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ORIGINAL ARTICLE

A survey-based research of medical faculty students' experiences on anatomy education during the Covid-19 pandemic process

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KEYWORDS

Covid-19 pandemic process;
Anatomy education;
Online education;
Medical faculty student opinions

Summary

Purpose. – In this study, the purpose was to uncover the views of medical students about online anatomy education adopted during the COVID-19 pandemic period. It was also aimed to determine whether medical school students found online education suitable for anatomy lectures and which materials they desired to use during teaching anatomy practice lectures in this process. **Methods.** – A survey form that was prepared with the Google Survey application was administered to the Medical Faculty Term 1 and 2 students who received anatomy courses at Istanbul Yeni Yüzyıl University in the spring semester of the 2019–2020 academic year.

Results. – A total of 180 students, 53.89% of whom were 1st graders and 46.11% 2nd graders participated in the study, and 43.89% of the students stated that they found online education suitable for anatomy theoretical courses, and 12.78% for anatomy practice courses. Also, 43.75% of Term 1 and 41.77% of Term 2 students stated that the pandemic negatively affected the teaching of anatomy theoretical courses. It was found that students considered that anatomy practice courses were more affected by the pandemic before and during the pandemic ($P < 0.001$).

Conclusions. – This study uncovered that the pandemic process negatively affected anatomy education and students made more use of face-to-face education. We believe that the results obtained in the study will shed light on the views of anatomists on the teaching of anatomy in the online education process.

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Introduction

The COVID-19 pandemic that originated from the novel type of Coronavirus (SARS-COV-2) started in Wuhan, China in December 2019, and soon affected the entire world [1]. The epidemic turned into a pandemic affecting the course of life all over the world because of the rapid spread of the virus. Many measures were taken to maintain social distance and ensure isolation to control the pandemic and reduce its spread. In this context, like most institutions, educational institutions were closed.

After the first case was detected in Turkey on March 11, 2020 [2], the Council of Higher Education (CoHE, the council responsible for the supervision of universities in Turkey) announced on March 12, 2020 that 8 million university students (associate, undergraduate, graduate, and doctorate degrees) were suspended from face-to-face education [3]. It was announced on March 23, 2020, that the training would start in the digital environment [3]. Theoretical and practical courses were held completely online in the spring semester of the 2019–2020 academic year and in the fall semester of the 2020–2021 academic year in line with this decision. Then, it was reported at the meeting of the CoHE on February 17, 2021 that theoretical training is performed online as much as possible, and practical training be carried out face-to-face by allocating fewer students or dividing them into groups, provided that maximum attention is paid and strict precautions are taken [4]. In this respect, some medical faculties in Turkey obeyed this requirement and started to offer face-to-face practice courses. CoHE decided to switch to hybrid (blended) education and to organize online education at a maximum rate of 40% in the 2021–2022 academic year [5].

As in the case across the country, an integrated curriculum is used in medical education in our faculty. Anatomy education starts in the spring semester of the first year and continues in the fall and spring semesters of the second year. First graders are provided with 34 hours of theoretical and 15 hours of practical courses, and second graders receive 115 hours of theoretical and 88 hours of practical courses. Theoretical courses are taught by the anatomy professor, and the practical courses by a specialist doctor and two research assistants. Anatomy practice lectures are taught on plastic models to first graders, and on both cadavers and plastic models to second graders. Cadaver training is performed as a prosection on two whole cadavers and plays, and students are divided into groups with a cadaver/student ratio of 1/15 in the prosection lectures.

Anatomy education was performed entirely face-to-face at our university before the Covid-19 pandemic; however face-to-face education was replaced by online education during the pandemic process. Theoretical lectures were taught synchronously (live) over the Microsoft Teams (Microsoft Corp., Redmond, WA) application, and the practical lectures were taught asynchronously (in the form of pre-recorded videos) over cadavers and plastic models. Theoretical lectures taught synchronously were recorded and uploaded to the student information system to enable all students to access them later. Asynchronous practice lecture videos were also uploaded to the same system in parallel with the theoretical lectures. Anatomy practice lectures were provided synchronously over the 3D cadaver atlas

called “Acland’s Video Atlas of Human Anatomy” as well as the videos narrated over cadavers/plastic models for the second graders. Also, based on the decision of CoHE dated 17.02.2021, students who volunteered in the spring term of 2020–2021 were divided into groups and face-to-face anatomy practice supplementary lectures were provided.

In our faculty, Term 1 and Term 2 courses, their percentages, and the number of theoretical/practical courses are given in (Table 1) and (Table 2). Anatomy theoretical courses accounted for 8.3% of Term 1 curriculum and 21.6% of Term 2 curriculum. Anatomy practice courses accounted for 22.7% of Term 1 curriculum and 63.7% of the Term 2 curriculum.

In the present study, the purpose was to examine how the online teaching of anatomy, which has a very important place in medical education because of the Covid-19 pandemic, affected the efficiency of the courses of Terms 1 and 2 student. It was also aimed to uncover whether medical school students found online education suitable for anatomy lectures, and how and with which materials they wanted to learn anatomy practice lectures in this process.

Method

The approval was received from Istanbul Yeni Yüzyıl University Science, Social and Non-Interventional Health Sciences Research Ethics Committee (IRB: 2020/07-486). A questionnaire form was created with the Google Forms application in the study. The questionnaire whose reliability analysis was conducted was e-mailed to 209 students, 123 Term 1 and 86 Term 2 students, who actively received anatomy lectures in the spring semester of the 2019–2020 academic year at Istanbul Yeni Yüzyıl University. Also, the survey link was shared in the Whatsapp Group of the students. Only volunteering students were asked to fill out the questionnaires. To ensure objective answers of the students, no information was asked to reveal identities, and the questionnaire was administered after the final exam results were announced.

The survey form consisted of 4 sections and a total of 25 questions. The sections of the survey, number of questions, evaluation criteria, and contents of the questions are given in (Table 3).

In our faculty, the anatomy education of Term 1 students starts in the spring semester, as in the entire Turkey. A limited number of face-to-face practice lectures could be held with term 1 students because of the interruption of education with the pandemic (12 March 2020) briefly after the start of the 2019–2020 spring semester (February 3, 2020). For this reason, when it is considered that the Term 1 students did not have adequate experience to evaluate the anatomy practice lectures, different questions were asked to Term 1 and Term 2 students in the second and third parts of the questionnaire.

Statistical analysis

Regarding the calculation of the sample group, based on the findings of the study conducted by Ögetürk et al. [6], a preliminary power analysis was performed. The sample size was calculated by considering the mean (\pm standard deviation) weekly practical lecture hours. The power of the study was found to be 0.80, the alpha value was 0.05, the required

Table 1 Basic medical sciences courses taken by our Faculty Term 1 students.

1st grade courses	Theoretical	Practical	Percentage
Anatomy	34	15	9.41
Biophysics	59	6	14.06
Biostatistics	26	0	5.9
Behavioral Sciences	36	0	8.16
Physiology	20	4	4.99
Public Health	20	0	4.54
Histology and Embryology	31	9	8.05
Basic First Aid	12	0	2.72
Medical Biochemistry	44	14	11.56
Medical Biology And Genetics	60	10	14.74
Medical Pharmacology	7	1	1.7
Medical Microbiology	13	4	3.4
Medical History and Ethics	38	3	8.96
Human Relations in Medicine	8	0	1.81
Total	408	66	100.0

Table 2 Basic medical sciences courses taken by our Faculty Term 2 students.

2nd grade courses	Theoretical	Practical	Percentage
Anatomy	115	88	26.5
Biophysics	14	0	2.3
Physiology	143	13	25.0
Basic Medical Pharmacology	21	1	3.6
Histology and Embryology	46	14	8.8
Medical Biochemistry	49	2	8.3
Medical Biology and Genetics	9	0	1.5
Medical Microbiology	104	20	19.0
Basic Pathology	29	0	4.8
Total	530	138	100.0

minimum sample size was calculated as $n = 33$ per group and a total of 66 students. Power analysis was performed under GPower 3.1 (<http://www.gpower.hhu.de/>).

The Cronbach Alpha Coefficient of the questions answered by Term 1 and Term 2 students was used to examine the reliability of the study. When the coefficients were examined, the reliability of the questions was found to be acceptable for Term 1 ($\alpha = 0.601$) and Term 2 ($\alpha = 0.657$).

The conformity of the variables to normal distribution was checked with the Shapiro Wilk Test. The categorical variables were compared between the groups by using the Pearson Chi-Square, Fisher’s Exact Chi-Square, Fisher Freeman Halton Test, and McNemar Test. According to the normality test results, the Mann-Whitney U Test was used for the comparisons between binary groups, and the Wilcoxon Test was used for the comparisons between dependent samples. The Statistics Statistical Analysis SPSS 22 (SPSS IBM) program was used, and $P < 0.05$ was considered significant.

Results

1st part of the questionnaire

A total of 180 students, 97 (53.89%) of whom were 1st graders and 83 (46.11%) 2nd graders participated in the

study. The demographic characteristics of the students who participated in the study are given in (Table 4). A total of 94.44% of the students preferred medical school voluntarily. It was found that 43.89% of the students spent 3–4 hours a day on the internet before the Covid-19 pandemic. It was found that 67.22% of the students who participated in the study liked the anatomy lecture, and 43.89% of them found the online education suitable for anatomy theoretical courses, and 12.78% for anatomy practice courses (Fig. 1).

2nd part of the questionnaire

It was found that 64.58% of Term 1 students were satisfied with before-the-Covid-19 (face-to-face) anatomy education, and 34.92% with online anatomy training, which was initiated because of the pandemic; and 43.75% of them stated that the pandemic affected the teaching of anatomy theoretical courses negatively.

A total of 78.13% of the students advocated that anatomy practice lectures should be performed with plastic models and/or digital 3D plastic models in a laboratory setting, and 9.37% of them found it sufficient to teach asynchronously with videos. Only the questions answered by Term 1 students are shown in the second part of the questionnaire in (Fig. 2).

Table 3 Sections and contents of the survey.

Sections of the survey	Names of sections	Number of questions	Evaluation methods	Contents of the questions
Section 1	General information	9	3-point Likert scale except for categorical questions	Age and gender Whether or not students preferred medical school voluntarily Daily internet usage times The term in medical school Whether they like/dislike anatomy Whether students find online education appropriate for the period they are in Whether students find online education appropriate for anatomy theoretical/practice courses
Section 2	Only Term 1 students	5	3-point Likert scale	Satisfaction with anatomy theoretical education before/during the pandemic Satisfaction with the way anatomy practice courses are taught
Section 3	Only Term 2 students	7	3-point Likert scale	Satisfaction with anatomy theoretical/practical education before/during the pandemic Thoughts on the materials used in anatomy practice courses Satisfaction with the way anatomy practice courses are taught
Section 4	Scoring of the anatomy course	4	10-point evaluation scale (1 the lowest, 10 the highest)	Students were asked to give a score from 1 to 10 Face-to-face anatomy theoretical education Face-to-face anatomy practice training Online anatomy theoretical education Online anatomy practice training

3rd part of the questionnaire

It was found that 65.82% of Term 2 students were satisfied with the pre-Covid-19 (face-to-face) anatomy training, and 44.31% with the online anatomy training that was initiated because of the pandemic; and 41.77% of the students stated that the anatomy theory lectures and 68.83% of them stated that the anatomy practice lectures were affected by the pandemic negatively.

It was found that 67.08% of the students considered it adequate to teach anatomy practice lectures with cadavers, 62.34% with plastic models and/or digital 3D atlas, and 27.5% with videos asynchronously. Only the questions answered by the Term 2 students in the third part of the questionnaire are shown in (Fig. 3).

When student views on face-to-face and online anatomy education were compared, it was found that there was a statistically significant difference between pre-pandemic and pandemic period satisfaction for students in both terms (Term 1 $P < 0.001$; Term 2 $P = 0.007$). The results of students' satisfaction with face-to-face and online anatomic education are given in (Table 5). Accordingly, 33.87% ($n = 21$) of Term I students who were satisfied with face-to-face anatomy education were also satisfied with online education; 38.71% ($n = 24$) were not satisfied with online education. It was determined that 46.15% ($n = 24$) of Term II

students who were satisfied with face-to-face anatomy education were also satisfied with online education, and 32.69% ($n = 17$) were not satisfied.

4th part of the questionnaire

Students found anatomy theoretical courses more effective in face-to-face (before the pandemic) education than in online (during the pandemic) education ($P = 0.014$). Similarly, they also found face-to-face education to be more efficient than online education for anatomy practice courses ($P < 0.001$). No statistically significant differences were detected between the efficiency of face-to-face anatomy theoretical education and anatomy practice training before the Covid-19 pandemic ($P = 0.238$). Students found online anatomy theoretical training to be more efficient than online anatomy practice training during the Covid-19 pandemic ($P < 0.001$).

When asked to rate the anatomy education, students gave a mean score of 6.89 points to before-the-pandemic anatomy theoretical courses and 7.17 points to practice courses, and it was found that they gave a mean score of 6.35 to the theoretical anatomy course and 5.05 to the practical lectures in the pandemic process (Table 6).

Table 4 General characteristics of the participants.

n = 180	n (%)
Age	
16–17 ages	1 (0.56)
18–20 ages	78 (43.33)
21–22 ages	79 (43.89)
22 age and over	22 (12.22)
Sex	
Female	112 (62.22)
Male	68 (37.78)
Did you prefer the faculty of medicine with your own will?	
Yes	170 (94.44)
No	10 (5.56)
How many hours did you use the Internet in your daily life before the Covid-19 pandemic?	
1–2 hours	54 (30.00)
3–4 hours	79 (43.89)
5–6 hours	28 (15.56)
6 hours and over	19 (10.56)
Which grade are you at?	
1st class	97 (53.89)
2nd class	83 (46.11)
Online education is suitable for the Faculty of Medicine in my current term (Term I/Term II)	
Yes	92 (51.11)
No	88 (48.89)

Discussion

Coronaviruses that threaten public health have emerged as of the beginning of the 21st century [7]. SARS-CoV affected 29 countries in 2002 [8], and MERS-CoV affected 27 countries in 2012 [9]. Then, the SARS-CoV-2 (COVID-19) pandemic, which affected the whole world in 2019 and resulted in a significant number of deaths globally, affected approximately 220 countries [10]. Although some countries that were affected by SARS and MERS epidemics had experienced web-based education [11,12], medical schools in Turkey met the Covid-19 pandemic for the first time with online education. For this reason, online education is a setting in which both instructors and students are inexperienced. In this study, a statistically significant difference was found when the student satisfaction about face-to-face and online anatomy education was compared (Table 5). In the subgroup analyzes to find out which group the difference originates from, it was seen that Term 1 students who were satisfied with face-to-face anatomy education were not satisfied with online education ($P=0.001$). And also, it was determined that Term 2 students who were satisfied with the face-to-face course were also satisfied with online education ($P=0.003$). We think that this difference between Terms 1 and 2 students is due to the fact that Term 1 students are inexperienced in anatomy lessons as well as online education.

As is the case in many other countries, students whose families lived outside the city/country had to leave the

cities where they lived abruptly to return to their hometowns after the transition to online education in universities in Turkey. In addition to the concerns about their health and future, they also started an educational process that they were never accustomed to before. Previous studies proved that the mental health of students was negatively affected in this process [13], and even show signs of depression-anxiety [14,15]. The psychosocial and economic status of each student are not the same, and it is not possible for every student to be affected by this process equally. For this reason, satisfaction with the online education process is also dependent on the student, and factors such as their level of interest in the anatomy course, willingness to prefer the medical faculty, and the daily internet usage durations may affect the perspectives of students on online anatomy education. With this in mind, these parameters were also considered when the opinions of students on online anatomy education were evaluated in this study. In this respect, when the relations between students' daily internet usage before the pandemic and their satisfaction with online education were evaluated, it was found that students who spent less time on the internet were less satisfied with online education. Students who had 1-2 hours of daily internet use before the Covid-19 pandemic said that they did not find online education appropriate when compared to students who had 3 hours or more ($P=0.046$). In their study conducted with 79 second-year students to evaluate student views on anatomy education, Uygur et al. [16] reported that the interests and love for the lecture of students are important in satisfaction with the lectures. In the present study, when the status of students' liking the anatomy course and the state of preferring the medical faculty voluntarily were questioned, it was found that the students who liked the course were more satisfied with the face-to-face anatomy education before the Covid-19 pandemic at a statistically significant level (Term 1 $P=0.008$; Term 2 $P<0.001$). However, it was also found that there were no significant relations between students' satisfaction with online education, their liking for anatomy courses, and their willingness to choose the medical school ($P>0.05$). For this reason, it can be speculated that online education suppresses the optimism and excitement of even those who love anatomy lectures.

Medical education is very important to train well-equipped physicians in our country as well as all over the world. One of the basic and indispensable conditions of being a well-equipped physician is to receive a good anatomy education [17]. Anatomy is the oldest scientific discipline of medicine as a distinctive basic medical science [18], and is at the very center of basic medical science education [19] because of its practical aspects. Basically, anatomy requires a solid understanding of the relations between structures [20,21]. It is essential to reinforce the subject learned in theory with practical training [17,22,23]. In the present study, when the opinions of students on theoretical and practical anatomy lectures during the pandemic process were investigated, it was found that students thought that practical anatomy lectures were more affected by this process when compared to theoretical lectures ($P=0.002$). We believe that this difference occurred because of the fact that there were no major changes in theoretical education, but a radical change was experienced in practical training. Similarly, in their study conducted on medical education,

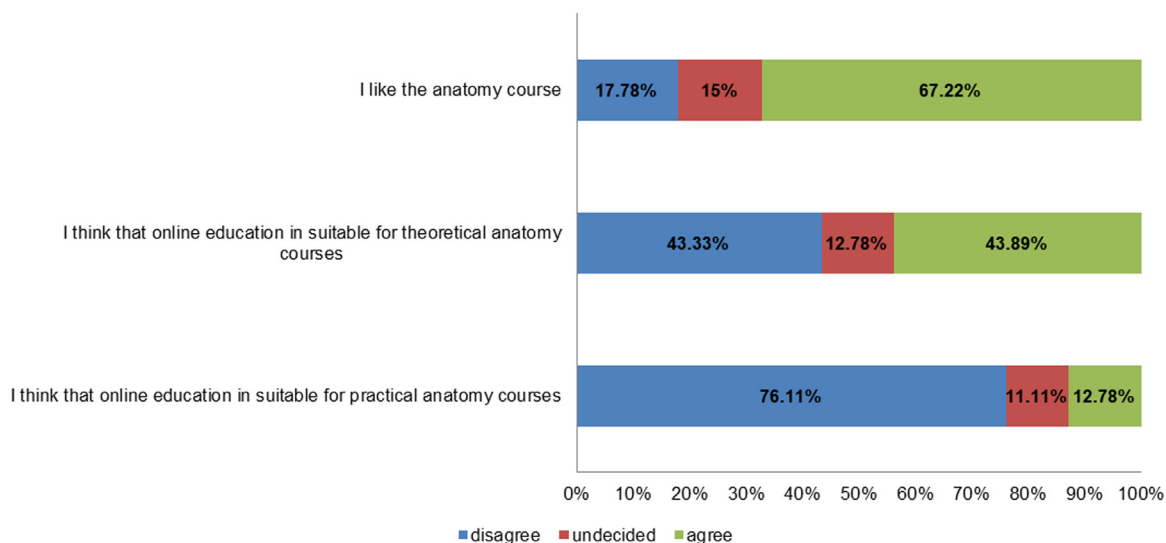


Figure 1 The evaluation of students regarding their interest in anatomy and its suitability for online education.

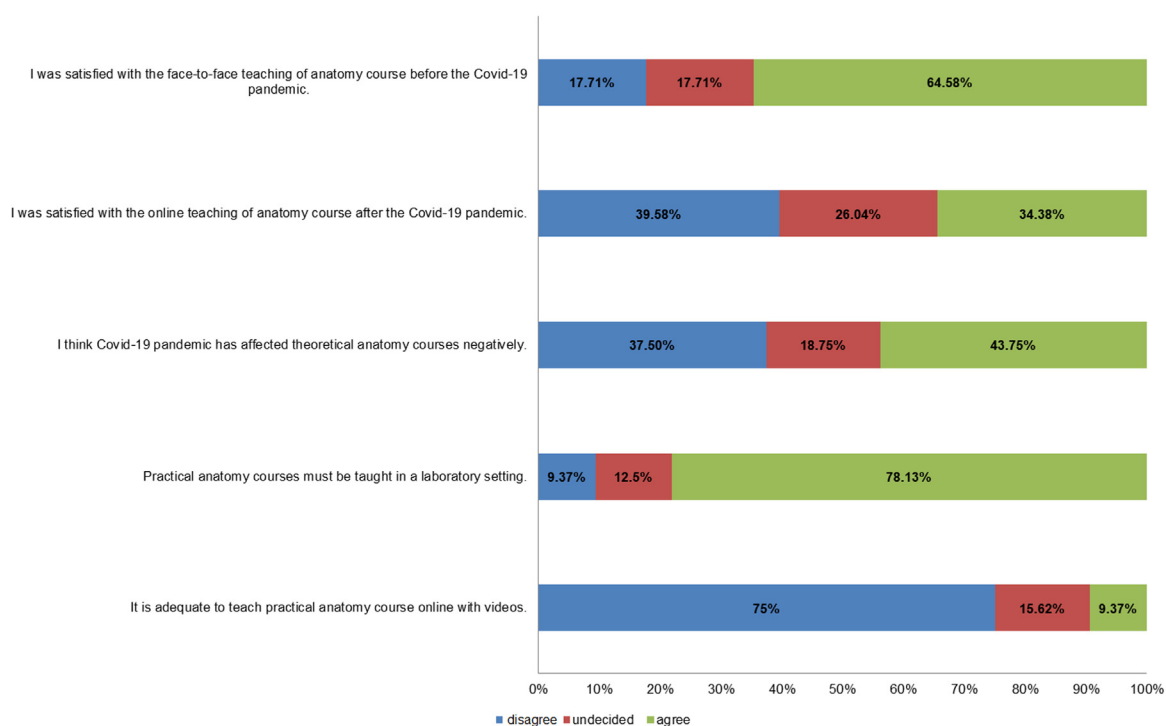


Figure 2 Questions answered only by Term 1 students.

Irby et al. [24] reported that offering practical training online was a greater challenge than delivering theoretical training online.

Theoretical education

Theoretical face-to-face anatomy lectures were replaced by live/pre-recorded virtual learning media with the transition to online education during the pandemic period. In previous studies that were conducted in this context, the lecture recording platform ‘Panopto’ (Panopto Inc., Seattle, WA)

and live broadcast programs such as ‘Zoom’ (Zoom Video Communications Inc., San Jose, CA), ‘Collaborate Ultra’ (Blackboard Inc., New York, NY), ‘Big Blue Button’ (Big Blue Button Inc., Ottawa, Canada), and ‘Microsoft Teams’ (Microsoft Corp., Redmond, WA) were reported to be the most common technologies employed in this respect [7,22].

When the opinions of the students for the anatomy theoretical lectures were questioned, it was found that the students found the face-to-face theoretical education before the pandemic to be more effective than the online theoretical training ($P=0.014$). The student interacts more with both their instructors and peers in face-to-face

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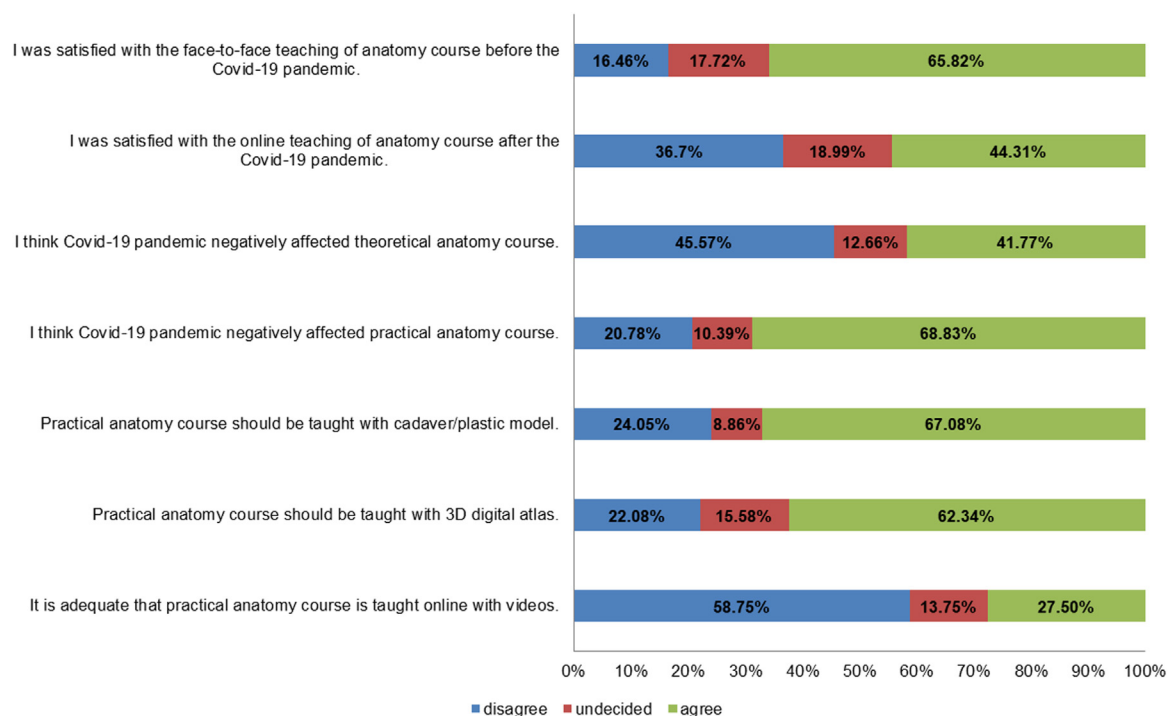


Figure 3 Questions answered only by Term 2 students.

Table 5 Comparison of students' satisfaction with the anatomy course before (face-to-face) and during the pandemic (online).

	I was satisfied with the online teaching of anatomy course during the Covid-19 pandemic			P-value
	Agree, n (%)	Undecided, n (%)	Disagree, n (%)	
Term I				
I was satisfied with the face-to-face teaching of anatomy course before the Covid-19 pandemic				
Agree	21 (33.87)	17 (27.42)	24 (38.71)	<0.001 ^a
Undecided	7 (41.18)	8 (47.06)	2 (11.76)	
Disagree	5 (29.41)	0 (0.00)	12 (70.59)	
Term II				
I was satisfied with the face-to-face teaching of anatomy course before the Covid-19 pandemic				
Agree	24 (46.15)	11 (21.15)	17 (32.69)	0.007 ^a
Undecided	8 (57.14)	4 (28.57)	2 (14.29)	
Disagree	3 (23.08)	0 (0.00)	10 (76.92)	

Data are expressed as n (%).

^a McNemar-Bowker Test.

education [25], which keeps the student aurally, visually, behaviorally, and mentally awake. It was understood that peer counseling is an important teaching form, especially in the pandemic process, with its features such as increasing student motivation and task management, providing psychological support, and improving critical thinking and

problem-solving skills [13,26]. However, students can be busy with other activities by keeping the camera off and/or muting the volume of the lecture in online education and become easily distracted [27]. This also creates a bilateral loss of interaction because it eliminates the opportunity for the instructor to catch the moments when students have dif-

Table 6 Mean scores and mode values given to the anatomy course before and during the pandemic.

Scoring of anatomy course	Before the Covid-19 pandemic (face-to-face education)		Covid-19 pandemic process (online education)	
	Theoretical	Practical	Theoretical	Practical
Mean score given to anatomy course	6.89 point	7.17 point	6.35 point	5.05 point
The score option that was most preferred (mode value)	26.1%;8 points	22.6%;10 points	17.2%;8 points	16.1%;5 points

faculty or are distracted during the lecture. Also, we believe that the fact that the lecture is more interactive in face-to-face education and that students rarely attend the lecture except for asking questions in online education reduce the efficiency of the lectures. For all these reasons, we believe that students find face-to-face theoretical anatomy courses to be more effective.

Practice training

Traditional methods (i.e. cadaver and plastic model) were used before the pandemic in anatomy practice classes throughout Turkey and in our faculty. It is possible to say that the majority of the our country met web-based education methods during the pandemic period. Videos on cadavers/plastic models were used in the anatomy practice classes in our faculty during the online education process.

The materials used in anatomy lectures also diversified with the development of technology in recent years. Computer-assisted training methods e.g. 3D anatomy atlases and virtual cadaver dissection programs began to take place in this training in addition to cadaver (dissection-prosection) and plastic model applications [28]. When the studies that compared traditional methods with computer-assisted education methods were examined, it was observed that both methods had advantages and disadvantages when compared to each other. Working on cadavers allows students to recognize and understand the structure and tissues of the human body in addition to learning anatomy. It was reported in previous studies that students develop interpersonal communication through teamwork [7], acquire a kinesthetic experience, develop fine motor skills [29], and form the basis of surgical disciplines [30,31]. There are also studies arguing that plastic models have advantages in developing visual-spatial evaluation, understanding anatomy, and outperforming computer-based methods [28,32]. It was reported that computer-assisted education models have advantages such as being adaptable according to the needs of each student, being always accessible, reducing the time and cost of education, and providing accurate laboratory conditions [13,33,34]. On the other hand, it was also reported that there are disadvantages such as loss of clinical/surgical skills and interaction with peers/institutions, technical difficulties, not being able to access digital technologies easily, possible security risks such as “zoom bombing”, and the requirements to have visuospatial skills for the orientation of the student [13,28,35]. However, it should be kept in mind that computer-assisted education can

continue during the current pandemic period [13], and perhaps this is the most important advantage of it. Web-based education method (3D virtual cadaver atlas) was included in the practical lectures in our faculty during the pandemic period along with traditional methods. Available data have not yet shown the best teaching method in terms of acquiring anatomical knowledge and postgraduate surgical proficiency; therefore, more studies are required to compare traditional methods with virtual teaching technologies [36].

When the student opinions on the functioning of the anatomy practice lectures during the pandemic process were examined, it was found that Term 1 students argued that practical lectures could not be performed with asynchronous videos, and Term 2 students argued that it could be done ($P=0.007$). We believe that this surprising difference occurred because of the fact that Term 2 students had more command of cadaver and plastic model applications in anatomy practice lectures, whereas Term 1 students had a hesitancy and anxiety about not understanding the course because they had just started anatomy theoretical and especially practical lectures. It was also found that Term 2 students thought that there were no differences between traditional (cadaver and plastic model) or web-based methods (3D digital atlas) ($P=0.438$), which shows that the students think that the material studied does not matter in the anatomy practice lectures.

The students included in the study found face-to-face anatomy practice education to be more effective than online practice education before the Covid-19 pandemic ($P<0.001$). We believe that the high degree of dissatisfaction with the practice lectures during the pandemic occurred because of the fact that students lost the opportunity to personally work with the materials in the face-to-face practice lectures. It was proven that students want to learn anatomy from practice lectures, which are more interactive [21]. They also think that it is important to participate in anatomy practice lectures [37], like to study more, and are more interested in practice lectures [16]. These results show that anatomy practice lectures are more interesting, enjoyable, understandable, and permanent for students [16].

Conclusion

The present study was designed to uncover the opinions of medical school students about online anatomy education during the pandemic process. Although the students were from Generation Z, who are good at using technology, their

opinions were that online education is not efficient for theoretical and practice anatomy lectures. However, they also argued that the pandemic process affected anatomy practice courses most negatively, stating that traditional and computer-assisted methods are not superior to each other in online anatomy practice courses.

Despite the presence of the vaccine and the acceleration of vaccinations in the entire world, online education will continue, although partially, because the transmission risk has not disappeared yet. We believe that students must be included in the educational processes in line with their feedback to ensure the sustainability of this period. To do this, we also believe that this study will shed light on the opinions of the students in the online education process we are still in. In this respect, there is a need for future studies to evaluate the opinions of educators about online education.

Limitations of study

The most important limitation of the study was that it had a single-centered design. Since each university has been determining the anatomy education in the pandemic process in Turkey according to its own conditions, it was not possible to apply the same questionnaire form in other universities. For this reason, it was not possible to plan this study in a multicentric design, and to make comparisons among institutions. Another limitation of the study was the inability to investigate the effects of changing educational methods before and after the pandemic on the outcomes of learning. The reason for this was that the exam methods changed as well as the education during the pandemic process.

Ethical statement

Ethics approval was granted by the Istanbul Yeni Yüzyıl University Science, Social and Non-Interventional Health Sciences Research Ethics Committee (IRB: 2020/07-486).

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Disclosure of interest

The authors declare that they have no competing interest.

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References

- [1] World Health Organization. WHO Director-General's remarks at the media briefing on 2019-nCoV on 11 February 2020; 2020 [https://www.who.int/dg/speeches/detail/who-director-general-s-remarks-at-the-media-briefing-on-2019-ncov-on-11-february-2020. Accessed 21 Sep 2021].
- [2] Anadolu A. Sağlık Bakanı Koca Türkiye'de ilk koronavirüs vakasının görüldüğünü açıkladı; 2020 [https://www.aa.com.tr/tr/koronavirus/saglik-bakanikoca-turkiyede-ilk-koronavirus-vakasinin-gorulduğunu-acikladi/1761466. Accessed Sep 2021].
- [3] Yükseköğretim K. yks-ertelenmesi-basin-aciklamasi; 2020 [https://www.yok.gov.tr/Sayfalar/Haberler/2020/YKS%20Ertelenmesi%20Bas%C4%B1n%20A%C3%A7%C4%B1klamas%C4%B1.aspx. Accessed Sep 2021].
- [4] Yükseköğretim K. Bahar dönemine ilişkin açıklama; 2021 [https://covid19.yok.gov.tr/HaberBelgeleri/2020-2021-Bahar-donemine-iliskin-aciklama/2020-2021-bahar-donemine-iliskin-aciklama.pdf. Accessed 21 Sep 2021].
- [5] Yükseköğretim K. Küresel Salgında Eğitim ve Öğretim Süreçlerine Yönelik Uygulamalar Rehberi; 2021 [https://www.yok.gov.tr/Documents/Yayinlar/Yayinlarimiz/2021/kuresel-salginda-egitim-ve-ogretim-sureclerine-yonelik-uygulamalar-kilavuzu-2021.pdf. Accessed 21 Sep 2021].
- [6] Ögetürk M, Kavaklı A, İlter K, Songur A, Zararsız İ, Sarsılmaz M. Tıp Öğrencileri Nasıl Bir Anatomi Eğitimi İstiyor? Tıp Eğitimi Dünyası 2003;10(10.).
- [7] Evans DJR, Bay BH, Wilson TD, Smith CF, Lachman N, Pawlina W. Going virtual to support anatomy education: a STOP-GAP in the midst of the Covid-19 pandemic. *Anat Sci Educ* 2020;13(3):279–83.
- [8] World Health Organization. Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003; 2003 [https://www.who.int/publications/m/item/summary-of-probable-sars-cases-with-onset-of-illness-from-1-november-2002-to-31-july-2003. Accessed 21 Sep 2021].
- [9] World Health Organization. Middle East respiratory syndrome coronavirus (MERS-CoV); 2019 [https://www.who.int/health-topics/middle-east-respiratory-syndrome-coronavirus-mers#tab=tab-1. Accessed 21 Sep 2021].
- [10] Okafor IA, Chia T. Covid-19: emerging considerations for body sourcing and handling. A perspective view from Nigeria. *Anat Sci Educ* 2021;14(2):154–62.
- [11] Lim EC, Oh VM, Koh D-R, Seet RC. The challenges of "continuing medical education" in a pandemic era. *Ann Acad Med Singap* 2009;38(8):724–6.
- [12] Patil NG, Yan YCH. SARS and its effect on medical education. *Adv Med Educ Pract* 2003;37(12):1127.
- [13] Wilcha R-J. Effectiveness of virtual medical teaching during the COVID-19 crisis: systematic review. *JMIR Med Educ* 2020;6(2):e20963.
- [14] Alsoufi A, Alsuyihili A, Msherghi A, Elhadi A, Atiyah H, Ashini A, et al. Impact of the COVID-19 pandemic on medical education: medical students' knowledge, attitudes, and practices regarding electronic learning. *PLoS One* 2020;15(11):e0242905.
- [15] Cao W, Fang Z, Hou G, Han M, Xu X, Dong J, et al. The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res* 2020;287:112934.
- [16] Uygur R, Çağlar V, Topçu B, Aktaş S, Oğuz Ö. Anatomi eğitimi hakkında öğrenci görüşlerinin değerlendirilmesi. *Int J Basic Clin Med* 2013;1(2):94–106.
- [17] Tuygar Ş, İlter K, Saygılı Ö, Özcan E, Gülçen B. Tıp fakültesi öğrencilerinin anatomi eğitimine yönelik memnuniyet düzeyleri ve ilgili değişkenlerin incelenmesi. *Tıp Eğitimi Dünyası* 2015;14(42):5–14.
- [18] Owolabi J, Bekele A. Implementation of innovative educational technologies in teaching of anatomy and basic medical sciences during the COVID-19 pandemic in a developing country: the COVID-19 silver lining? *Adv Med Educ Pract* 2021;12:619.
- [19] Cheng X, Chan LK, Pan S-Q, Cai H, Li Y-Q, Yang X. Gross anatomy education in China during the Covid-19 pandemic: a national survey. *Anat Sci Educ* 2021;14(1):8–18.
- [20] Carmichael SW, Pawlina W. Animated PowerPoint as a tool to teach anatomy. *Anat Rec* 2000;261(2):83–8.

- [21] Sindel M, Şenol Y, Gürpınar E. Akdeniz Üniversitesi Tıp Fakültesi'nde anatomi eğitiminin öğrenciler tarafından değerlendirilmesi. *Tıp Eğitimi Dünyası* 2008;28(28):31–6.
- [22] Longhurst GJ, Stone DM, Dulohery K, Scully D, Campbell T, Smith CF. Strength, weakness, opportunity, threat (SWOT) analysis of the adaptations to anatomical education in the United Kingdom and Republic of Ireland in response to the Covid-19 pandemic. *Anat Sci Educ* 2020;13(3):301–11.
- [23] Srinivasan DK. Medical students' perceptions and an anatomy teacher's personal experience using an e-Learning platform for tutorials during the Covid-19 crisis. *Anat Sci Educ* 2020:318–9.
- [24] Irby DM, Cooke M, O'Brien BC. Calls for reform of medical education by the Carnegie Foundation for the Advancement of Teaching: 1910 and 2010. *Acad Med* 2010;85(2):220–7.
- [25] Kaur N, Dwivedi D, Arora J, Gandhi A. Study of the effectiveness of e-learning to conventional teaching in medical undergraduates amid COVID-19 pandemic. *Natl J Physiol Pharm Pharmacol* 2020;10(7):563–7.
- [26] Hamad SMS, Iqbal S, Alothri AM, Alghamadi MAA, Elhelow MKKA. "To teach is to learn twice" Added value of peer learning among medical students during COVID-19 Pandemic. *MedEd-Publish* 2020:1.
- [27] Zureick AH, Burk-Rafel J, Purkiss JA, Hortsch M. The interrupted learner: how distractions during live and video lectures influence learning outcomes. *Anat Sci Educ* 2018;11(4):366–76.
- [28] Khot Z, Quinlan K, Norman GR, Wainman B. The relative effectiveness of computer-based and traditional resources for education in anatomy. *Anat Sci Educ* 2013;6(4):211–5.
- [29] Krähenbühl SM, Čvančara P, Stieglitz T, et al. Return of the cadaver: key role of anatomic dissection for plastic surgery resident training. *Medicine (Baltimore)* 2017;96:e7528.
- [30] Franchi T. The impact of the Covid-19 pandemic on current anatomy education and future careers: a student's perspective. *Anat Sci Educ* 2020;13(3):312.
- [31] Ravi KS. Dead body management in times of Covid-19 and its potential impact on the availability of cadavers for medical education in India. *Anat Sci Educ* 2020;13(3):316.
- [32] Preece D, Williams SB, Lam R, Weller R. "Let's get physical": advantages of a physical model over 3D computer models and textbooks in learning imaging anatomy. *Anat Sci Educ* 2013;6(4):216–24.
- [33] Kurt E, Yurdakul SE, Ataç A. An overview of the technologies used for anatomy education in terms of medical history. *Procedia Soc Behav Sci* 2013;103:109–15.
- [34] Tam M, Hart AR, Williams S, Heylings D, Leinster S. Is learning anatomy facilitated by computer-aided learning? A review of the literature. *Med Teach* 2009;31(9):e393–6.
- [35] Kaup S, Jain R, Shivalli S, Pandey S, Kaup S. Sustaining academics during COVID-19 pandemic: the role of online teaching-learning. *Indian J Ophthalmol* 2020;68(6):1220.
- [36] Chytas D, Salmas M, Piagkou M, Johnson EO. Decline of cadaveric dissection in anatomy education during the Covid-19 pandemic: can it affect future surgeons' competency? *Anat Sci Educ* 2021;14(2):166–8.
- [37] Vatansever A, Özcan E. Tıp fakültesi dönem 1 ve dönem 2 öğrencilerinin anatomi pratik eğitimini değerlendirmeleri. *Uludağ Üniversitesi Tıp Fakültesi Dergisi* 2018;44(2):125–8.