

Efficacy of Online Theoretical Prosthetic Dentistry Lessons on the Didactic Benefit of Students During COVID-19 Isolation

Çevrim İçi Teorik Protetik Diş Tedavisi Derslerinin COVID-19 İzolasyonu Sırasında Öğrencilerin Öğrenim Faydası Üzerindeki Etkinliği

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ABSTRACT Objective: The aim of this study was to evaluate the online learning from the perspective of the students. **Material and Methods:** Students participating in prosthodontics lessons with at least 6 months of the face-to-face learning experience (n=198) were included. An online survey was used to evaluate the technical qualification of online lessons, didactic benefits of online learning, motivation to online learning, and overall assessment. The students also asked for amount of online learning in the future curriculum. The survey settings were arranged to ensure that the survey results were sent to the researchers without the participants' identifications. Data were subjected to a chi-squared test and t-test (p<0.05). **Results:** Of the students, 77.77% (154) completed and sent back the survey. The majority of students stated online lessons were technically well prepared, well structured and the image and sound quality were satisfying, 37.5% of male students stated inadequate desire for online learning (p=0.015). The third-year (45.3%) and the fourth-year students (42.9%) did not feel well prepared for the practical part (p=0.043). Most students agreed online learning is the best option in the current situation. Most students hoped that dental education will continue face-to-face in the next academic year. Students stated that online learning should be applied to 40.09% of the prosthodontics' curriculum. **Conclusion:** Students showed a negative perspective on the implementation of online learning. Developments on online learning are needed to use online learning for long-time outbreaks in the future curriculum.

ÖZET Amaç: Bu çalışmanın amacı, öğrencilerin bakış açısından çevrim içi eğitimin değerlendirilmesidir. **Gereç ve Yöntemler:** Çalışmaya en az 6 aylık yüz yüze eğitim tecrübesi bulunan ve protetik diş tedavisi derslerine devam eden (n=198) öğrenciler dâhil edilmiştir. Çevrim içi derslerin teknik değerlendirmesi, öğrenme çıktıları, motivasyon genel değerlendirme başlıkları altında çevrim içi anket kullanılarak değerlendirilmiştir. Aynı zamanda öğrencilere, müfredatta çevrim içi eğitimin hangi oranda kullanılması gerektiği de sorulmuştur. Anket sonuçlarının araştırmacılara katılımcıların kişisel bilgileri olmadan iletilmesi sağlanmıştır. Elde edilen veriler ki-kare testi ve t-testi kullanılarak değerlendirilmiştir (p<0,05). **Bulgular:** Öğrencilerin %77,77'si anketi tamamlamış ve geri yollamıştır (n=154). Öğrencilerin çoğu çevrim içi derslerin teknik olarak iyi hazırlandığını, iyi yapılandırıldığını, görüntü ve ses kalitesinin tatmin edici düzeyde olduğunu bildirmişlerdir. Erkek öğrencilerin %37,5'i çevrim içi eğitim boyunca yetersiz öğrenim arzusu gösterdiklerini bildirmişlerdir (p=0,015). Üçüncü sınıf (%45,3) ve 4. sınıf (%42,9) öğrencileri çevrim içi eğitim sürecinde eğitimin pratik bölümüyle ilgili kendilerini yeterince hazırlamadıklarını bildirmişlerdir (p=0,043). Öğrencilerin büyük bir çoğunluğu, mevcut koşullar altında çevrim içi eğitimin en uygun seçenek olduğunu belirtmişlerdir. Çoğu öğrenci, gelecek akademik yılla beraber yüz yüze eğitim modelinin uygulanmasını arzulamaktadır. Protetik diş tedavisi müfredatında çevrim içi eğitime %40,09 oranında yer verilmesi gerektiğini belirtmişlerdir. **Sonuç:** Öğrencilerin çevrim içi eğitim modeli hakkındaki olumsuz görüşleri mevcuttur. Çevrim içi eğitimin gelecekteki müfredatta uzun süreli dâhil edilebilmesi için geliştirilmesi gerekmektedir.

Keywords: COVID-19; online learning; dental education

Anahtar Kelimeler: COVID-19; Çevrim içi eğitim; diş hekimliği eğitimi

Severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) with the symptoms of an atypical and rapidly spreading pneumonia was diagnosed in

Wuhan, China, in 2019. SARS-CoV-2 spread throughout the world and caused a pandemic.¹ The World Health Organization named the disease "coro-

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navirus disease-2019 (COVID-19)” and announced it as an “International Emergency Public Health Problem”.²

COVID-19, which is transmitted by aerosols in close contact between people, can affect all age groups with usually mild to moderate clinical symptoms. However, the course of the disease worsens and mortality rates increase in people with comorbidities (asthma, diabetes, and heart disease) and in individuals over 65 years of age having these diseases.³ Most countries implemented social distance rules to limit the spread of SARS-CoV-2.^{3,4} Precautions for preventing the spread of COVID-19 have affected every aspect of life, including education. To delimitate the spread of COVID-19 among students, the curriculum within universities including dentistry faculties were revised. Most of the countries proceeded to synchronous online learning.⁵⁻⁷

Before the COVID-19 pandemic, scientific publications highlighted the achievements of online learning methods and technological infrastructure requirements.^{8,9} The COVID-19 pandemic became an accelerating factor for the integration of online learning into the medical curriculum.¹⁰ However, dentistry education is based on impacting the theoretical knowledge with the preclinical and clinical dental applications. Especially, the field of prosthetic dentistry reinforces theoretical education with practical courses from the first to the last semester of dentistry education. During practical courses, instructors supervise the students, the practical deficiencies are simultaneously compensated, and their mistakes are corrected.⁶ Alternatively, after theoretical courses, synchronous videos while demonstrating processes of dental prosthesis and practicing on real patients may help to strengthen students’ dental practical skills.¹¹ However, the restriction of dental treatments to dental emergency treatments due to the pandemic does not make it possible to find a case related to the subject mentioned in the theoretical part. Synchronous videos cannot completely replace chairside clinical training.¹² It was remarked that online learning is only applicable to theoretical learning of dentistry.^{6,12}

Students’ assessments are one of the substantial factors for evaluating the didactic benefits of online

lessons.^{13,14} Most scientific reports focused on evaluating the didactic benefits of online lessons from students’ perspectives.^{6,11,15,16} Effectiveness of online learning depends on motivation, subjects of the lecture, technological abilities of students, and presentation ability of lecturer.^{12,17,18} However, these studies include evaluating online learning from the students’ perspective in the early and limited time of the COVID-19 pandemic. For efficient further development of online learning, long-term didactic benefits have to be considered.

Considering all these conditions makes it important to define long-time didactic benefits of online learning, to plan the amount of online learning that can be applied in the prosthodontics curriculum. Accordingly, this study aims to evaluate online learning from the perspective of the students in the 10th month of online learning that is compulsorily continued in the Department of Prosthodontics, Gülhane Faculty of Dentistry.

MATERIAL AND METHODS

The study was conducted following the ethical standards of the Scientific Research Ethics Committee (Ref. no. 2020-483) of Health Sciences University, Ankara, Turkey. Data were collected using a survey, developed by Schlenz et al. Necessary permission to use the survey was obtained by e-mail. The first part of the survey included agreement or disagreement with the statements about technical qualification, didactic benefits, and motivation to online learning using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).⁶ There were also questions for participants to choose between online, equal, and face-to-face education models. Besides, the preferred amount of online learning in the future curriculum was also questioned. In the last part of the survey, demographic questions and questions about internet accessibility were asked. The “No answer” option was added to all questions. The survey was translated into Turkish using the relevant literature. Microsoft Forms (Microsoft 365, Microsoft Corporation, Redmond, WA, USA) was used to prepare the survey. The survey settings were arranged to ensure that the survey results were sent to the researchers without the participants’ identifications.

All dentistry students participating in prosthodontics lessons in the first semester of the 2020-21 education period (n=198) with at least 6 months of face-to-face learning experience were included in this study. Second-year (n=92), third-year (n=60), and fourth-year (n=46) students were determined as the participant group in this study. The online survey was conducted at the end of the fall semester of 2020-21. The link to the survey was sent to the students' Health Sciences University e-mail addresses. Survey response time was set as 10 days. A reminder was sent to all students on the first and fifth days. Participants were informed that participation in the survey is not mandatory and that the "No answer" option can be selected for questions that they do not want to answer. Survey response time was not extended, and only fully completed surveys were included in the statistical analysis.

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS Statistics (version 22, IBM, Armonk, NY, USA). Number and percentage were used for descriptive data. Data of technical qualification, didactic benefits, and motivation were analyzed. Principle axis factoring (using oblimin rotation) was conducted and two factors were applied. Cronbach's alpha showed acceptable reliability in the data of technical qualification (0.758) and didactic benefit (0.717) (Table 1). A chi-

squared test was used to analyze the comparison of the data according to gender and class. t-test was used to analyze the amount of online learning in the future curriculum ($p<0.05$).

RESULTS

A total of 154 (112 female, 42 male) students completed the survey with 7 minutes and 39 seconds of completion meantime, which represented a response rate of 77.77%. There were no significant differences compared to gender and semester (n=154, chi-squared test, $p=0.061$). Of students, 43.58% participated in all, and 36.36% of them participated in the majority of online lessons.

Students' evaluations on the technical qualification of online lessons, didactic benefits of online learning, and motivation were depicted in Table 2. The majority of students stated online learning were technically well prepared, unless, could not adequately prepare themselves for online learning. Most of the students agreed that online learning was well structured; the image and sound quality were satisfying; 33.9% of the second-year students, 34% of the third-year students, and 14.3% of the fourth-year students agreed to the "My desire to online learning was good" statement (n=154, chi-squared test, $p=0.017$). While 34.8% of female students agreed, 37.5% of male students did not agree (n=154, chi-squared test, $p=0.015$).

TABLE 1: Factor loadings of data (principle axis factoring using oblimin rotation).

		Factor	
		1	2
TQ3	Online learning was well structured	0.725	-
TQ1	The technical introduction in the first week of the semester prepared me well for online learning.	0.719	-
TQ5	Video and sound quality in online lessons was good.	0.711	-
TQ2	I was able to prepare myself for online learning (articles and books on the topic)	0.633	-
TQ4	My desire to online learning was good.	0.558	0.374
DB5	I do not think online learning is useful and I hope that the education will continue face-to-face with the next academic year.	-	0.828
DB4	I usually prefer to learn face-to-face rather than online learning.	-	0.793
DB1	Currently, online learning are a good option to learn the theoretical part of education.	0.346	0.577
DB2	By participating in online lessons, I feel well prepared for the practical part of the training.	0.351	0.540
DB3	In terms of online learning, I durst to ask questions more often than face-to-face learning.	-	0.519
Eigenvalues		2.629	2.489
% of variance		26.290	24.892
Cronbach's alpha		0.758	0.717

TQ: Technical qualification; DB: didactic benefits.

TABLE 2: Descriptive of technical qualification and didactic benefits (analyzing the association with gender and class).

Survey question						Chi-square		
	Gender	Semester				n		
TQ1 The technical introduction in the first week of the semester prepared me well for online learning.								
1	2	3	4	5				
10 (6.5%)	29 (18.8%)	45 (29.3%)	62 (40.3%)	2 (1.3%)	0.274	0.276	149 (96.8%)	
TQ2 I was able to prepare myself for online learning (articles and books on the topic)								
1	2	3	4	5				
12 (7.8%)	79 (51.3%)	44 (28.6%)	14 (9.1%)	4 (2.6%)	0.665	0.563	153 (99.4%)	
TQ3 Online learning was well structured								
1	2	3	4	5				
5 (3.2%)	14 (9.1%)	49 (31.38)	73 (47.4%)	12 (7.8%)	0.764	0.288	153 (99.4%)	
TQ4 My desire to online learning was good.								
1	2	3	4	5				
18 (11.7%)	45 (29.2%)	39 (25.3%)	44 (28.6%)	8 (5.2%)	0.015*	0.017*	154 (100%)	
TQ5 Video and sound quality in online lessons was good.								
1	2	3	4	5				
7 (4.5%)	22 (14.3%)	36 (23.4%)	68 (44.2%)	20 (13%)	0.132	0.605	153 (99.4%)	
DB1 Currently, online learning are a good option to learn the theoretical part of education.								
1	2	3	4	5				
4 (2.6%)	21 (13.6%)	42 (27.3%)	56 (36.4%)	30 (19.5%)	0.220	0.107	153 (99.4%)	
DB2 By participating in online lessons, I feel well prepared for the practical part of the training.								
1	2	3	4	5				
23 (14.9%)	55 (35.7%)	50 (32.5%)	24 (15.6%)	2 (1.3%)	0.105	0.043*	154 (100%)	
DB3 In terms of online learning, I durst to ask questions more often than face-to-face learning.								
1	2	3	4	5				
4 (2.6%)	17 (11%)	26 (16.9%)	74 (48.1%)	29 (18.8%)	0.131	0.506	150 (97.4%)	
DB4 I usually prefer to learn face-to-face rather than online learning.								
1	2	3	4	5				
5 (3.2%)	6 (3.9%)	19 (12.3)	41 (26.6%)	83(53.9%)	0.243	0.659	154 (100%)	
DB5 I do not think online learning is useful and I hope that the education will continue face-to-face with the next academic year.								
1	2	3	4	5				
5 (3.2%)	5 (3.2%)	33 (21%)	50 (32%)	60 (39%)	0.566	0.053	153 (99.4%)	
M The use of new digital teaching methods (e.g. online learning) motivates me to learn.								
1	2	3	4	5				
20 (13%)	60 (39%)	45 (29.2%)	25 (16.2%)	4 (2.6%)	0.247	0.486	154 (100%)	

*p<0.05; TQ: Technical qualification; DB: Didactic benefits; M: Motivation (type of answer: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree).

During the COVID-19 pandemic, most students agreed online learning is the best option for dental education. While the third-year students (45.3%) and the fourth-year students (42.9%) did not feel well prepared for the practical part, the second-year students (40.7%) were neutral (n=154, chi-squared test, p=0.043). Most of the students declared having difficulties motivating themselves during online lessons. Most students report that they conveniently asked questions during the online lessons. Most students preferred face-to-face learning to online learning and

hoped that dental education will continue face-to-face in the next academic year.

Most students preferred face-to-face learning for more successful knowledge transfer, finding answers to their questions, giving more clues about the subject, and more fun (Table 3). There were no significant differences between gender and semester (n=154, chi-squared test, p>0.05). Students stated that online learning should be applied to 40.09% (standard deviation: 28.17) of the dental education curriculum. When the ratio of online learning in the

TABLE 3: Descriptive of overall assessments (analyzing the association with gender and class).

				Chi-square		n
	Face-to-face	Equal	Online	Gender	Semester	
In which teaching method do you think you make less effort to learn?	58 (38%)	35 (23%)	52 (34%)	0.668	0.148	147 (95.5%)
In which teaching method do you think you can attend courses more easily?	76 (49%)	27 (18%)	47 (31%)	0.687	0.341	150 (97.4%)
In which teaching method do you think knowledge transfer is more successful?	123 (80%)	22 (14%)	8 (5%)	0.277	0.986	153 (99.4%)
In which teaching method do you think you find answers to your questions easier?	95 (62%)	50 (32%)	7 (5%)	0.842	0.087	152 (98.7%)
In which teaching method do you think the lecturer gives more clues about the subject?	87 (56%)	51 (33%)	10 (6%)	0.291	0.478	147 (95.5%)
Which teaching method do you think is more fun?	119 (77%)	16 (10%)	14 (9%)	0.313	0.468	149 (96.8%)
Which teaching method do you think is more modern?	74 (48%)	29 (19%)	44 (29%)	0.904	0.699	147 (95.5%)

curriculum was compared with the gender and semester, there were no significant differences (t-test, 0.728 and 0.328, respectively).

The majority of students used laptop computers (69%) and wireless LAN (74%) for online learning. Most of the students stated the frequency of internet connection problems as seldom (61.03%) and never (5.19%), however, 18.83% of students as half of the courses and 2.5% of students as routinely.

DISCUSSION

During the COVID-19 pandemic, social distancing to prevent the community from the spread of SARS-CoV-2 has an enormous impact on prosthodontic education. Synchronous online prosthodontic education courses were evaluated to ensure continuity of education. To achieve the highest didactic benefits, involving all participants in the teaching process is crucial.¹³ In order to compare the didactic benefits of online learning and face-to-face education, students who had been studying face-to-face for at least 6 months were included in this study. The students of first-class were excluded due to the lack of face-to-face education experience. In the present study, a method was used as sending the link to the students via e-mail and delivering the answers to the researchers anonymously. With this method, researchers tried to make the students feel comfortable and to know that their answers would not have any consequences. A Likert scale was used to evaluate didactic benefits from students' perspectives as routinely used in medicine.^{6,8}

After the diagnosis of the first case of COVID-19 (March 11, 2020) in Turkey, theoretical online learning was started in universities and face-to-face educa-

tion including practical training was suspended while the term continued. However, this rapid change resulted in technical difficulties for students and faculty members during online learning. For this reason, most of the students stated that they were not able to prepare themselves for online learning. To cope with this problem, Gülhane Faculty of Dentistry administration and Department of Prosthodontics planned and implemented rehearsal online lessons during the ongoing semester and at the beginning of the fall semester 2020-21 to minimize this problem by planning and implementing. Information documents prepared in different departments of the University of Health Sciences were delivered to students. In this way, students and faculty members were easily adapted to the system.

Besides, rehearsal online lessons and information documents provided students for contributing to the easy access that is one of the crucial factors affecting the success of online learning.⁶ In this study, most students participated in synchronous online learning using a wireless LAN connection and stated lower internet connection problems. Easy access is important for didactic benefits.⁶ However, there were students with a higher frequency of internet connection failures. The reason for this situation may derive from a lack of existing Internet infrastructure facilities. Since online learning has started not only in universities but also in all educational institutions, it is thought that the Internet infrastructure in the residence of students might not be able to handle the density.

Motivation is another factor affecting the success of online learning.¹² In the present study, lower motivation to online learning was stated. An inadequate desire of fourth class and male students to on-

line learning might be affected due to loss of motivation. Making it easier for students to ask questions during online classes enabled instant interaction with the student during online learning. Instant interaction plays a key role in increasing students' motivation and the didactic benefit of online learning.¹⁹ The technically well-prepared and well-structured online lessons with satisfying image and sound quality had also a positive effect on motivation and desire of learning.²⁰ However, the intensive curriculum of prosthodontics courses leads to the implementation of long online lessons. Online learners may have motivation difficulties during long online lessons.¹² Freely entering and leave the online classroom and getting distracted by surroundings were stated as the facilitators for the loss of motivation.¹⁷ Long online prosthodontic courses were considered to be the main reason why the motivation and desire for online learning were inadequate.

In the Department of Prosthodontics, Gülhane Faculty of Dentistry, online theoretical training continued in the fall term of 2020-21 and face-to-face practical training planned for the spring term of 2020-21. Under the current circumstances, students cited online learning as the most viable learning option. However, students stated that they could not prepare themselves for practical applications during online learning. In prosthodontics training, it is essential to combine theoretical knowledge with practice such as manual training and clinical patient care. This result was more pronounced in higher classes who have reached the clinical patient care stage. Similarly, not only in the Department of Prosthodontics, Gülhane Faculty of Dentistry but also in faculties of dentistry around the world, students stated that they could not prepare themselves enough for online learning.^{6,7,19} This situation can also be considered as the reason why students choose face-to-face training in the overall assessments section. Unless the negative-rated aspects of online learning, students indicated a mean amount of 40.09% (standard deviation: 28.17) regarding terms of online learning for the theoretical part of the future curriculum. Schlenz et al. stated that as the grade level increases, students expressed that online learning should be included in the theoretical curriculum more.⁶ However,

in the present study, there was not a significant difference. Although students have negative feedback about online learning, they desire relatively high integration of online learning in the future. This situation showed that students understand the importance of online learning in undergraduate and postgraduate dental education. Students' easy access to educational webinars on various topics during the pandemic may have led them to conclude that online learning should be included in the dentistry curriculum.

There were several limitations of this study. In the present study, lecturers' perspectives were not considered for the implementation of online learning in dental education. It was due to the limited number of lectures of the Department of Prosthodontics, Gülhane Faculty of Dentistry. A study involving other dentistry faculties using the same online teaching method should be compared. In this way, the perspective of lecturers for the implementation of online learning in dental education which is important for the development of better online lessons can be included in a future study.^{5,6}

With the development of the COVID-19 vaccine and the start of vaccination in the community, it is planned to return to face-to-face education gradually. Therefore, students will begin to exercise in on manikins and will start to practice on patients. However, since the complete elimination of the risk will take time, theoretical training will continue online during the partial transition. The results of this survey displaced the perspective of students for the ten months of online learning and will be used to minimize the impact of long-time outbreaks on teaching in dentistry. The new and more flexible online learning concepts should be developed to increase the didactic benefits of dentistry curriculum without face-to-face learning.

CONCLUSION

Within the limitation of this study, students showed a negative perspective on the implementation of online learning. Developments on online learning are needed to use online learning for long-time outbreaks in the future curriculum.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise,

working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Bahadır Ezmek, Osman Cumhur Sipahi; **Design:** Bahadır Ezmek, Osman Cumhur Sipahi; **Control/Supervision:** Bahadır Ezmek, Osman Cumhur Sipahi; **Data Collection and/or Processing:** Bahadır Ezmek; **Analysis and/or Interpretation:** Bahadır Ezmek; **Literature Review:** Bahadır Ezmek; **Writing the Article:** Bahadır Ezmek; **Critical Review:** Osman Cumhur Sipahi; **References and Fundings:** Bahadır Ezmek, Osman Cumhur Sipahi; **Materials:** Bahadır Ezmek, Osman Cumhur Sipahi.

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