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Remote vs. In-person Anatomy Education: A Comparative Study Among Health Vocational Students

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What is known on this subject?

Anatomy is a fundamental course for health vocational students, yet teaching applied content through remote instruction has been shown to reduce engagement and learning efficiency. Previous studies have reported that online anatomy education may limit interaction, practical skill development, and students' sense of professional identity.

What this study adds?

This study directly compares remote and in-person anatomy education within the same curriculum, instructor, and content framework. It identifies specific barriers such as inequalities in access and a reduced sense of professional identity, emphasizing the importance of infrastructure and interactivity in remote anatomy teaching.

ABSTRACT

Objective: This study aimed to compare the educational effectiveness of students who continued their anatomy education remotely with that of students who had taken the same course in person the previous year.

Material and Methods: This cross-sectional study included 116 first-year students who took the anatomy course via remote education and 138 second-year students who took the same course in person during the previous academic year. Data collected via an online survey included socio-demographic characteristics, the comprehensibility of the course, participants' understanding of its importance, and problems encountered. Descriptive statistics are presented as numbers and percentages, and the chi-square test is used to compare categorical variables.

Results: Although the course was taught using the same syllabus, presentation materials, and instructor, the perceived difficulty was 59.4% in the in-person education group and 82.8% in the remote education group ($p<0.05$). It was determined that 37.1% of students in remote education lacked a personal device (computer or tablet) to access education, 19.8% experienced internet connection problems, and 12.1% lacked a suitable working environment.

Conclusion: Remote education complicates learning in applied courses such as anatomy. The absence of in-person interaction reduced participation, diminished course effectiveness, and hindered the development of professional identity. Infrastructural deficiencies and technological inequalities were also identified as significant barriers. These findings can guide the development of sustainable and inclusive remote education policies.

Keywords: Anatomy education, remote education, health education, in-person education

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Introduction

Synchronous (real-time) education refers to instruction conducted online via internet technologies, bringing together students and instructors in different locations. It is a virtual classroom environment. In these virtual classrooms, students can ask the instructor questions and participate in lessons in real time. Asynchronous (non-simultaneous) education refers to students accessing pre-prepared or recorded course materials at their convenience (1,2).

Remote education is known to offer numerous benefits, such as allowing students to learn outside the classroom and instilling in them a sense of responsibility for independent learning (3,4). The ability to continuously replay recorded lessons and the opportunity to provide a learning environment where everyone can hear equally well and watch from the same distance, compared with the difficulties experienced in crowded classrooms, are some of the advantages of remote education (1,4). Moreover, the best-known limitations of remote education are increased failure rates among students who have not acquired responsibility for their learning, greater difficulty communicating with instructors compared with in-person education, and reduced student socialization. The most serious limitation encountered is that students can observe but cannot practice in application-based courses (2,5). The absence, in remote education, of activities such as collaborative learning experiences, real-time feedback, individual participation in class, and instant information exchange, which are common in classroom and school settings, has the potential to harm educational outcomes (6). These conditions have also required instructors to prepare new course content and develop new teaching methods for practical courses, rather than rely on existing methods (7). Recent global developments have compelled higher education institutions to transition rapidly to mass remote learning models. This sudden and comprehensive transition has made the educational effectiveness and student gains in practice-based courses, such as anatomy, a significant topic of discussion.

Anatomy is the scientific discipline that studies the standard shape and structure of the human body, including the organs that compose it, and the structural and functional relationships among these organs (8,9). Anatomy education, the foundation of medicine and the health sciences, has been described in numerous studies as a challenging subject to learn (10,11). Anatomy courses are among the most challenging subjects for students, partly because they are easily forgotten if not reviewed frequently and partly because of the Latin terminology they contain (8).

Therefore, the primary objective of this study is to compare the learning experiences and perceived levels of effectiveness and efficiency of students taking anatomy courses taught by the same instructor using the same curriculum but delivered in person rather than online. The secondary objective is to examine how the teaching method (online or in-person) affects students' perceptions of their professional identity as future healthcare professionals. It also aims to identify the problems, limitations, and opportunities encountered in online education.

Material and Methods

This cross-sectional study was conducted at Istanbul University-Cerrahpaşa, Vocational School of Health Services between May and June 2021. The study included 254 students who voluntarily participated. Data were collected using a structured online questionnaire. The study population consisted of first-year students who took anatomy remotely during the 2020-2021 academic year, and second-year students who had taken the course in person during the previous year. Although students were enrolled in different associate-degree programs and their distribution was unequal, they all took the anatomy course from the same instructor. Furthermore, the course syllabi and presentations used in both online and in-person education were identical. One hundred and sixteen first-year students took an anatomy course for the first time and attended it online. In contrast, 138 second-year students took the anatomy course in person during their first year (the previous academic year), with the same content and instruction.

In this study, two separate survey forms were used. These were sent electronically via Google Forms. Each form had multiple-choice questions that were the same for all participants within a group but different across groups. Everyone taking part was informed about the study on the first page. This information emphasised that responses would be kept anonymous and that the data would be used only for research purposes. Completion and submission of the survey constituted informed consent. To ensure the reliability of the feedback, students were asked not to provide their names. The survey questions were designed to compare remote and in-person anatomy education, measure how well students understood the course and how important they perceived it to be, and identify problems students experienced. The questionnaire used in this study was developed by adapting items from previously published questionnaires related to remote learning and anatomy education and by incorporating our students' feedback on remote learning courses. The questionnaire contains items related to the perceived effectiveness and adequacy of the

anatomy course, students' perceptions of their professional identity as future health professionals, and the problems they experience during distance learning.

This study was approved by the Clinical Research Ethics Committee of University of Health Sciences Türkiye, İstanbul Training and Research Hospital (decision number: 2842, date: 21.05.2021).

Statistical Analysis

IBM SPSS Statistics software (version 21.2; Armonk, NY: IBM Corp.) was used for data analysis. The distribution of responses to Likert-type questions was evaluated using descriptive statistics (frequency and percentage) and multiple-choice questions were analyzed using frequency analysis. The chi-square (χ^2) test was applied to evaluate the relationship between categorical variables. The Shapiro-Wilk and Kolmogorov-Smirnov tests were used to assess whether the data were normally distributed. The statistical significance level was set at $p<0.05$.

Results

Demographic and academic characteristics of the students included in the study are summarized in Table 1. These data were analyzed to ensure the comparability of the two groups in terms of gender, department, and employment status.

The majority of the participants were female (79.9%), and most were enrolled in programs related to dental health, radiotherapy, and medical imaging. In addition, approximately half of the students were working either full-time or part-time while pursuing their education.

Findings comparing the opinions of students who received anatomy education remotely and in person are presented in Table 2.

Statistically significant differences were found between the two groups with respect to perceptions of course sufficiency, the necessity of including anatomy in the second-year curriculum, and feelings of professional identity ($p<0.05$).

For instance, 60.1% of second-year students (in-person) considered the first-year anatomy course sufficient, whereas this rate was 46.6% among first-year students (remote). Similarly, nearly half of the in-person students (47.1%) believed anatomy should continue in the second year, compared with only 23.3% of the remote learners. Moreover, while 89.9% of students who received in-person education stated that anatomy made them feel like healthcare professionals, this rate dropped to 64.7% among those who received remote education.

In addition to the overall comparisons, the specific views of second-year students who previously received in-person anatomy education are summarized in Table 3. For example, 53.6% of these students reported that the information learned in anatomy classes is easily forgotten, and 49.3% indicated that the main reason for this is the subject's memorization-based nature. Furthermore, 63.0% of the students believed that the anatomy classes they attended would be beneficial for their professional practice after graduation.

Table 4 details the perceptions and experiences of first-year students who received remote anatomy education, including their communication with instructors, class participation, and technological access. For example, 68.1%

Table 1. Descriptive information about the students participating in the study

Variables		1st year n (%)	2nd year n (%)	Total n (%)
Gender	Female	96 (82.8)	107 (77.5)	203 (79.9)
	Male	20 (17.2)	31 (22.5)	51 (20.1)
Department of study	Oral and dental health program	13 (11.2)	59 (42.8)	72 (28.3)
	Dental prosthetics technology program	25 (21.6)	24 (17.4)	49 (19.3)
	Nuclear medicine techniques program	4 (3.4)	22 (15.9)	26 (10.2)
	Radiotherapy program	38 (32.8)	6 (4.3)	44 (17.3)
	Medical documentation and secretarial program	10 (8.6)	1 (0.7)	11 (4.3)
	Medical imaging techniques program	7 (6.0)	26 (18.8)	33 (13.0)
	Medical laboratory techniques program	19 (16.4)	0 (0.0)	19 (7.5)
Are you working at the same time as being a student?	Yes, I am in permanent employment	37 (31.9)	37 (26.8)	74 (29.1)
	Yes, I am sometimes employed	16 (13.8)	35 (25.4)	51 (20.1)
	No, I am not employed	63 (54.3)	66 (47.8)	129 (50.8)
Total		**116 (100.0)**	**138 (100.0)**	**254 (100.0)**

Table 2. **Students' opinions on anatomy education by mode of delivery (remote vs. in-person)**

Questions	Response options	1st year n (%)	2nd year n (%)	Total n (%)	p-value
Do you think the 1st-year anatomy course is sufficient?	Yes	54 (46.6)	83 (60.1)	137 (53.9)	**0.016***
	No	44 (37.9)	47 (34.1)	91 (35.8)	
	I don't know	18 (15.5)	8 (5.8)	26 (10.2)	
Should anatomy be included in the 2nd-year curriculum?	Yes	27 (23.3)	65 (47.1)	92 (36.2)	**0.000***
	No	58 (50.0)	56 (40.6)	114 (44.9)	
	I don't know	31 (26.7)	17 (12.3)	48 (18.9)	
Is a practical component essential in anatomy courses?	Yes	86 (74.1)	96 (69.6)	182 (71.7)	**0.284**
	No	20 (17.2)	34 (24.6)	54 (21.3)	
	I don't know	10 (8.6)	8 (5.8)	18 (7.1)	
Should clinical examples be included in anatomy courses?	Yes	94 (81.0)	113 (81.9)	207 (81.5)	**0.005***
	No	3 (2.6)	15 (10.9)	18 (7.1)	
	I don't know	19 (16.4)	10 (7.2)	29 (11.4)	
Should cadaver or lab-based anatomy be part of associate degree education?	Yes	91 (78.4)	112 (81.2)	203 (79.9)	**0.381**
	No	14 (12.1)	19 (13.8)	33 (13.0)	
	I don't know	11 (9.5)	7 (5.1)	18 (7.1)	
Does anatomy education make you feel like a healthcare professional?	Yes	75 (64.7)	124 (89.9)	199 (78.3)	**0.000***
	No	33 (28.4)	10 (7.2)	43 (16.9)	
	I don't know	8 (6.9)	4 (2.9)	12 (4.7)	
Should anatomy be offered as an elective course?	Yes	35 (30.2)	21 (15.2)	56 (22.0)	**0.000***
	No	60 (51.7)	112 (81.2)	172 (67.7)	
	I don't know	21 (18.1)	5 (3.6)	26 (10.2)	
Would you take anatomy if it were an elective?	Yes	63 (54.3)	102 (73.9)	165 (65.0)	**0.004***
	No	32 (27.6)	24 (17.4)	56 (22.0)	
	I don't know	21 (18.1)	12 (8.7)	33 (13.0)	
Did you experience difficulty in learning anatomy?	Yes	96 (82.8)	82 (59.4)	178 (70.1)	**0.000***
	No	17 (14.7)	53 (38.4)	70 (27.6)	
	I don't know	3 (2.6)	3 (2.2)	6 (2.4)	
Is it necessary to provide lecture notes before anatomy class?	Yes	116 (100.0)	135 (97.8)	251 (98.8)	0.279
	No	0 (0.0)	2 (1.4)	2 (0.8)	
	I don't know	0 (0.0)	1 (0.7)	1 (0.4)	
Do anatomy exams adequately assess your knowledge?	Yes	79 (68.1)	101 (73.2)	180 (70.9)	0.600
	No	22 (19.0)	24 (17.4)	46 (18.1)	
	I don't know	15 (12.9)	13 (9.4)	28 (11.0)	
Could you ask questions freely in anatomy classes?	Yes	85 (73.3)	85 (61.6)	170 (66.9)	0.116
	No	21 (18.1)	32 (23.2)	53 (20.9)	
	I don't know	10 (8.6)	21 (15.2)	31 (12.2)	
Do you think this survey will be beneficial?	Yes	79 (68.1)	86 (62.3)	165 (65.0)	0.507
	No	18 (15.5)	29 (21.0)	47 (18.5)	
	I don't know	19 (16.4)	23 (16.7)	42 (16.5)	
Is remote anatomy education an alternative solution?	Yes	49 (42.2)	46 (33.3)	95 (37.4)	**0.011***
	No	42 (36.2)	75 (54.3)	117 (46.1)	
	I don't know	25 (21.6)	17 (12.3)	42 (16.5)	

Table 2. **Continued**

Questions	Response options	1st year n (%)	2nd year n (%)	Total n (%)	p-value
Should remote anatomy education be expanded?	Yes	26 (22.4)	26 (18.8)	52 (20.5)	0.116
	No	56 (48.3)	84 (60.9)	140 (55.1)	
	I don't know	34 (29.3)	28 (20.3)	62 (24.4)	
Can remote anatomy education be avoided in the future?	Yes	32 (27.6)	43 (31.2)	75 (29.5)	0.799
	No	44 (37.9)	48 (34.8)	92 (36.2)	
	I don't know	40 (34.5)	47 (34.1)	87 (34.3)	
Is remote education an effective learning model for anatomy?	Yes	17 (14.7)	31 (22.5)	48 (18.9)	**0.042***
	No	87 (75.0)	83 (60.1)	170 (66.9)	
	I don't know	12 (10.3)	24 (17.4)	36 (14.2)	
Total		**116 (100.0)**	**138 (100.0)**	**254 (100.0)**	

**p<0.05 indicates statistical significance*

of the students reported that they could easily communicate with the instructor during remote learning, and 69.0% stated that they were able to express their thoughts freely. However, 47.4% believed that remote learning reduced the effectiveness of teamwork.

The 35.3% of students regularly attended courses, whereas 6.0% reported that they were unable to attend them at all. The most common reasons cited for inability to attend were lack of a personal device (37.1%) and lack of an internet connection (25.0%); other reasons included an unsuitable study environment (12.1%), connection problems (19.8%), and employment outside the home (6.0%).

In general, most students (84.5%) attended anatomy classes at home; the proportion who considered the remote learning environment suitable was equal to the proportion who did not (44.8%). The most common reasons cited for the learning environment being unsuitable for listening to lectures were environmental noise (48.6%) and the presence of other people (36.9%). Furthermore, 73.3% of the first-year students participating in the study believed that remote learning was less effective than in-person education.

Table 3. **Perceptions of second-year students who received in-person anatomy education**

Questions	Response options	n (%)
Is the information learned in anatomy education forgotten quickly/easily?	Yes	74 (53.6)
	No	48 (34.8)
	I don't know	16 (11.6)
If anatomy knowledge is forgotten, what do you think is the reason?	Rote memorization	68 (49.3)
	Insufficient prior knowledge	32 (23.2)
	Latin terms	38 (27.5)
Is anatomy education absolutely necessary for your current academic program?	Yes	100 (72.5)
	No	26 (18.8)
	I don't know	12 (8.7)
Was the anatomy education you received beneficial for your other courses?	Yes	100 (72.5)
	No	27 (19.6)
	I don't know	11 (8.0)
Do you believe the anatomy course will be beneficial in your professional life after graduation?	Yes	87 (63.0)
	No	33 (23.9)
	I don't know	18 (13.0)

Table 4. **Perceptions of first-year students who received remote anatomy education**

Questions	Response options	n (%)
I can easily communicate with the instructor in online anatomy classes	Yes	79 (68.1)
	No	20 (17.2)
	I don't know	17 (14.7)
I can easily express my thoughts in online anatomy classes	Yes	80 (69.0)
	No	19 (16.4)
	I don't know	17 (14.7)
Remote anatomy education increases independent work but reduces opportunities for teamwork	Yes	55 (47.4)
	No	22 (19.0)
	I don't know	39 (33.6)
How often do you attend online anatomy classes?	Regularly	41 (35.3)
	Often but sometimes miss	54 (46.6)
	Rarely	14 (12.1)
	Do not attend	7 (6.0)
What is the most common reason you cannot follow the online anatomy lessons?	Lack of device	43 (37.1)
	No internet package	29 (25.0)
	Connection problem	23 (19.8)
	Inadequate environment	14 (12.1)
	Working outside the home	7 (6.0)
Which device do you use to attend online anatomy classes?	Laptop	54 (46.6)
	Desktop	10 (8.6)
	Tablet	3 (2.6)
	Smartphone	49 (42.2)
When you follow the lesson via smartphone, does it reduce learning efficiency?	Yes	52 (44.8)
	No	29 (25.0)
	I don't know	35 (30.2)
What is the most effective online teaching method in anatomy, in your opinion?	Live class	51 (44.0)
	Recorded lecture	48 (41.4)
	Shared video links	10 (8.6)
	Homework delivery	7 (6.0)
Where do you most frequently attend your online anatomy classes?	Home	98 (84.5)
	Workplace	18 (15.5)
Do you think your learning environment is suitable while attending online anatomy classes?	Yes	52 (44.8)
	No	52 (44.8)
	I don't know	12 (10.3)
If not, what is the most common reason your environment is not suitable for online anatomy education?	Noisy environment	54 (48.6)
	Presence of other people	41 (36.9)
	Being at the workplace	16 (14.4)
Is remote anatomy education as effective as in-person education?	Yes	13 (11.2)
	No	85 (73.3)
	I don't know	18 (15.5)

Discussion

The use of remote education models in higher education has made educational effectiveness, particularly in applied health sciences courses such as anatomy, a fundamental research issue. This study differs from many previous reports on anatomy education in several respects. Both remote and in-person groups received the same curriculum and materials from the same instructor, minimizing differences attributable to teachers or course designs. Furthermore, the sample consisted of students enrolled in vocational health services programs, who play an important role in routine health services but are infrequently mentioned in the literature. Finally, our study evaluates the advantages and challenges of online anatomy education from a broad perspective, not only regarding the effectiveness of the course but also regarding students' perceptions of professional identity and their access to devices, internet connectivity, and suitable working environments. The most significant finding of our study is that, despite sharing the same course, subject, instructor, and materials, the rate of learning difficulties was 59.4% among second-year students who received in-person education, compared with 82.8% among first-year students who received remote education ($p<0.001$).

A study on anatomy and physiology education supports our findings (12). In this study, even with in-person education, 59.6% of students reported difficulty learning the course, which closely matches the 59.4% observed in our study's formal education group. In the same study, 48.8% of students reported that they did not consider anatomy lessons necessary, and 67.4% that they would not choose them as an elective course (12).

According to a study by Kürtüncü and Aylin (13), 76.4% of students believe that remote learning is insufficient for practice-based courses. The 79.9% of the students participating in our study believe that associate-degree education should include cadaveric anatomy or laboratory training. Studies by Sahu (14) and Wang et al. (15) report that it is not appropriate to deliver practical courses through remote education. Other studies suggest that remote education can contribute to theoretical knowledge, whereas in-person education is necessary for practical skills. It is important for students to practice analyzing and integrating the information obtained (16,17). These findings indicate that students recognize the importance of practical courses, which are essential to education, and that they have concerns about the practical aspects of remote learning.

Among participants in our study, 60.1% of second-year students and 46.6% of first-year students considered the anatomy course sufficient in their first year; however, the proportion of undecided respondents was higher among first-year students. A statistically significant difference was found between the responses of the two groups ($p=0.016$). This indicates that students who took the course remotely did not fully grasp the importance of the anatomy course, did not consider the information available to them adequate, and did not master the subject matter. Responses to the question "Is remote anatomy education an alternative solution?" also support this finding ($p=0.011$). Indeed, the percentage of first-year students with no experience comparing remote and formal education who responded "I don't know" (21.6%) was higher than the percentage of second-year students with formal education experience who responded "I don't know" (12.3%) confirming this lack of experience and indecision.

In work environments, schools, and universities, individuals socialize and interact constantly with their colleagues and friends. In group settings, individuals exchange ideas more frequently and actively attempt to understand others' thoughts and teachings (18,19). Bernard et al. (20) examined the effect of three types of interaction (student-student, student-instructor, and student-material) on student achievement using meta-analytic methods. The study found that all three types of interaction had positive effects; student-instructor interaction, in particular, had stronger effects than the other two. Cheng and Chau's (18) study reported that the lack of social communication among students in remote education and the reduced sense of community could contribute to poorer academic performance by diminishing students' social interactions. In the study by Keskin and Kaya (17), 36.0% of students reported that remote education reduced teamwork by directing them toward individual work. Similar to these studies, 68.1% of first-year students in our study stated that they could easily communicate with the instructor in remote anatomy education; 69.0% stated that they could easily express their thoughts; and 47.4% believed that remote anatomy education increased individual work and reduced teamwork.

Our study revealed the decisive role of formal and remote education in students' awareness of the professional necessity of the course. The clearest evidence of this lack of awareness is the responses to the question: "Should the anatomy course be included in the second-year curriculum?" Second-year students with formal educational experience who understand the importance of the course support this idea at a rate of 47.1%. By comparison, 50.0% of first-year students who take the course remotely and struggle to develop this awareness

answered "No". This difference in perception between the two groups is statistically significant ($p<0.001$) and parallels findings in the literature (12). These findings strongly support the notion that remote learning leads not only to a deficiency in students' learning of the course content but also to a deficiency in their understanding of why that course is essential for their profession.

The 67.7% of the students in our study believed that anatomy should not be an elective course, and 65.0% stated that they would take the course if it were an elective. Again, there were statistically significant differences between first- and second-year students for these responses ($p<0.001$ and $p=0.004$). Moreover, in these responses, we observe that second-year students who received in-person education in their first year make more accurate judgments.

One of the most striking findings of our study emerged in relation to students' perception of professional identity. When asked, "Does anatomy education make you feel like a healthcare professional?", 64.7% (n=75) of first-year students enrolled in remote education answered "Yes". In comparison, this rate rose to 89.9% (n=124) among second-year students with formal educational experience. This difference is statistically significant. Similarly, 63% of second-year students answered "Yes" to the question: "Do you believe that the anatomy course you are taking will be useful in your professional life after graduation?". In light of these data, remote anatomy education appears to provide less support than formal education for students' development of their health professional identity and professional self-confidence. This finding is consistent with a study conducted in Brazil that showed that over 70.0% of students were concerned about the future of their professional education and only 24.1% found remote learning effective (21).

In a study by Rizun and Strzelecki (22), university students reported wanting to return to in-person education. In a study by Uzun et al. (23) examining the attitudes of 128 university students toward distance learning, only 15 (11.72%) considered it practical. Similarly, 73.3% of first-year students in our study reported that distance anatomy education was less effective than in-person instruction, whereas 55.1% of students in both classes opposed expansion of distance anatomy education. In the studies conducted by Başer et al. (7) during the pandemic, 46.4% of students reported having a suitable home environment for studying. Additionally, 55.1% of students were unable to attend their lessons regularly due to problems with internet infrastructure and access. In our study, 44.8% of students considered the learning environment was suitable. According to a study by Kürtüncü and Aylin (13) among nursing department students (n=824), only 105 of 516 participants reported that they could follow their classes without problems related to internet access or computers. In a study by Karadağ and Yücel (24) involving 17,939 students from various classes at 163 universities, 37.0% lacked internet access at home, 34.0% lacked a computer or tablet, and 23.0% reported that they could not continue their remote education. According to a report published by Kırşehir Ahi Evran University in 2020 (25), 23.0% of the 2,781 students were unable to attend online classes, and 75.0% of those unable to attend online classes reported internet connection issues. According to the data from our study, 37.1% of the 116 students did not have access to a computer, tablet, or smartphone; 25.0% did not have an internet package; and 19.8% experienced internet connection problems. Based on the studies conducted and our findings, it is evident that internet connectivity and infrastructure problems have not yet been completely resolved in our country, and that the percentage of students without access to a computer, tablet, or smartphone remains high. When equal opportunities in education cannot be fully ensured, courses may not reach their full potential, and instructors may have fewer opportunities to effectively support students. Many studies comparing online and in-person education found no difference in participants' success at the end of training (26,27,28). In fact, according to some studies, remote education is more effective than formal education in terms of participants' academic success (26,29,30). Considering these data, we believe that remote education in our country will again become a debatable issue once the learning environment is more suitable, internet infrastructure and access problems are resolved, and access to technology (e.g., phones, tablets, and computers) is ensured.

Study Limitations

The first major limitation of the study is that the sample consisted exclusively of students from the Health Services Vocational School of a single university, drawn from multiple health-related associate degree programs with unequal group sizes. Consequently, the findings may not be generalizable to other institutions or programs, and unmeasured program-level differences (e.g., baseline academic preparation or career orientation) may have confounded the comparative results. Furthermore, since the data obtained through the questionnaire are based on the students' subjective statements, the accuracy of the responses may have been affected by individual differences. Another important

limitation is that although the survey is based on existing surveys and student feedback, no separate pilot test or formal psychometric analyses (e.g., Cronbach's alpha or KR-20 for internal consistency) were conducted on the current version of the instrument. Therefore, measurement error and limited generalizability of survey scores cannot be completely disregarded.

Conclusion

This study has revealed that distance learning models used in practical health courses, such as anatomy, may significantly complicate the learning process and negatively impact educational efficiency. Limited in-person interaction and active participation have prevented students from fully grasping the professional importance of the course. Furthermore, infrastructural deficiencies, technological limitations, and educational inequality experienced during this process have been identified as key factors reinforcing these negative outcomes. These digital education models, whose use is expected to increase in the near future, need to be reevaluated and improved in light of the current findings, to make them sustainable and inclusive.

Ethics

Ethics Committee Approval: This study was approved by the Clinical Research Ethics Committee of University of Health Sciences Türkiye, İstanbul Training and Research Hospital (decision number: 2842, date: 21.05.2021).

Informed Consent: Completion and submission of the survey constituted informed consent.

Footnotes

Authorship Contributions

Concept: Ö.C.S., Ö.K., F.F.K., Design: Ö.C.S., F.F.K., Data Collection or Processing: Ö.C.S., Ö.K., F.F.K., Analysis or Interpretation: Ö.K., Literature Search: Ö.C.S., Ö.K., Writing: Ö.C.S., Ö.K., F.F.K.

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REFERENCES

1. Herand D, Hatipoğlu ZA. Comparison of distance education and distance education platforms. Çukurova Üniversitesi İİBF Dergisi. 2014;18:65-75.
2. Kırık A. Historical development of distance education and the situation in Turkey. Marmara İlet Derg. 2016;73-94.
3. Çetin A, Özdemir ÖF. The effect of teaching methods used in blended and face-to-face learning environments on attitudes towards the internet. Abant İzzet Baysal Univ Fac Educ J. 2018;18:1378-1403.
4. Altıparmak M, Kurt İD, Kapıdere M. Open source learning management systems in e-learning and distance education. *XI Acad Inform Congress*. 2011;4:320-321. (in Turkish)
5. Avcı E. Comparison of distance education and traditional education. Asst Prof Dr Mehmet Necati Cizrelioğulları PhD Publ. 2020:243-250. (in Turkish)
6. Tokuç B, Varol G. COVID-19 pandemic and medical education in Turkey. Namık Kemal Med J. 2020;8:595-599.
7. Başer DA, Ağadayı E, Karagöz N. Behaviors and problems of medical students regarding distance education during the pandemic: medical education during the pandemic process. J Turkish Fam Physician. 2020;11:149-158. (in Turkish)
8. Abdullahi A, Gannon M. Improving college students' success in gateway science courses: lessons learned from an anatomy and physiology workshop. Am J Health Sci (AJHS). 2012;3:159-168.
9. Gözil R, Özkan S, Bahçelioğlu M, et al. Phase II student's evaluation of anatomy teaching at Gazi University Medical School. TED. 2006;23:27-32.
10. Atay E, Çınar Ş, Özçelik Bozkurt Ö, Tokpınar A, Soysal H, Doğan U. Sociodemographic characteristics of first-year medical students and their opinions about anatomy education: a survey study. Med Educ J. 2016;15:110-118. (in Turkish)
11. Sindel M, Şenol Y, Gürpınar E. Evaluation of anatomy education by students in Akdeniz University School of Medicine. Tıp Eğitimi Dünyası. 2008;28:31-36.
12. Otağ İ, Otağ A. Student opinions on human anatomy and physiology education. Cumhuriyet Int J Educ. 2013;2:39-45.
13. Kürtüncü M, Aylin K. Problems experienced by nursing students regarding distance education during the COVID-19 pandemic period. Eurasian J Soc Econ Res. 2020;7:66-77.
14. Sahu P. Closure of universities due to coronavirus disease 2019 (COVID-19): impact on education and mental health of students and academic staff. Cureus. 2020;12:e7541.
15. Wang C, Cheng Z, Yue XG, McAleer M. Risk management of COVID-19 by universities in China. J Risk Financ Manag. 2020;13:36.
16. Forehand M. Bloom's taxonomy. Emerg perspect learn teach technol. 2010;41:47-56.
17. Keskin M, Kaya DÖ. Evaluation of students' feedback on web-based distance education during the COVID-19 process. Izmir Katip Celebi Univ Health Sci Fac J. 2020;5:59-67.
18. Cheng G, Chau J. Exploring the relationships between learning styles, online participation, learning achievement and course satisfaction: an empirical study of a blended learning course. Br J Educ Technol. 2016;47:257-278.
19. Clark C, Strudler N, Grove K. Comparing asynchronous and synchronous video vs. text-based discussions in an online teacher education course. Online Learn J. 2015;19:48-69.
20. Bernard RM, Abrami PC, Borokhovski E, et al. A meta-analysis of three types of interaction treatments in distance education. Rev Educ Res. 2009;79:1243-1289.
21. Peloso RM, Ferruzzi F, Mori AA, et al. Concerns of health-related higher education students in Brazil pertaining to distance learning

during the coronavirus pandemic. Eval Health Prof. 2020;43:201-203.

22. Rizun M, Strzelecki A. Students' acceptance of the COVID-19 impact on shifting higher education to distance learning in Poland. Int J Environ Res Public Health. 2020;17:6468.
23. Uzun GÖ, Eş AÇ, Evram G. Examination of attitudes of university students in distance education according to some variables. Near East Univ Online J Educ. 2020;3:104-115.
24. Karadağ E, Yücel C. Distance education in universities during the new type of coronavirus pandemic: an evaluation study covering undergraduate students. J Higher Educ. 2020;10:181-192.
25. Kırşehir Ahi Evran University. A different management approach report in times of crisis. Kırşehir Ahi Evran Univ Publ. 2020. (in Turkish)
26. Suanpang P, Petocz P, Kalceff W. Student attitudes to learning business statistics: comparison of online and traditional methods. J Educ Technol Soc. 2004;7:9-20.
27. Navarro P, Shoemaker J. Performance and perceptions of distance learners in cyberspace. Am J Distance Educ. 2000;14:15-35.
28. Horton W. Leading e-learning. Alexandria (VA): American Society for Training and Development; 2001.
29. McKinnon DH, Nolan CP. Distance education for the gifted and talented: an interactive design model. Roeper Rev. 1999;21:320-325.
30. Hartman J, Dziuban C, Moskal P. Faculty satisfaction in asynchronous learning networks: a dependent or independent variable. J Asynchronous Learn Netw. 2000;4:155-179.