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Perception of Undergraduate Dental Students About the Advantages and Disadvantages of Distance Education During the COVID-19 Pandemic

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Objectives The present study aimed to assess the dental students' perception about distance education during the coronavirus disease-2019 (COVID-19) pandemic.
Methods An analytical cross-sectional study was done on 288 dental students from Shahid Beheshti and Mashhad Universities of Medical sciences in February 2022. A standardized, electronic questionnaire was used for data collection. The questionnaire included a comparison of pros and cons of distance and in-person education and the NAVID system with online video lectures. The content validity of the questionnaire was assessed by qualitative and quantitative validation tools. The Chi-square test was used to compare the advantages and disadvantages of distance learning. Online video lectures and the NAVID system were compared by the Wilcoxon signed rank test.
Results Totally, 288 students (141 females and 147 males) completed the online questionnaire. Instant access to online sources was the most essential advantage of e-learning (74.7%), and the most critical disadvantages were lack of student-tutor (50.5%) and student-student interactions (50%). The NAVID system was easier to use than the online video lectures. The online classes were less successful in building student-tutor interactions compared with in-person classes. The NAVID system received more scores in fulfilling the students' expectations about the quality of conveying the concepts and learning.
Conclusion The sudden shift from in-person to distance learning has caused some educational problems and lowered the student-student and student-tutor interaction quality. However, optimizing the infrastructure and necessary facilities for online education would help obviate the students' academic needs.
Keywords COVID-19; Pandemics; Education, Distance; Perception

Introduction

The coronavirus disease-2019 (COVID-19) pandemic is the first pandemic after the H1N1 swine flu in 2009 and the Spanish flu in 1918. Over 584 million people were infected and over 6,420,000 died from the virus until August 2022. [1] The unprecedented COVID-19 pandemic locked down educational classes of more than 1.6 billion students worldwide. Since the first case of COVID-19 in China, more than 61 countries in Africa, Asia, Europe, Eastern Mediterranean, and northern and southern America have suspended school and university classes. A sudden shift towards online teaching was found to be the only solution to continue the education process.[2] Increasing the number of online lectures, teleconferences, E-books, online exams, and communication in virtual meeting platforms have digitally revolutionized the educational systems. [3]

Curtain et al. defined online learning as teacher-student interaction through the Internet. It can cover both asynchronous forms of interaction (i.e., assessment tools and provision of web-based course materials) and synchronous interactions through email, newsgroups, and conferencing tools. [4] Compared with previous educational methods, online learning provides students the opportunity to learn anywhere and anytime, following their own speed. In other words, students can keep learning despite occupational and family issues, disability, and distance problems. They will also have enough time to read, understand and respond. The outcome would be more motivated learners.[5] In addition, the effective use of figures, flowcharts, and diagrams improves the students' deep learning. [6] However, this new method has limitations and drawbacks, namely lack of sufficient and practical perception of virtual spaces, inadequate familiarity with its function and capabilities, and dependence of learning efficiency on the person's adaptation and technical skills in use of computers, smartphones, etc.[7] Specifically, in distant and deprived regions, improper facilities such as poor Internet connections, low quality of teaching methods, and lack of focus during online classes are reported as the most essential drawbacks of online education. [3]

Different aspects of e-learners' perception and satisfaction should be analyzed to evaluate the efficacy of electronic learning. In general, the users' attitudes toward the Internet and online technologies can be categorized into three main groups: emotional attitude, cognitive attitude, and behavioral attitude. Emotional attitude is related to the amount of desire, and cognitive attitude involves aspects like self-efficacy and feeling of usefulness, which can positively impact the behavioral attitude. The behavioral attitude is defined as the intention to use online methods for educational purposes. [8] Considering the importance of the

students' attitudes and perceptions of the effective use of online learning methods, the present study aimed to evaluate the dental students' perception of distance education at Sahid Beheshti and Mashhad Universities of Medical Sciences during the COVID-19 pandemic.

Methods and Materials

Questionnaire design and distribution:

The present analytical cross-sectional study was conducted via an online questionnaire. A standardized, electronic questionnaire was used for data collection. The questionnaire was created using Porsline, an online survey software, and distributed via an anonymous link from February 2022 to April 2022. The questions were collected from the questionnaires by Dost et al, [2] (the four initial sections of the DREEM evaluation system, which were designed to measure the educational environment of medical schools and healthcare professionals) and Bączek et al. [9] Some questions were modified based on the specific online educational methods of Shahid Beheshti and Mashhad Universities. Finally, the validity and reliability of the questionnaire were evaluated. The questionnaire's validity was evaluated quantitatively by calculating the content validity ratio and content validity index. Ten professionals were asked to categorize the questions as "necessary," "beneficial but not necessary," and "not necessary." According to the Lawshe Table, questions with a content validity ratio less than 0.6 were excluded from the questionnaire. [10] Reliability was calculated using the Cohen's kappa coefficient (κ). Ten students answered the questions twice with a one-week interval and the questions with the Cohen's coefficient more than 0.6 were included in the questionnaire. The final questionnaire explored the following items:

• General demographics.
• Advantages and disadvantages of offline distant courses.
• Comparison of online video lectures and in-person classes for theoretical and practical courses
• Comparison of online video lectures and pre-recorded sources (the NAVIDs' system)

Five-point Likert-type questions ranging from very low to very high were used for sections 3 and 4.

In 2016, the Virtual University of Medical Sciences embarked on the NAVID project as a responsible body for establishing a national Learning Management System. A team of experts initiated the project's consultation phase in 2016 to identify the primary and functional requirements for supporting teaching-learning. In the fall semester of 2017, faculty, staff, and e-learning students in the Medical Education Department of Tehran University of Medical Sciences and Alborz University of Medical Sciences evaluated the system during a pilot program. Since the COVID-19 pandemic, 64 medical universities, including TUMS, launched NAVID. With NAVID, instructors are able to share materials (including multimedia), facilitate student collaboration and discussions, manage assignments and quizzes, assign grades, and get reports. The following variables were evaluated by the questionnaire: sex, university, academic grade [either before or after passing the Basic Science Examination (BSE)], simplicity of using the system, efficacy in conveying the concepts, level of interaction and class activity, the uploaded files' quality, willingness to keep up with online teaching methods, and the experience of attendance in online video lecture type classes.

Participants*:*

A total of 840 undergraduate dental students ofShahidBeheshti and Mashhad Universities of Medical Sciences were eligible to participate. The sample size was calculated by the modified Cochran's formula for the finite populations with p=0.50, d=0.05, 1-α=0.95 and N=840. The minimum number of required participants for the present study was calculated to be n=264. Students who attended less than five virtual courses and the ones who were not willing to complete the questionnaire were excluded from the study.

Participant consent and ethical considerations:

Participation in the study was voluntary, and participants were ensured that all the collected data would be used anonymously and only for research purposes.

Statistical analysis:

Statistical analysis of the final results was conducted by SPSS® version 20 (SPSS Inc., Chicago, IL, USA). Quantitative data were presented as mean and standard deviation. Qualitative data were presented as frequency and percentage. The pearson Chi-square test was used to compare the advantages and disadvantages of distance learning between male/females and pre/post BSE students. Online video lectures and the NAVID system were compared by the Wilcoxon signed rank test. $P<0.05$ was considered to be statistically significant.

Results

Demographic information:

A total of 288 students including 141 (49%) females and 147 (51%) males completed the study. Of all, 155 (54.5%) students were from Shahid Beheshti University of Medical Sciences and 131 (45.5%) students were from Mashhad University of Medical Sciences. Also, 114 (39.6%) students had yet to participate in the BSE while 174 (60.4%) students were from higher academic grades.

Advantages and disadvantages of distance education:

Based on the participants' perspective, instant access to online references (74.7%) was the most important advantage of distance education, followed by staying at home and saving time (71.5%) and less anxiety during the

exams. Further study of reference books and other sources was considered as the least beneficial item (22.6%). On the other hand, lack of sufficient interaction with the instructors (50.5%) and friends (50%) was regarded as the most important disadvantage of this method. Prioritization of the advantages and disadvantages according to the students' points of view was similar when comparing the universities. The advantages of this teaching method were generally more than its disadvantages (Figures 1 and 2)

Relationship of gender and educational level with the mentioned advantages and disadvantages of distance education.

Evaluation of the relationship of gender with the mentioned advantages revealed that females placed more emphasis on the items of further study of reference books and other sources (P=0.043).The difference between females and males in reporting lower level of anxiety during the exams (P=0.5), higher learning flexibility and learning based on personal features (P=0.107), instant access to online references (P=0.248), and staying at home and saving time (P=0.456) was not statistically significant.

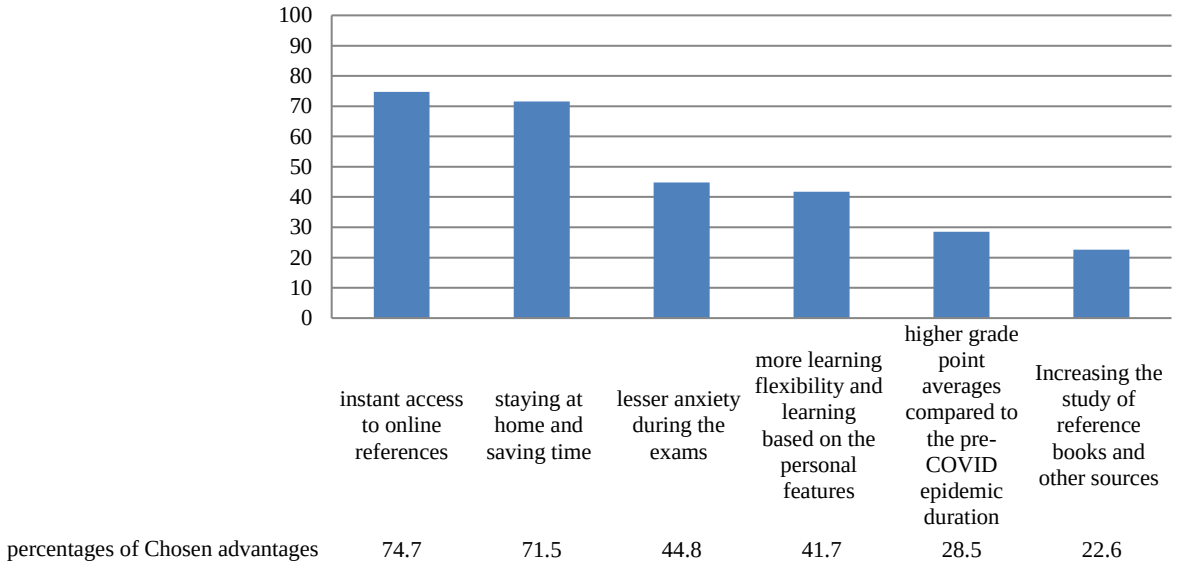

Figure 1 Reported advantages (%). The students' ratings for the advantages of distance education

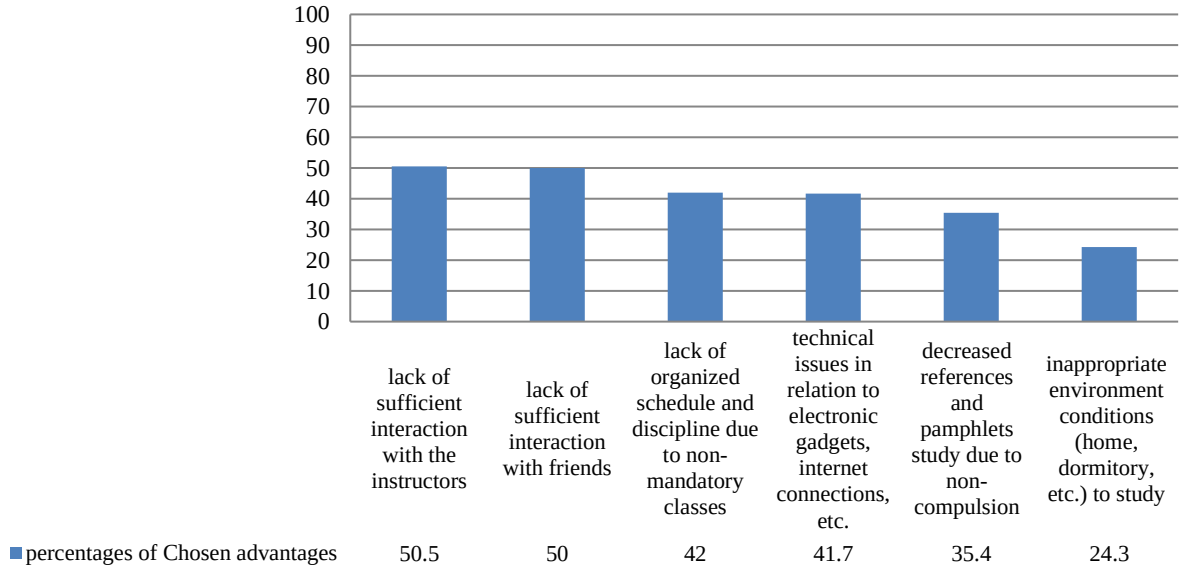

Figure 2: Reported disadvantages (%). The students' ratings for the disadvantages of distance education

In comparison to the pre-BSE students, a little higher percentage of post-BSE students chose the items of higher grade point average (P=0.085), more learning flexibility and learning based on personal features (P=0.179) and further study of reference books and other sources (P=0.282); however, the differences were not statistically significant (Table 1).

Table 2 shows the relationship of gender, and educational level with the chosen disadvantages of distance education.

Table 1- Relationship of gender, and educational level with the reported advantages of distance education

Variable		Advantages					
		Instant access to online references N (%)	Staying at home and saving time N (%)	Lower level of anxiety during the exams N (%)	More learning flexibility and learning based on the personal features N (%)	Higher grade point average compared to the pre-COVID epidemic duration N (%)	Further study of reference books and other sources N (%)
Gender	Male	114(76.6)	108(73.5)	63(42.9)	68(46.3)	41(27.9)	26(17.7)
	Female	101(71.6)	98(69.5)	66(46.8)	52(36.9)	41(29.1)	39(27.7)
	P value	0.248	0.456	0.500	0.107	0.823	**0.043***
Educational level	Pre-BSE	84(73.7)	78(68.4)	50(43.9)	42(36.8)	26(22.8)	22(19.3)
	Post-BSE	131(75.3)	128(73.6)	79(45.4)	78(44.8)	56(32.2)	43(24.7)
	P value	0.760	0.344	0.797	0.179	0.085	0.282

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Table 2- Relationship of gender, and educational level with the reported disadvantages of distance education

Variable		Disadvantages					
		Lack of sufficient interaction with the instructors N (%)	Lack of sufficient interaction with friends N (%)	Lack of organized schedule and discipline due to non-mandatory classes N (%)	Technical issues in relation to electronic gadgets, Internet connections, etc. N (%)	Decreased study of reference books and pamphlets due to non-compulsion N (%)	Inappropriate environmental conditions (home, dormitory, etc.) to study N (%)
Gender	Male	67(45.6)	71(48.3)	61(41.5)	59(40.1)	49(33.3)	34(23.1)
	Female	77(54.6)	73(51.8)	60(42.6)	61(43.3)	53(37.6)	36(25.5)
	P value	0.125	0.556	0.856	0.591	0.450	0.635
Educational level	Pre-BSE	60(52.6)	69(60.5)	60(52.6)	47(41.2)	44(38.6)	36(31.6)
	Post-BSE	84(48.3)	75(43.1)	61(35.1)	73(42)	58(33.3)	34(19.5)
	P value	0.470	0.004*	0.003*	0.603	0.361	0.020*

A significantly higher number of pre-BSE students chose the items of inappropriate environmental conditions (home, dormitory, etc.) to study (P=0.020), lack of organized schedule and discipline due to non-mandatory classes (P=0.003), and lack of sufficient interaction with friends (P=0.004).

Students' satisfaction with the NAVID system versus online video lecture classes

The numerical data (Figure 2) showed that a higher percentage of the participants scored the NAVID system's easiness to use as high and very high and considered this item to be favorable (61.5%); however, most of them thought that the quality of the uploaded files was low (69.8%) such that most students' expectations were not met to convey concepts and learn lessons (62.5%). Nevertheless, most of the participants wanted this education method to remain in the curricula (56.9%).

Evaluating the online video lectures revealed that most of the students scored the easiness to use the online video lectures as low and moderate (72.2%). The efficacy of this method in improving the students' practical skills was low (82.3%) and it did not meet most of the students' expectations in conveying concepts and learning lessons (80.6%). The interaction between the students and the tutors was rated as low and very low in both in-person classes (75.4%) and the online video lecture classes (83.8%) (Figure 3).

Online video lectures versus the NAVID system

Most of the students of both Shahid Beheshti (56 out of 116 students) and Mashhad (51 out of 98 students) universities gave higher scores to the NAVID system when comparing easiness to use (totally 107 out of 288 students). The difference between these methods was statistically significant ($P \leq 0.001$). Considering the methods' scores in fulfilling the students' expectations in conveying the concepts and learning the lessons, 53 and 47 students of Shahid Beheshti university gave similar and higher scores to the NAVID system compared to the online video lectures, respectively. In Mashhad University, these numbers were 47 and 32, respectively. Collectively, the NAVID system gained similar (100 out of 288 students) or higher (79 out of 288 students) scores in fulfilling the students' expectations in conveying the concepts and learning the lessons in comparison to online video lectures ($P \leq 0.001$).

Online video lectures versus in-person classes

Among 213 students that experienced attending online video lecture classes, 94 thought that in-person classes provide more opportunity for interaction with students and tutors, and 66 students gave similar scores to both methods. Fifty-five students reported that they had more interaction with the tutors in online video lecture classes. The differences between groups were statistically significant ($P < 0.001$).(Figure 4).

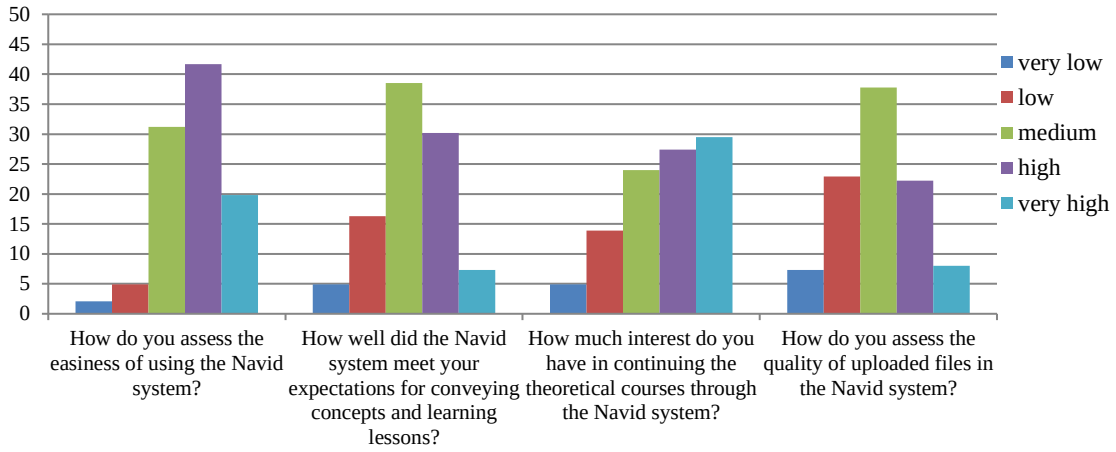

Figure 3: NAVID System satisfaction level

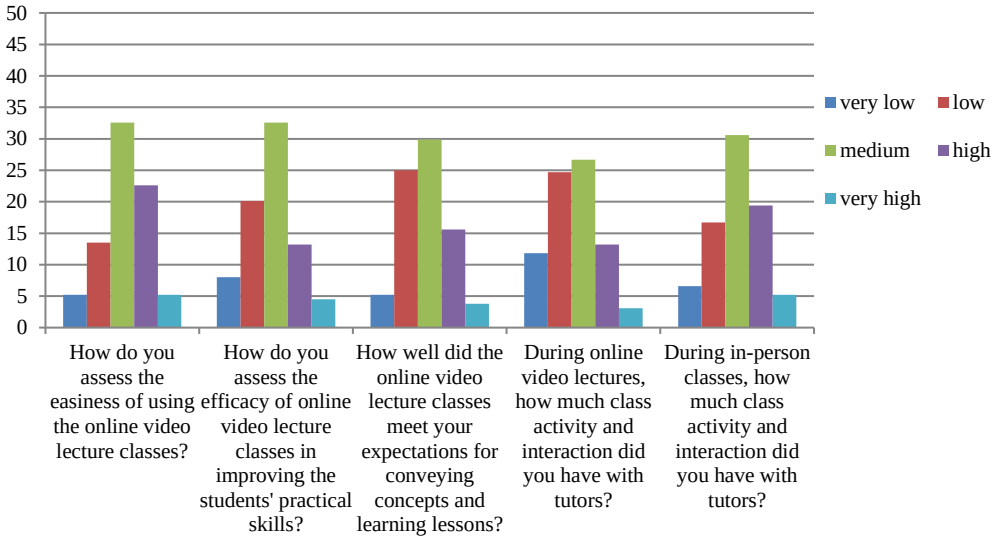

Figure 4: Online video lecture satisfaction level

Discussion

Since the spread of COVID-19, almost all educational institutions, including medical and dental schools, have conducted all or part of their academic programs virtually, using distance learning methods. This shift aimed not only to control the virus transmission but also to maintain the educational process. However, the fact that not all types of education can be entirely conducted via virtual methods is crystal clear. This is especially true for practical education, which needs improving skills and experiences. Medical and dental students need to make direct contact with patients to learn patient care and therapeutic methods. [11] The present study aimed to evaluate the undergraduate dental students' standpoint regarding the efficacy of e-learning and its limitations and challenges.

Advantages and disadvantages

According to the perspective of the participants in the present study, instant access to online references, staying at home and saving time, lower anxiety level during the exams, and more learning flexibility and learning based on personal features were the most important advantages of distance education. Items of higher grade point average compared to the pre-COVID epidemic period and further study of reference books and other sources were of less importance. Also, the UK medical students (studying in 39 medical schools in the UK) thought that saving time and money due to less commute and schedule flexibility allowing the students to learn from almost anywhere were the most significant pros of this method. [2] Similarly, nearly 60% of medical students participating in the study by Ibrahim et al. thought that online learning with the advantages of adaptation, flexibility, and saving time could be a suitable alternative to in-person educational methods during the quarantine period. [12] Saving time was also considered as a major advantage of e-learning in the study by Jordanian et al. [13]

On the other hand, the results of the present study revealed that the most significant disadvantages of distance education were lack of sufficient interaction with the

instructors and with friends, lack of organized schedule and discipline due to non-mandatory classes, and technical issues with electronic gadgets, Internet connections, etc. Items of decreased review of reference books and pamphlets due to non-compulsion and inappropriate environmental conditions (home, dormitory, etc.) to study were less emphasized. Many students prioritize in-person education over distance learning because it provides the opportunity for direct interaction with others, sharing of knowledge, and enhanced understanding. [14] In a study by Lakbala et al, insufficient and inadequate interaction with tutors was considered as a critical weak point of e-learning, while technology-related issues were of least importance. [15] In contrast, more than three-quarters of participants in the study by Ibrahim et al. considered the student-tutor interactions as adequate and sufficient. [11] The reason might be that the King Abdulaziz University tutors receive medical education training courses periodically on how to provide efficient interactive classes. In addition, some of the staff in this university have medical education degrees, so the tutors and staff might have used their previous experiences to increase the interaction quality and quantity of their online classes. Yasini et al, also reported that based on the students' and tutors' opinions, online teaching-learning activities have not been efficacious, and this method is not capable of building adequate student-tutor and student-student interactions. Deployment of various activities such as online discussions and conferences, combination methods (i.e., discussions via e-mails or visual-auditory methods), and learner-dependent activities have been suggested to increase the interactions in online courses. [16]

Lack of direct interaction with the tutors and friends can harm the students' mental health by increasing their stress and anxiety level. This has also been introduced as one of the destructive effects of quarantine during the pandemic. [17] On the other hand, open-book exams and holding the exams in non-limited and non-academic environments have reduced exam-related stress[18]; however, we should not ignore the distractions caused by non-academic exam circumstances which can affect the students' focus and thus, the exam results. Dost et el. reported that the most critical obstacles in the way of online teaching are family and noise disturbances, Internet connection troubles, and tutorial time consumption. [2] Also, inadequate infrastructures, as well as weak Internet connections, were reported in other studies [12, 19, 20] These issues are specifically bolder in large families and deprived areas such as many of the villages in Iran. In addition, some student-related problems have been reported, like inadequate electronic device skills, poor discipline due to a non-compulsive educational schedule, and a negative attitude towards e-learning. [12, 20-22] Gardner et al. reported that internal motivation is needed to complete an online course. [23]

The NAVID system versus online video lectures

The e-learning system's ease of use encourages the students to focus more on the learning process and spend less time learning how to work with the system. [24] Based on the present study's findings, a significant percentage of the students rated the NAVID system's ease of use as favorable. Despite the weakness of this system in fulfilling the users' expectations in conveying the concepts and improving the learning, most of the students demanded retaining this system. Conversely, the ease of use and efficacy of online video lectures in enhancing the practical and scientific knowledge of the students were rated moderate and lower than the expectations, respectively. In the study by Puljak et al, most of the tutors held their classes in online video lecture format, and few of them merely shared a pre-recorded presentation with the students. They reported that the students preferred online video lectures and thought that tutors should not be content with these pre-recorded presentations but should make them available to the students along with online video lectures. Therefore, students can review them at their convenience. [11]

In-person classes versus online video lectures

The results of the present study showed that the student-tutor interactions in online video lectures were similar or lower than those in in-person classes. Tuma et al. reported that from the medical students' perspective, the total quality of distance education methods was lower than in-person classes. [14] Similar results were reported by Dost et al, and most of the students preferred in-person classes over online video lectures. [2] Medical students of Wasit Medical School reported that online class attendance was more difficult than in-person classes because of low quality of infrastructures, poor Internet connections, and the fatigue due to prolonged presence in online courses. [14] The COVID-19 pandemic caused a sudden extended shift from in-person to distance education. This sudden shift caused inconsistency between the online education schedules and pre-formulated medical and dental education curricula. It also has been the main reason for technical issues and inadequate tutors' adaptation to new educational methods. In addition, Internet connection problems and family and environmental disturbances may lower the quality of online classes. [2]

In contrast, more than half of the students in King Abdulaziz University thought that online courses were similar or a better experience than in-person classes. The reason might be the previous experiences of students with the Blackboard Program application. [12] The results of a recent systematic review and meta-analysis showed that distance education methods were more effective in improving the students' knowledge and skills when compared with previous methods; however, this result cannot be generalized to every topic and every student. For instance, case-based online teaching can be an effective strategy but not static and not interactive. Moreover, the success of this educational method also depends on the students' personal features such as sex, educational level, university, attitude, satisfaction, interaction, and participation.[25] The students' responsibility and discipline are the key factors in successful online education. Universities can play a vital role in preparing such students and teaching them the concept of lifelong learning so that students will be skilled enough to update their knowledge. They can do so by (I) increasing participation and creating flexible learning routes, (II) guiding towards e-learning and teaching adaptation methods, (III) companionship of the

universities, and (IV) efforts for international connections of universities.

Limitations

Small sample size of the present study decreased its generalizability. In addition, the distance education methods evaluated in the present study have been developed during the pandemic era of COVID-19, and due to the emergency, it lacks adequate planning and infrastructure; therefore, it differs from the standard methods, which are developed by considering the necessary requirements.

Conclusion

The sudden shift from in-person to distance learning caused some educational problems and lowered the student-student and student-tutor interaction quality. However, optimizing the necessary facilities for online education would help cover the students' academic needs. To enhance the quality of distance educational methods, improving the quality of uploaded files in the NAVID system, creating proper infrastructures, and training the tutors are necessary. In light of these improvements, we can take advantage of online learning options such as instant access to online sources and save more time and effort.

Conflict of Interest

No Conflict of Interest Declared■

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Questionnaire

Dear participant, the present questionnaire was designed to evaluate your standpoint on distance education during the COVID-19 pandemic. We hope the study results will help improve this educational method. Answering the questions is voluntary, and the answers will be kept anonymously

Question	Answer
What is your educational level?	○ Before the Basic Science Examination ○ After the Basic Science Examination
Which university are you studying at?	○ Shahid Beheshti University of Medical Sciences ○ Mashhad University of Medical Sciences
Gender	○ Male ○ Female
In your opinion, which of the below items can be considered an e-learning advantage? (You can choose more than one)	○ Instant access to online references ○ Staying at home and saving time ○ Lower level of anxiety during the exams ○ More learning flexibility and learning based on personal features ○ Higher grade point average compared to the pre-COVID epidemic period ○ Further study of reference books and other sources
In your opinion, which of the below items can be considered an e-learning disadvantage? (You can choose more than one)	○ Lack of sufficient interaction with the instructors ○ Lack of sufficient interaction with friends ○ Lack of organized schedule and discipline due to non-mandatory classes ○ Technical issues in relation to electronic gadgets, Internet connections, etc. ○ Decreased study of reference books and pamphlets due to non-compulsion ○ Inappropriate environmental conditions (home, dormitory, etc.) to study
How do you assess the easiness of using the NAVID system?	○ Very high ○ High ○ Moderate ○ Low ○ Very low
How well did the NAVID system meet your expectations in conveying the concepts and learning the lessons?	○ Very high ○ High ○ Moderate ○ Low ○ Very low
How much interest do you have in continuing the theoretical courses through the NAVID system?	○ Very high ○ High ○ Moderate ○ Low ○ Very low
How do you assess the quality of uploaded files in the NAVID system?	○ Very high ○ High ○ Moderate ○ Low ○ Very low
During the COVID-19 pandemic, have you taken courses with online video lectures?	○ Yes ○ No
(If you chose "yes," please answer the following questions)	
How do you assess the easiness of using the online video lecture classes?	○ Very high ○ High ○ Moderate ○ Low ○ Very low
How do you assess the efficacy of online video lecture classes in improving the students' practical skills?	○ Very high ○ High ○ Moderate ○ Low ○ Very low
How well did the online video lecture classes meet your expectations in conveying the concepts and learning the lessons?	○ Very high ○ High ○ Moderate ○ Low ○ Very low
During online video lectures, how much class activity and interaction did you have with the tutors?	○ Very high ○ High ○ Moderate ○ Low ○ Very low
During in-person classes, how much class activity and interaction did you have with the tutors?	○ Very high ○ High ○ Moderate ○ Low ○ Very low