



Attainments during the COVID-19: a comparative survey study on ideal anatomy education from the students' perspective

Abdullah Ortadeveci¹ · Merve Nur Ermez¹ · Semih Oz² · Hilmi Ozden¹

Received: 2 March 2022 / Accepted: 16 June 2022 / Published online: 2 July 2022
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Abstract

Purpose Anatomy, one of the cornerstone branches of medical education, is one of the rare areas, where the traditional method remains the most efficient education method despite technological developments. However, the COVID-19 pandemic has made it impossible for the traditional method to continue and has enabled the integration of different distance learning methods into anatomy education. The aim of our study is to perform comparative evaluation of three education methods (traditional, asynchronous online, synchronous online) from the students' perspective.

Methods In our study, a questionnaire form was sent to Eskişehir Osmangazi University Faculty of Medicine students ($n = 168$) via Google forms. The students were asked to rank the anatomy education types from the most appropriate to the least appropriate in the proposals. The questionnaire consisted of multiple choice and open-ended questions in addition to 15 proposals questioning demographic information, student autonomy, efficiency, and preference.

Results According to the results obtained, the students stated that the most efficient method (in terms of both theoretical "50%" and practical "55.4%") is the traditional method. In addition, when it comes to preference, students who preferred one of the distance online education types (asynchronous or synchronous) for theoretical anatomy constituted the majority (59.5%). The traditional method was rated as the least appropriate in terms of accessing course resources (42.3%).

Conclusions According to our study, while face-to-face education is still indispensable for the practical part of the ideal anatomy education, the theoretical part can be carried out remotely by strengthening it with some activities.

Keywords COVID-19 · Anatomy education · Traditional anatomy education · Asynchronous online anatomy education · Synchronous online anatomy education · Medical education · Pedagogy

Introduction

Anatomy is widely accepted as one of the most fundamental disciplines of medicine [6]. When technology and new developments change the health systems and the medicine itself, lecture hours of anatomy and its existence in the medical curricula evolved with time. For instance, total hours devoted to gross anatomy decreased by 11% in only 7 years between 2002 and 2009 [4]. In addition, while the use of cadavers has decreased with time, the use of plastic models, 3d computer models, and some technology integrated

methods such as web-based teaching has become widespread [18]. Furthermore, some alternative approaches to traditional anatomy education (TAE) based on face-to-face (F2F) theoretical and practical trainings have emerged and their effects on students have been studied [5]. Although there is not an absolute consensus on how to name all these approaches, two of them, asynchronous online and synchronous online anatomy education, are in the scope of this study.

Asynchronous online education is an education method that is simply based on transferring video–audio recordings and other materials between spatiotemporally separated groups of education providers and receivers. On the other hand, synchronous online education is generally implemented with live video conferencing systems. Studies have evaluated synchronous online and asynchronous online education comparatively, emphasizing the features that seem superior or inferior to each other [13]. However, the outbreak of the COVID-19 disease in China in December 2019

✉ Abdullah Ortadeveci
abdullahortadeveci@gmail.com; aortadeveci@ogu.edu.tr

¹ Department of Anatomy, Faculty of Medicine, Eskişehir Osmangazi University, Eskişehir, Turkey

² Health Services Vocational School, Eskişehir Osmangazi University, Eskişehir, Turkey

and its rapid spread all over the world made it necessary to replace traditional F2F education with distance education to prevent the spread of the virus. Anatomy education also got its share from this forced change [16]. This rapid change made it possible to examine the effectiveness of these methods and evaluations of students on them.

Many medical faculties that had to adapt to pandemic stats were caught flat-footed and had to opt for asynchronous online anatomy education (AAE) that required less technological infrastructure [3]. We define this period as the acute pandemic period. In the literature, it is called "emergency remote teaching" that a F2F education is carried out remotely due to war, natural disaster, pandemic, etc. [8]. Like our faculty, some of institutions completed the necessary infrastructure with the prolongation of the pandemic and switched to synchronous online anatomy education (SAE) [19]. We define this period as the elongated pandemic period.

Although there are many studies on different types of distance online anatomy education in the literature, the comparative evaluation of TAE, AAE, and SAE from students' perspective has not been well-studied. The aim of our study is to take the comparative evaluations of the participants about these teaching methods, which are among the most common types of anatomy education, and to see the pros and cons of these methods from the perspective of the students.

Materials and methods

In our study, TAE defines classical anatomy education based on cadaver and lifelike plastic materials, including F2F theoretical and practical training in which the instructor and the students are together spatiotemporally. AAE in our study is a type of education in which both the theoretical and practical trainings are recorded by the instructors and uploaded to the common system and presented to the students as open access, where the instructor and the students are separated spatiotemporally. As for SAE, it is a form of education in which the theoretical and practical courses are carried out with distance education systems that provide simultaneous audio and video transmission, where the instructor and the students are temporally together but spatially separate. Eskisehir Osmangazi University, Faculty of Medicine (ESOGU-FM) students who participated in our study got anatomy trainings in the pre-pandemic, acute pandemic, and elongated pandemic periods. The participants have experienced TAE, AAE, and SAE types, respectively. The students of our faculty started the anatomy education with TAE method in the fall semester of the 2019–2020 academic year. Due to the COVID-19 measures implemented in the middle of the spring semester, they continued the anatomy education with AAE method. In the fall and spring semesters of

the 2020–2021 academic year, they had anatomy education with SAE method.

The questionnaire used in the study was sent to 290 (population) students in the second grade at the ESOGU-FM which is an accredited faculty. 168 (sample) students completed the questionnaire. Our questionnaire was approved by the ESOGU Non-invasive Procedures Ethics Committee.

The questionnaire consists of four parts. In the first section, there were statements explaining the questionnaire, aims of study, and detailing the voluntary aspect of the participation. The second part consisted of some demographic questions that collect data, such as age, gender, family income, location, and the most preferred technological device during distance education. In the third part, there were 15 items in matrix system, each of it needed to be evaluated and ranked as 1, 2, 3 ("1—the most appropriate", "2—appropriate", "3—the least appropriate") among three types of education methods. In other words, students were asked to rank their educational models regarding to each item. The suggestions in this section were grouped under the headings of "personal suitability, student autonomy, and interactivity", "efficiency", and "preference". In the last part of the questionnaire, in addition to two multiple-choice questions directly questioning the preferred method in theoretical and practical education, there was also a non-mandatory open-ended question.

The suggestions in the questionnaire were adapted from previous studies in the literature [17, 25]. It was prepared in Google Forms and sent to the participants via internet, and the results were also obtained from Google Forms. All data obtained are presented as percentages.

Results

According to the results of the questionnaire 57.7% of the 168 participants were women. The age distribution of the participants was 19 years (12.5%), 20 years (48.8%), 21 years (31%), 22 years (6%), and 23 years (1.8%) old. The most frequently used device while participating in online trainings was the computer (79.8%), followed by mobile phone (18.5%) and the tablet or other devices (1.8%).

More than half (55.3%) of the participants opted TAE as the most appropriate education model, that makes them active. Only 9.5% of them put SAE on the top. The preferred type of education in terms of the course materials is TAE with 37.5%, AAE with 37.5% and SAE with 25%. Other proposals regarding "personal suitability, student autonomy, and interactivity", and its' results are presented in Table 1.

According to 41% of the participants "The most efficient model regarding to time management" is TAE. Participants placed "TAE" as the best method in the proposal asking them to rank the most effective anatomy teaching method,

Table 1 Results of all expressions on personal suitability, student autonomy, and interactivity

Expressions (<i>n</i> = 168)	Ranking	TAE(F2F)	SAE	AAE
This education makes the students more active	1	93 (55.4%)	16 (9.5%)	59 (35.1%)
	2	13 (7.7%)	123 (73.2%)	32 (19.0%)
	3	62 (36.9%)	29 (17.3%)	77 (45.8%)
I think the content of lessons are sufficient in this education model	1	86 (51.2%)	33 (19.6%)	49 (29.2%)
	2	30 (17.9%)	100 (59.5%)	38 (22.6%)
	3	52 (31.0%)	35 (20.8%)	81 (48.2%)
I communicate the lecturers more easily in this education model	1	88 (52.4%)	21 (12.5%)	59 (35.1%)
	2	19 (11.3%)	133 (79.2%)	16 (9.5%)
	3	61 (36.3%)	14 (8.3%)	93 (55.4%)
I play more active role of this education model's learning process	1	91 (54.2%)	21 (12.5%)	56 (33.3%)
	2	17 (10.1%)	124 (73.8%)	27 (16.1%)
	3	60 (35.7%)	23 (13.7%)	85 (50.6%)
I can focus my attention on the lesson better in this education model	1	86 (51.2%)	35 (20.8%)	47 (28.0%)
	2	30 (17.9%)	104 (61.9%)	34 (20.2%)
	3	52 (31.0%)	29 (17.3%)	87 (51.8%)
I feel more relaxed asking questions in this education model	1	67 (39.9%)	41 (24.4%)	60 (35.7%)
	2	46 (27.4%)	103 (61.3%)	19 (11.3%)
	3	55 (32.7%)	24 (14.3%)	89 (53.0%)

1 the most appropriate; 2 appropriate; 3; the least appropriate; *TAE* traditional anatomy education; *F2F* face-to-face; *SAE* synchronous online anatomy education; *AAE* asynchronous online anatomy education

55.4% for practical part and 50% for theoretical part. In both theoretical (71.4%) and practical (62.5%) training, *SAE* was considered as the second option by the majority of the participants. The most effective method in terms of self-motivation is *TAE* according to 54.2% of the participants.

All the expressions on efficiency and the results are given in Table 2.

In the proposals questioning the preferred education type, *TAE* ranked first with 53.4% for practical and 40.5% for theoretical trainings. From another point of view, the

Table 2 Results of all expressions on “efficiency”

Expressions (<i>n</i> = 168)	Ranking	TAE (F2F)	SAE	AAE
This education model is the most efficient one for PP	1	93 (55.4%)	18 (10.7%)	57 (33.9%)
	2	8 (4.8%)	120 (71.4%)	40 (23.8%)
	3	67 (39.9%)	30 (17.9%)	71 (42.3%)
This education model is the most efficient one for TP	1	84 (50.0%)	30 (17.9%)	54 (32.1%)
	2	32 (19.0%)	105 (62.5%)	31 (18.5%)
	3	52 (31.0%)	33 (19.6%)	83 (49.4%)
This education model is the most efficient one for anatomy education in total	1	91 (54.2%)	24 (14.3%)	53 (31.5%)
	2	15 (8.9%)	116 (69.0%)	37 (22.0%)
	3	62 (36.9%)	28 (16.7%)	78 (46.4%)
This education model is the most efficient for time management	1	69 (41.1%)	34 (20.2%)	65 (38.7%)
	2	46 (27.4%)	101 (60.1%)	21 (12.5%)
	3	53 (31.5%)	33 (19.6%)	82 (48.8%)
This education model is the most efficient for self-motivation	1	91 (54.2%)	22 (13.1%)	55 (32.7%)
	2	19 (11.3%)	122 (72.6%)	27 (16.1%)
	3	58 (34.5%)	24 (14.3%)	86 (51.2%)

1 the most appropriate; 2 appropriate; 3 the least appropriate; *TAE* traditional anatomy education; *F2F* face-to-face; *SAE* synchronous online anatomy education; *AAE* asynchronous online anatomy education; *PP* practical part of anatomy education; *TP* theoretical part of anatomy education

majority of students (59.5%) put one of the distance online education methods the first place for theoretical trainings. Participants ranked TAE and AAE in the first place equally (37.5%) in the proposal questioning which training method they preferred in terms of course resources. All proposals about preference, and the obtained results are presented in Table 3.

In the multiple-choice questions, the participants stated that F2F education is the best option for both ideal theoretical anatomy education (53%) and ideal practical anatomy education (95.8%) (Fig. 1).

At the end of the questionnaire, 48 students answered the open-ended and non-mandatory question. Many students stated that F2F lectures supported by videos that we can rewind and forward in the system would increase efficiency. Some students expressed, “TAE offers the opportunity to see, touch and examine. That’s why it should definitely be done F2F”. Some students emphasized the importance of physical interaction in TAE. Many students underlined that the home setting negatively affected their focus on the lesson in distance online education methods and stated that being ready to listen to the lesson in the classrooms in TAE increases self-motivation. On the contrary, some students stated that the noise and crowd in the laboratory caused a lack of concentration in the practice lessons, and they concentrated better, because these problems were not encountered in AAE and SAE. There were also students who stated that exposing all students to the same visuals, materials, and instructors in asynchronous and online training creates a more equal learning setting. Many students stated that the integration of the instructor with technology and online education methods increases the efficiency.

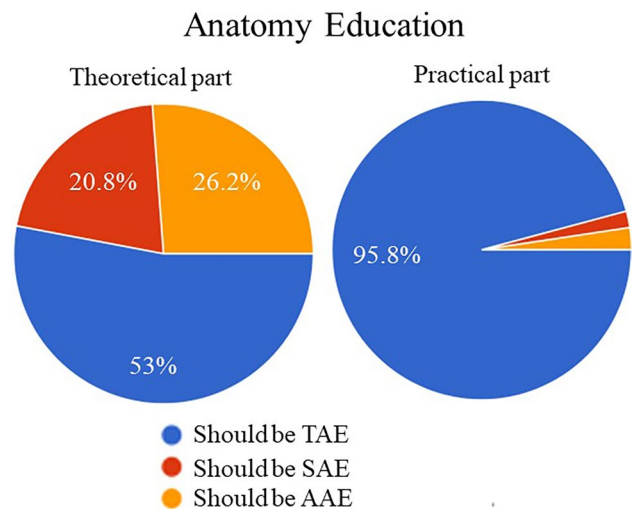


Fig. 1 Distribution of the participants’ answers given to the multiple-choice questions about the ideal theoretical and practical anatomy education

Discussion

Distance education, which has a history of approximately 170 years and carried out by sending letters or books initially, has been increasing its speed of integration into higher education especially in the last two decades [12, 20]. The development of technology has made this type of education more useful by providing an online infrastructure for distance education. The integration of distance online educations which proceeded at its natural pace became an obligation after the outbreak of the COVID-19 pandemic in early

Table 3 Results of all expressions on “preference”

Expressions (<i>n</i> = 168)	Ranking	TAE (F2F)	SAE	AAE
I prefer this method in TP	1	68 (40.5%)	47 (28.0%)	53 (31.5%)
	2	46 (27.4%)	88 (52.4%)	34 (20.2%)
	3	54 (32.1%)	33 (19.6%)	81 (48.2%)
I prefer this method in PP	1	90 (53.6%)	20 (11.9%)	58 (34.5%)
	2	14 (8.3%)	120 (71.4%)	34 (20.2%)
	3	64 (38.1%)	28 (16.7%)	76 (45.2%)
I prefer this education method in anatomy education in total	1	91 (54.2%)	27 (16.1%)	50 (29.8%)
	2	15 (8.9%)	109 (64.9%)	44 (26.2%)
	3	62 (36.9%)	32 (19.0%)	74 (44.0%)
I prefer this education method in terms of course resources (accessing the archive, written and visual materials)	1	63 (37.5%)	42 (25.0%)	63 (37.5%)
	2	46 (27.4%)	88 (52.4%)	34 (20.2%)
	3	59 (35.1%)	38 (22.6%)	71 (42.3%)

1 the most appropriate; 2 appropriate; 3 the least appropriate; TAE traditional anatomy education; F2F face-to-face; SAE synchronous online anatomy education; AAE asynchronous online anatomy education; PP practical part of anatomy education; TP theoretical part of anatomy education

2020. Distance online educations, which was initially carried out in panic and uncertainty, has become the new normal in just 2 years [3]. Despite this rapid revolution, distance online educations still have challenging aspects for both instructors and has quite a long road ahead to reach its ideal form. Studies show that instructors spend most of their time adapting to changing teaching systems. On the other hand, a changing teaching method has a negative effect on the students' motivation, understanding, and hence achievement [12].

In our study, we asked medical students to rank anatomy education types; the TAE in the pre-pandemic period, AAE in the acute pandemic period, and SAE in the elongated pandemic period. Majority of the students chose TAE as the best education model in terms of concentration, interactivity, and sufficiency of course content. They also stated that TAE is the best method for efficiency and self-motivation. However, when it comes to preference, most of the students stated that they wanted to get the theoretical part of anatomy education with one of the distance online education methods (SAE or AAE). In addition, in terms of time management and course resources, more than half of the students preferred one of the distance online education methods in our study.

Personal factors—digital natives vs. traditionalist

Previous studies have also revealed that distance online education methods have advantages over F2F in terms of time management and access to resources, in parallel with our study [14, 22]. As parallel to the literature, in our study, more than half of the students placed an online education type in the first place in terms of access to course resources and time management. In the open-ended questions of our study, students also stated that watching fast forwarding videos, rewinding, or watching them at 2× speed is a significant advantage over TAE. Similarly, in a study conducted at Edinburgh University on online anatomy training, students emphasized that the “rewind or forward as you please” feature is valuable [11]. In addition, this opportunity can eliminate the problems that occur in TAE due to the difference in perception rates among students. Students also stated that being able to access course resources and videos whenever they want makes them feel freer.

While some students stated that a physical classroom is a social interaction environment and has an aspect like social contract, some others stated that the noise and crowd in the classroom negatively affected their learning efficiency. These two views are poles apart and this could be due to dissimilarity of students' intrinsic learning motivations or social communicative languages of generation Z. In a study in 2009, Prensky called this generation “Homo sapiens digital” and stated that it should not be assumed that all members of the next generation are competent in the use of educational technology [21]. The result of our study confirms this view

and can be a proof that there are both “digital native” and “traditionalist” students among our participants who have diametrically opposite views.

Many studies showed that TAE was the most efficient method in terms of self-motivation [12, 22]. This may be an indicator of students' failure in adapting to distance online education. Studies have revealed that there is a significant relationship between students' intrinsic learning motivation and satisfaction of the basic needs for competence [9]. In another study, medical students stated that the online anatomy lessons were not sufficient for their medical profession [23]. The lack of a sense of professional competence may be one of the reasons that negatively affects self-motivation in distance online anatomy education. At this point, students' awareness of the importance of anatomy in their professional qualifications can increase their internal motivation. Symposiums, briefings, and clinical case workshops can be organized to raise this awareness. Motivated students will get the necessary information with the most appropriate learning method for themselves. Studies show that the rate of students learning anatomy through YouTube videos reaches 78% [2].

A study by Umbach and Wawrzynski (2005) suggested that students became increasingly resistant to communicating directly with academics [24]. Similarly in our study, in total, more than 60% of students stated that they felt more comfortable asking questions in one of the distance online education models. Social media is also a platform that offers students the opportunity to learn anatomy without direct contact. It has been demonstrated that a Facebook page created by the institution and designed to contribute to anatomy courses affects anatomy education of medical students positively [10].

In the open-ended question about anatomy education types, students stated that home settings were a challenging factor for them in distance online educations. This situation can be overcome with the flipped classroom pedagogy, which has become increasingly common in recent years. In this system, the videos and materials related to the course are presented to the students online, and the learning parts, where the student is passive (such as listening to the lecture) are carried out at home. In the lesson, interactive activities are carried out with the student who has knowledge about the topic. Flipped classroom pedagogy has been applied in anatomy education and its positive effects have been demonstrated [7].

Efficient but not preferable

In many studies comparing F2F anatomy education with any distance online education type, students stated that F2F education has higher efficiency, and they prefer the F2F model for anatomy education [1, 19]. In our study, the F2F model was evaluated as the most appropriate

by at least half for both theoretical and practical parts in terms of efficiency (50% and 55.4%, respectively). When it comes to the preferences of the students in question, some differences emerged between the results obtained, especially in terms of the theoretical part. In the practical part, the students found the TAE, which they thought to be the most efficient, the most preferable at almost the same rate. However, about 20% of the students who found F2F the most efficient in the theoretical part, changed their minds when it came to preferring a type, and evaluated one of the distance online education types as the best option. Although TAE is still the type of education that is placed in the first place among the three different education methods in terms of the theoretical part, the rate of those who preferred any of the distance online education types was the higher (59.5%). This result contains some inconsistencies with the results of the studies conducted by Babacan et al. and Ozen et al. The discrepancies between results may be due to differences in the form of propositions in the questionnaires. In our study, the students evaluated and ranked three different types of education at the same time. In the studies mentioned, the students evaluated in the proposals two different education types with a 5-point Likert scale [1, 19].

It should also be noted that; TAE was placed in the first place at almost the same rates in efficiency and preference propositions related to the practical part. This shows that most students find F2F education preferable for the practical part, despite the advantages of distance online educations, such as autonomy, time management and unlimited access. On the other hand, the sensitivity of people to social distancing rules may also have caused this difference between efficiency and preference. From another point of view, while students tend to think it is worth taking the risk to attend practical classes F2F during the pandemic, they may not have wanted to take the risk for the theoretical part. Current studies claim that among the factors affecting the students' preference are their readiness for collaborative learning, their willingness to learn, and readiness for online learning [15]. In parallel with this idea, study sessions can be organized in which only students can participate. In this way, peer learning and cooperation are ensured. This may contribute positively to students' willingness to learn.

Studies show that distance education methods have challenging aspects for both the instructor and the student in fields that have a practice-based curriculum [15]. The results we obtained in our study revealed that practice training was mostly preferred as F2F. These results are in line and reveal that students still give priority to traditional methods as the most ideal method in practice-based education.

Limitations

It is worth noting that; This study was carried out with the participation of only one medical faculty students. Discussing different anatomy topics during different training methods may also be a factor affecting the results. In addition, positive or negative effects from technical infrastructure and instructors may have affected the results of our study. More reliable results can be obtained by comparing groups with similar characteristics and different types of education with the same instructors and course topics.

Conclusions

The feedback from these students, who have the experience of today and the past, will contribute to the determination of the characteristics of the ideal anatomy education.

As a consequence, in ideal anatomy education; the theoretical part should be able to be attended both F2F and online at the same time and recorded, and the practical part should be done F2F. In addition to these, it is important to support it with educatory social media contents and a software infrastructure that provides open access to visuals, notes, presentations, videos, etc. related to the course. Additional courses with recommendations that will enable integration with distance education and strengthen self-motivation for both educators and students will maximize the efficiency of anatomy education.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00276-022-02978-9>.

Acknowledgements All the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version. The study does not have any funding. All the authors thank to Yasin Emre Oguz for contributions.

Author contributions AO Protocol development. data collection and analysis. manuscript writing. MNE Data collection and analysis. manuscript writing. SOZ Data management. manuscript editing. HO Protocol development. manuscript editing.

Funding The authors received no funding related to the conduction of this study.

Availability of data and materials Tables are available. No tissue samples exist.

Code availability Not applicable.

Declarations

Conflicts of interest The authors have no conflicts of interest/competing interests to disclose.

Ethical approval The study was approved by the “ESOGU Non-invasive Clinical Researches Ethics Committee” on 13.07.2021 (Decree no: 19).

Consent to participate All authors approve the participation of the study.

Consent for publication All authors approve the publication of the study.

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