84
P value	0.093	<0.001	<0.001	<0.00	0.055	0.45	0.089	0.019

Continued.

Descriptive variables	Mean ranks of theoretical experience items*				Mean ranks of practical and clinical experience items*			
	Item 1	Item 2	Item 3	Item 4	Item 1	Item 2	Item 3	Item 4
How would you describe your IT skills?								
Above average	145.24	145.11	151.22	120.93	126.02	115.62	121.04	111.98
Average	123.28	117.87	118.27	127.96	128.09	127.51	125.28	130.38
Below average	110.5	147.15	135.17	115.85	107.28	126.98	133.76	113.13
P value	0.089	0.001	0.016	0.625	0.35	0.616	0.764	0.189
Have you ever participated in any type of e-learning before the COVID-19 pandemic?								
Yes	143.66	128.33	134.36	136.75	135.21	133.71	134.64	133.63
No	103.12	121.4	114.59	111.64	113.54	115.38	114.24	115.49
P value	<0.001	0.277	0.024	0.004	0.014	0.04	0.023	0.039

*Item 1 - Before COVID-19 pandemic lockdown; item 2 - during complete COVID-19 Pandemic Lockdown; Item 3 - after partial returning following COVID-19 lockdown; item 4 - after complete returning following COVID-19 lockdown; IT – information technology

Table 6: Comparison of mean ranks of participants' responses towards their overall satisfaction with e-learning experience during different stages of COVID-19 lockdown in relation to descriptive variables.

Descriptive variables	Before COVID-19		During complete COVID-19 lockdown of all educational institutions		After partial returning to campus following the COVID-19 lockdown		After complete returning to campus following COVID-19 lockdown	
	Mean ranks	P value	Mean ranks	P value	Mean ranks	P value	Mean ranks	P value
Age group (in years)								
≤21	130.4	0.817	132.44	0.225	149.04	0.011	115.69	0.717
22-25	123.73		128.51		128.39		127.35	
≥26	129.69		109.51		100.39		123.8	
Gender								
Male	128.46	0.524	132.21	0.145	132.08	0.156	134.66	0.058
Female	122.81		119.4		119.52		117.18	
Academic level								
3rd year student	131.13	0.868	127.91	0.144	136.2	0.006	113.12	0.159
4th year student	130.53		141.86		140.53		127.89	
5th year student	121.08		116.25		127.29		138.66	
Intern	119.53		115.32		88.18		104.4	
Postgraduate	121.56		115.02		114.01		131.27	
How would you describe your IT skills?								
Above average	106.73	0.069	124.6	0.549	137.35	0.379	120.85	0.81
Average	131.68		127.7		121.82		127.26	
Below average	112.23		112.06		132.31		120.72	
Have you ever participated in any type of e-learning before the COVID-19 pandemic?								
Yes	129.45	0.321	122.37	0.43	123.55	0.624	122.97	0.525
No	120.63		129.35		127.9		128.62	

IT – information technology

DISCUSSION

E-learning introduced as a result of technological advances has helped create a positive environment wherein students are motivated to learn at their own pace. Online education in general has been shown to be more student-centric, and the level of interaction with instructors has been rated as satisfactory.[13] Nevertheless, e-learning has its limitations such as technical failures, student isolation, and lack of face-to-face communication, which are critical for healthcare education.[14]

Although the drastic shift in learning experience from traditional classroom to online mode, during COVID-19 pandemic, was welcome initially, academicians and students faced great challenges due to a transition in teaching pedagogy.[1,5] Hence, this study aimed to investigate the perceptions of undergraduate dental students about e-learning before, during, and after the

COVID-19 pandemic in the dental colleges at King Saud University (KSU), Riyadh.

Familiarity with any new system is one of the prime determinants to assess a learner's satisfaction and acceptance, and e-learning is no exception to it.[15] In total, 58.8% of the participants were highly satisfied with e-learning platforms, even before the pandemic. Approximately 78% showed their involvement towards e-learning during and after the COVID-19 pandemic. These findings are in accordance with a similar study conducted at King Abdulaziz University, Saudi Arabia, where 90% of the students who had earlier exposure to the Blackboard e-learning platform found the transition accommodative.[10] On the contrary, students who lacked earlier experience with e-learning, provided only negative responses for perceptions and attitudes towards e-learning.[15] These evidences prove that for an effective transformation of the pedagogical tool from face-to-face to e-learning, technological literacy and acclimatization are fundamental requirements.

E-learning platforms enable uploading of course content and reference materials before the scheduled session for easy referencing by students.[7] This approach assures familiarity with the subject of discussion for the day, thereby boosting student confidence. Additionally, these material could be made available long after the teaching sessions are over, so that students could revisit them at any time of the study year.[2] In our study, approximately two-thirds of the students found this aspect of e-learning very useful. This finding is in line with a previous study, which demonstrated that online study resources, when made accessible over a longer period of time, encouraged students to utilize and benefit from them.[10] Education administrators should realize these advantages of e-learning and utilize it for the regular curriculum, to enhance student participation and successful fulfilment of course outcomes.[11]

The field of dentistry is clinically oriented and requires practice-based training; thus, the upheaval of the learning methodology to e-learning is often doubted.[11] However, the present study explored students' preferences comparing traditional classroom learning and e-learning and found the scope for evolution. The current dental curriculum in Saudi universities consists of the pre-clinical years (2nd and 3rd year) and clinical years (4th, 5th, and 6th years) courses. In our study, the inclination towards learning modalities changed with respect to the academic levels. Significant changes were reported by students of the 3rd, 4th, and 5th year for practical/clinical as well as theoretical learning experience during complete lockdown, and after partial and complete return following the COVID-19 lockdown. Several studies have reiterated similar results when comparing across the academic levels, pre- and post-pandemic.[1,4,10,15]

In general, face-to-face interaction is considered essential for the preclinical years for the students to get accustomed to the college environment and their peer group, and this was also reinforced by the findings of this study.[11] Moreover, research papers have shown that during the COVID-19 pandemic, laboratory-based training was adversely affected.[11] Nevertheless, e-learning opened the avenues for technology-based diversions during the period of study. Similar to some recent studies, female students exhibited greater preference for e-learning than male students.[10] This may be attributed to the ingrained character of female students to self-motivate themselves and oblige to their commitment, which is critical in online learning. Although e-learning received positive responses encouraging its implementation as an integral part of the dental curriculum, there are several factors to be considered. Periodic monitoring of the student's challenges, requirements, and learning outcomes is essential to evaluate the effectiveness of e-learning. Because this mode of education is relatively new, students' perceptions over the past two years cannot be considered conclusive. Our study, being a cross-sectional study among dental students in a particular geography, has some limitations. Therefore, the findings of this study cannot be generalized to a larger student population. Academic levels through different years may be biased due to the probability of under-representation or over-representation. In addition, the close-ended questions with binary answers may not extract the required information from respondents. In the future, an extensive study to investigate the definite challenges encountered by students in e-learning from different universities and geographic locations need to be conducted.

CONCLUSION

The present study ascertained the positive perceptions of dental students regarding e-learning as a preferred learning method. However, between the students of preclinical and clinical years there were varying preferences towards traditional face-to-face education and online learning. Periodic evaluation of the e-learning platforms, long-term perception of the students, and related challenges are imperative for optimizing the newer learning methods in the dental curriculum.

ACKNOWLEDGEMENTS

Authors would like to thank "Prince Naif Health Research Center, Investigator support Unit" for the language editing service provided.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Baczek M, Zaganczyk-Baczek M, Szpringer M, Jaroszynski A, Wozakowska-Kaplon B. Students' perception of online learning during the COVID-19

pandemic: A survey study of Polish medical students. Medicine. 2021;100(7):e24821.
2. Olum R, Atulinda L, Kigozi E, Nassozi DR, Mulekwa A, Bongomin F, Kiguli S. Medical Education and E-Learning During COVID-19 Pandemic: Awareness, Attitudes, Preferences, and Barriers Among Undergraduate Medicine and Nursing Students at Makerere University, Uganda. J Med Educ Curric Dev. 2020;7:2382120520973212.
3. Khalil R, Mansour AE, Fadda WA, Almisnid K, Aldamegh M, Al-Nafeesah A, Alkhalifah A, Al-Wutayd O. The sudden transition to synchronized online learning during the COVID-19 pandemic in Saudi Arabia: a qualitative study exploring medical students' perspectives. BMC Med Educ. 2020;20(1):285.
4. Binrayes A, Almahdy A, Habib SR, Aljutaili A, Alotaibi Y, Aldoihi S, Alkhathran A. Dental students' academic performance before and after the Covid-19 pandemic: A retrospective analysis. Saudi Dent J .2022;34(8):751-6.
5. Ibrahim NK, Al Raddadi R, AlDarmasi M, Al Ghamdi A, Gaddoury M, AlBar HM, et al. Medical students' acceptance and perceptions of e-learning during the Covid-19 closure time in King Abdulaziz University, Jeddah. J Infect Public Health. 2021;14(1):17-23.
6. Afrashtehfar KI, Assery MK. From dental science to clinical practice: Knowledge translation and evidence-based dentistry principles. Saudi Dent J. 2017;29(3):83-92.
7. Qutieshat AS, Abusamak MO, Maragha TN. Impact of Blended Learning on Dental Students' Performance and Satisfaction in Clinical Education. J Dent Educ. 2020;84(2):135-42.
8. Al-Saleh S, Al-Madi EM, AlMufleh B, Al-Degheishem AH. Educational environment as perceived by dental students at King Saud University. Saudi Dent J. 2018;30(3):240-9.
9. Asiry MA. Dental students' perceptions of an online learning. Saudi Dent J. 2017;29(4):167-70.
10. Bahanan L, Alsharif M, Samman M. Dental Students' Perception of Integrating E-learning During COVID-19: A Cross-Sectional Study in a Saudi University. Adv Med Educ Pract. 2022;13:839-47.
11. Shahrvini B, Baxter SL, Coffey CS, MacDonald BV, Lander L. Pre-clinical remote undergraduate medical education during the COVID-19 pandemic: a survey study. BMC Med Educ. 2021;21(1):13.
12. Kang H. Sample size determination and power analysis using the G*Power software. J Educ Eval Health Prof. 2021;18:17.
13. Diaz-Narvaez VP, Amezaga-Avitia AC, Sarabia-Alvarez PA. Chilean Dentistry students, levels of empathy and empathic erosion: Necessary evaluation before a planned intervention: Levels of empathy, evaluation and intervention. Saudi Dent J. 2018;30(2):117-24.
14. Sinclair PM, Kable A, Levett-Jones T, Booth D. The effectiveness of Internet-based e-learning on clinician behaviour and patient outcomes: A systematic review. Int J Nurs Studies. 2016;57:70-81.
15. Linjawi AI, Alfadda LS. Students' perception, attitudes, and readiness toward online learning in dental education in Saudi Arabia: a cohort study. Adv Med Educ Pract. 2018;9:855-63.

Cite this article as: Basudan AM, Almubarak AM, Al-Zawawi AS, Al-Ahmari FM, Aldulaijan HA, Almoharib HS, et al. Dental e-learning before, during and after COVID-19 pandemic: a cross sectional study among Saudi dental students. Int J Community Med Public Health 2023;10:1971-8.