ORIGINAL RESEARCH ARTICLE

Digital Divide Affects Oral and Dental Health Students' Preferences During COVID-19 Outbreak: A Comparison of Distance and Face-to-face Education

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Abstract

Purpose: The digital divide is the gap between those who can access and use digital media and those who do not have easy access to it. Distance education started in dentistry education and all activities and applications conducted online during COVID-19 outbreak. However, the possible effects of the digital divide on learning processes were ignored in this process. This study aims to investigate how the digital divide effects disadvantaged dental health students' preferences during COVID-19.

Materials and Methods: We used a mixed method to investigate the results of the Likert-type items and open-ended questions. The study group who requires clinical training and has difficulties reaching the Internet and personal devices was selected as Oral and Dental Health students to investigate their preferences and opinions towards distance education and face-to-face education.

Results: The results showed the students, who require clinical skills in their education and are disadvantaged in terms of Internet and computer access, cannot embrace distance education. They are worried about finding a job after graduation due to the limited application of clinical skills. The most important positive aspect of distance education that its contribution to a feeling of safety and contributions to students' economic situation. The most negative aspects of distance education are its difficulties for disadvantaged students and its limitations for clinical applications. Students suggested that interactions in synchronous lectures and the use of visual demonstrations should be increased.

Conclusions: In possible future pandemic and lockdown situations, educational institutions need to identify the digital divide between their students. Distance education requires good planning, training of instructors, and distribution of pre-class activities or offline materials for the students who have difficulties reaching Internet and computer access.

Key words: COVID-19; Dental education; Digital divide; Distance education; Oral and dental health students

Introduction

The digital divide is the gap between those who can access and use digital media and those who do not have easy access to it [1]. N. Selwyn and K. Facer [2] state that policymakers, technologists, and other interested parties must create a policy agenda because the digital divide is still a significant issue. Individual attributes, such as age, sex, ethnicity, employment status, income, and education levels, are linked to different levels of access to ICTs [3]. Frederico Cruz-Jesus, et al. [4] reported that even developed countries, which are doing quite well, had certain population disparities to close in terms of digital divide. On the other hand, developing countries lag substantially behind developed countries in terms of embracing new digital technology, particularly the Internet [5]. Because educated individuals are more likely to be able to handle the complexity of technology with less difficulty, education emerges as a very essential component of the digital divide [6]. Sisira Edirippulige, et al. [7] found that while many participants thought that e-learning methods may help address some of the issues in medical education in developing countries, a lack of resources and educational opportunities has limited the potential advantages. The digital divide has become more noticeable in the COVID-19 period due to issues with limited access to ICT and the Internet, as well as a lack of specialized knowledge and skills relating to the production of online content and instructional videos, use of specialized educational software and hardware, and use of specific online learning environments [8]. Institutions and individuals must understand the importance of online education, recognize the obstacles, and work fast to find solutions to integrate the new competency-based sys-

tem and online education [9]. According to Chirag Vasavda, et al. [10], social interaction is another issue, because the absence of social connection in virtual learning environments might "further the digital divide" and harm students' mental health. In the literature, there are several studies focusing on the students' experiences during distance learning period. University students think that online education is useful [11], the students make their schedule in a relaxed environment and feel free to ask questions and communicate with teachers and save travel time [12]. On the other hand, the lack of face-to-face interaction, the use of Internet bandwidth, connectivity restrictions, unfamiliarity with the online environments, and technical support restrictions are significant drawbacks of distance education [13]. University students also think that distance education is stressful [11] and they do not enjoy studying from home [14]. European Academic Dental Institutions reported that educators need evidence-based information to make informed decisions and that they should be more prepared for other epidemics that may occur in the future [15]. Thus, dental education programs must consider the digital divide and incorporate appropriate ICT for students pursuing careers in oral health [16]. However, there is limited information regarding the undergraduate dental health students' experiences related to distance education, their preferences based on ICT access opportunities, and how the digital divide affects their opinions. Dental education also requires clinical skills and there is a gap in the literature about how the digital divide affects clinical education, especially for disadvantaged students. The Oral and Dental Health (ODH) program prepares technical staff for dentists, making it a field where clinical experience is crucial. Research questions are: 1) What are the preferences of ODH students towards face-to-face or distance education? 2) What are the ODH students' preferences towards distance or face-to-face education in terms of their access to computers and Internet? 3)What are the opinions of the ODH students towards distance education?

Material and Methods

Study design

In this study, a mixed method was used to determine how the digital divide affects students' opinions. At the end of the spring semester of the 2020-2021 academic year, an online student opinion survey was applied and collected, including the demographic survey. This study was approved by the Non-interventional Clinical Research Ethics Board of Hacettepe University (project no: GO 21/177, decision no: 2021/03-02, date: 02.02.2021).

Study group

We used convenience sampling, and our focus group is comprised of 1st and 2nd year ODH students at a public university in Asia. Participants are disadvantaged compared to the dental school students [17,18]. The data of the study were collected between February and May 2021, a total of 102 (out of 150) students agreed to participate in the study. Since this is a non-interventional study (survey), we collected the participants' informed consent via online forms due to the Covid procedures.

Oral and dental health (ODH) program curriculum

This is a 2-year program, and it aims to train staff who have the knowledge and skills to prepare the necessary environment for all clinical work of the dentist and to take responsibility for patient admission, treatment, and records in dentist's offices, and public or private dental clinics. The theoretical part of the curriculum includes clinical assistantship in all branches of dentistry including orthodontics, endodontics, conservative dental treatment, prosthe-

sis, periodontology, pedodontics, oral surgery, and oral diagnosis and radiology, as well as dental hygiene, professional ethics and deontology, practice management, sterilization, terminology in dentistry, and computer literacy courses. The students complete the practical part of the curriculum by visiting the clinical departments in the dental faculty hospital of the university. Graduates of this department can work as technicians in dental clinics, dental units of hospitals, or public institutions. As a consequence of the Pandemic, the courses of this program were taught completely online until the spring of 2021. Practical applications could not be applied. With the easing of the pandemic after March 2021, students were taken to internships for only a short time (2 half days for each department) on rotation. All formative and summative assessments were applied online.

Data collection tools

A questionnaire of 20 questions was applied to the participants. It consisted of detailed questions to investigate the socio-demographic information such as having a computer of its own, type of computer, having an Internet connection. The second part of the questionnaire included 11-Item Likert-type questions about their preferences towards distance education or face-to-face education. In the third and last part of the questionnaire, there were 4 open-ended questions to collect the students' opinions on distance education. All questions were applied via an online form. Reliability Statistics showed that Cronbach's Alpha of Likert-type 11-Items have a value of .868 for the student preferences questionnaire.

Statistical analysis

To answer the first research question, descriptive statistics of student responses obtained from the 11-item student preferences questionnaire were calculated. In the second research question, the questionnaire total scores (dependent variable) were compared with Mann-Whitney U test in terms of having a personal computer and having an Internet connection (independent variables). In the third research question, the main themes and their sub-themes were determined via MAXQDA2020 qualitative and mixed methods data analysis software.

Results

What are the preferences of ODH students towards face-to-face or distance education?

In this research question, an 11-item Likert (5) type questionnaire was applied to determine whether the students' preferences were face-to-face education or distance education. The descriptive statistics of the answers given by the 102 students who participated in the survey (Table 1).

According to these results, students, in general, prefer face-to-face education. There is also a tendency to continue distance education due to the Pandemic and health issues. Students stated that distance education was not effective, they could not find the opportunity for social interaction in distance education, and technical problems negatively affected instructional activities. In addition, it is seen that they do not feel ready for clinical applications and demonstrations of these skills in distance education are not useful.

Table 1. Students' preferences for face-to-face education or distance education

	Items	Mean	Std. Deviation
1.	I think distance education is more effective than face-to-face education.	1.79	1.205
2.	Overall, I prefer distance education to face-to-face education	2.17	1.483
3.	I prefer distance education to face-to-face education in terms of social engagement.	2.00	1.407
4.	The technical problems (Internet connection problems, computer problems, etc.) that I experienced during distance education did not affect my educational process	2.22	1.354
5.	I think I am ready for clinical applications during distance education.	1.78	1.077
6.	I can easily apply the skills shown/explained in distance education.	2.11	1.168
7.	I am worried about face-to-face applications due to the COVID-19 pandemic.	3.08	1.447
8.	During the COVID-19 pandemic, I prefer face-to-face education to online education.	3.36	1.420
9.	If I am vaccinated, I would like to participate in face-to-face education.	3.75	1.338
10.	Outside of the online course hours, I get in contact with my friends for educational purposes.	3.03	1.375
11.	I prefer the online exam to the paper-pencil exam.	2.81	1.398

What are the ODH students' preferences towards distance or face-to-face education in terms of their access to computers and Internet?

Total score was calculated according to the answers given to the 11-Item Likert-type questionnaire. Item 8 and 9 in the questionnaire were converted and scored because of their reverse item structure in terms of a tendency towards distance education preference. As the total scores given to the questionnaire increased, student preferences show a tendency toward distance education. Mann-Whitney U Tests showed that; the total scores for the distance learning preference questionnaire of students who have a personal PC (Mdn=27) were higher than the students who do not have any PC (Mdn=23), U=1748, z= 3.015, p=.003. In addition, the total scores of the students who have an Internet connection (Mdn=27) were higher than the students who do not have an Internet connection (Mdn=22), U=1478.5, z= 2.160, p=.031.

What are the opinions of the ODH students towards distance education?

A total of 227 codes and three themes were determined. These themes are positive aspects (Table 2) and negative aspects (Table 3) of distance education and their suggestions for distance education (Table 4).

Discussion

In the first research question, students' preferences for face-to-face education or distance education were determined. The results indicate that face-to-face education is considered more effective, and they may prefer distance education until vaccines are released only due to the pandemic. Mustafa Tevfik Hebebci, et al.[19] reported that students have negative perceptions of distance learning. Similarly, Aleksandra Stevanović, et al.[12] reported that especially first-year students believe distance learning to be less beneficial and fascinating than face-to-face education. Considering that the students in our study group studied for 2 years of specialization and most of them were first-year students, these results also confirmed the findings of previous studies. On the other hand, first-year students preferred distance learning to face-to-face instruction to their seniors[20]. In our study, other factors such as lack of social interaction

Table 2. Positive aspects of distance education

Sub-Themes	Frequency
The feeling of being safe	18
Economic aspects	17
Managing their learning processes	5
Reducing student stress	4
Equivalent to face-to-face education in terms of theoretical lectures	3

Some of the students' opinions on positive aspects of distance education are as follows:

Std37, M: Due to the pandemic, I would like to continue my education in distance. I think that if face-to-face education starts, the disease will spread more easily and it will harm public health.

Std70, F: The fact that the university is far from my house, saved me from the transportation problem.

Std13, F: Since I had more time, I had the opportunity to do the things I wanted to do. In this process, I learned to arrange my curriculum.

Std78, F: While I couldn't feel comfortable and was afraid of the reaction that would be given in the classroom environment, I was able to ask my questions comfortably in online education.

Table 3. Negative aspects of distance education

Sub-Themes	Frequency
Difficulties for disadvantaged students	26
Not suitable for clinical practices	25
Learning/Comprehension difficulties	16
Not as effective as face-to-face learning	12
Anxiety for after-graduation	6
Not supporting the social interaction	5
Instructors' distance education readiness levels	4

Some of the opinions on the negative aspects of distance education are as follows:

Std20, F: Internet is not always available, there is no study environment at home (too crowded and noisy), not everyone has their own room, and not everyone has their own computer. I even do homework via a mobile phone; it freezes every second. Housework does not end, guests do not end, how can I study, I do not even have a life. We live in a house of 3 families.

Std6, F: Although our teachers try to support us, we have a problem focusing. I am currently in my 2nd year and we are about to graduate, but I do not think that I will be able to find a job when I graduate. We have both practical and theoretical shortcomings and I have very serious concerns about getting a job.

Std56, F: Although we need to touch and investigate the materials, we try to recognize them only through visuals.

Std24, F: We stayed away from our social environment

Table 4. Students' suggestions for distance education period

Sub-Themes	Frequency
Increasing interactions in the synchronous lectures	26
Use of visual materials and demonstrations	25
Sharing the instructional materials on time	16
Increasing the online exam durations	12
Transition to the face-to-face education	6
Faculty training for distance education	5
Giving only the theoretical lectures in distance	4

Some suggestions are as follows:

Std66, M: I believe that progress with the students in the form of question-answer to make the education more successful in the synchronous lectures conducted through various systems will be better as it will attract the students' attention to the lecture, and the lectures will be more productive with the increase of student participation.

Std24, F: In terms of training our clinical skills, more visual and instructive resources such as application videos should be provided.

Std56, If all our teachers can send the lecture notes to us before or just after the lecture, we can work on the topics and reinforce them immediately.

Std7, F: I just think that the theoretical courses should be with distance education… it will be more efficient, it is not possible without the application of clinical skills.

in distance education, experiencing technical problems, being limited in gaining clinical skills, and the absence of clinical applications affect the participants' preferences for face-to-face education. Similarly, previous studies also reported that lack of social interaction among students[21] and lack of hands-on practice[22,23]. According to the results of the second research question, we found that the students who have access to computers and the Internet have a more positive view of distance education than the others. Victoria Coleman[24] stated that there is a digital divide that has several dimensions including access to devices and the Internet, digital literacy, and the students who are already disadvantaged are most impacted during the Pandemic. The results of our study supported this statement. We found that the students who have difficulties accessing the Internet or computer do not want distance education even if there is a security threat during Pandemic.

In the third question, students' views on distance education were examined. We found the most important positive aspect of distance education that its contribution to feeling safe and contributions to students' economic situation. Compulsory distance education has positive aspects for disadvantaged students[25]. Our participants also stated that they learned to manage their learning processes during the Pandemic. Problem-solving strategies were employed more frequently during the Pandemic than previously[26]. In addition, students' readiness for self-directed learning and metacognitive awareness can both increase after implementing novel strategies such as online flipped classrooms[27]. This explains the need for students to devote time to themselves, to create their study strategies to be successful in their classes, and as a result, developing their metacognitive skills. Another positive aspect is the perception that it has the same effect as face-to-face education in theoretical lectures. Students frequently use lecture recordings in distance learning, and these materials benefit student learning outcomes[28]. According to Lee Chye Sen and Suliman Al-Hawamdeh[29], virtual classrooms can make it easier for instructors and students to collaborate and integrate video conferencing, discussion boards, chat rooms, quiz administrations, lecture notes, and assignment tasks into a traditional lecturer-based system. Thus, in our study, students also tend to prefer virtual classrooms to lecture theaters.

Our results showed that the most negative aspects of distance education are its difficulties for disadvantaged students and its limitations for clinical applications. During distance learning, institutions must identify students who do not have access to technology and the Internet, and students who do not have a private studying environment and provide them with distance education solutions[30]. Dental students had a positive attitude and perspective and thought that e-learning is effective and can be an alternative to traditional teaching[31]. On the other hand, dentistry education is entirely based

on practical training and virtual training cannot transfer practical skills to the level of face-to-face learning[32]. It is important for the development of clinical, and technical skills and their transfer to the clinic via new technological devices such as instrumentation systems, haptic systems, simulations, and 3D printers[33], however, our results showed that it is the responsibility of institutions to offer these opportunities to students and to ensure that students benefit equally. We found that the students had anxiety about finding a job after graduation. Similarly, previous studies reported higher levels of depression, stress, and anxiety[34], and increased future career anxiety, and perceived job insecurity[35]. Thus, lack of clinical practice and a small number of clinical applications may have caused anxiety to find a job or be successful after graduation.

Students suggested that interactions in synchronous lectures and the use of visual demonstrations should be increased. Visual demonstrations and materials can enhance the practical skills in teaching health sciences[36], Therefore, integrating technology for interactive teaching[37], visual demonstrations, virtual patient applications[38], and interactive simulators[39] can contribute to online synchronous lectures in dental education. The students also suggested that the instructors should be prepared for distance education in terms of technology literacy as Malihe Sadat Mousavi, et al.[40] reported.

In this study, since there is not yet a valid and reliable scale related to the Pandemic for this preference in the literature, we developed and applied a questionnaire. In the second research question, to investigate the students' general trends, the total scores (dependent variable) of responses to this questionnaire (Likert type) were calculated, and comparisons were applied with independent variables. Examining the total scores of the questionnaire as a continuous numerical variable is a limitation. The online collection of the responses to the survey due to the pandemic is another limitation of our study. Students' opinions could be obtained in more detail through focus group discussions. The data used in the current research was collected during the pandemic, which means that the opinions gathered were based on experiences during emergency distance education process. Therefore, it is important to note that the opinions of oral and dental health students may differ in future studies on distance education.

Conclusion

As a result, we found that ODH students, who require clinical skills in their education and are disadvantaged in terms of Internet and computer access, cannot embrace distance education. A mixed method study showed that they were worried about finding a job after graduation due to the limited application of clinical skills in distance education processes. Students who already have difficulties in accessing technology also experience learning difficulties in the distance education process due to the lack of suitable working environments at home and economic problems. In addition, students believe that distance education gives a feeling of being safe and there is an economic benefit in terms of time and transportation. It may be beneficial to give theoretical lectures from distance. Based on these results, in possible future pandemic and lockdown situations, before transitioning from face-to-face education to distance education, it is suggested that educational institutions need to determine the digital divide between the students. The programs which have clinical skills in their curriculum, it would be more beneficial to prefer hybrid learning models. Flipped classrooms, where theoretical courses are given online, and practices are applied in classroom or laboratory environments. However, it requires good planning, training of instructors, and distribution of pre-class activities or offline materials for the students who have difficulties reaching Internet and computer access. Clinical and laboratory applications can be provided by taking appropriate precautions in the hospital environment and if not, by making the simulation

applications available to the students. For formative assessments, theoretical subjects and items for knowledge and comprehension level gains according to Bloom's taxonomy can be applied via online exams. However, it is recommended that laboratory and clinical applications be carried out in an application environment with rubric evaluation and a combination of several measurement methods.

Author Contributions

Conceptualization, A.B., E.O.B.; Methodology, A.B., E.O.B.; Formal analysis, A.B., E.O.B.; Data Collection, E.O.B.; Writing (original draft preparation), A.B.; Writing (review and editing), E.O.B.; Supervision, E.O.B.; Project Administration, A.B., E.O.B. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors reported no disclosures or conflict of interest.

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