

## Investigation of Students' Opinions on Distance Neuroanatomy Education during the Pandemic

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**Abstract:** The coronavirus disease 2019 (COVID-19) outbreak has had an impact on many areas, including education. In order to prevent the spread of the virus, face-to-face education has been replaced by distance education. Although distance education provides students with positive effects such as flexibility, there are also negative effects. Especially in neuroanatomy education, online learning is thought to be insufficient to understand three-dimensional and complex structures. Physiotherapy and Rehabilitation (PMR) students' views on neuroanatomy courses during the distance education process were investigated. In this study, the attitude levels of PMR students were analyzed using the "Attitude Scale towards Distance Education" questionnaire. In the survey, in which Turkish and foreign PMR students (n=91) participated, neuroanatomy course hours were sufficient for the students. In addition, the students stated that learning neuroanatomy with the distance education method can make an important contribution to their profession. Providing educational materials to us in advance, and practice exams before midterm and final exams made it easier for students to learn neuroanatomy. In addition, it was determined that those who took the course for the first time were more successful than those who took the course for the second time. As a result, although the sudden transition to distance education models due to COVID-19 has created various challenges, it has allowed the traditional education system to be reconsidered and adapted to new practices to improve educational experiences. In this context, feedback from student surveys is of great importance in terms of improving the education model.

### INTRODUCTION

The outbreak of coronavirus disease 2019 (COVID-19) has posed a major challenge to education systems<sup>1</sup>. Face-to-face lectures at universities and colleges around the world have been limited by social distancing measures aimed at flattening the spread of infection and reducing overall deaths from the disease<sup>2</sup>. To maintain the academic calendar during the pandemic, online teaching has become the main method of teaching<sup>3</sup>. Online learning provides a flexible and interactive learning experience<sup>4,5</sup>. As face-to-face and online learning were compared, it was indicated that there was no significant difference in terms of increasing knowledge<sup>6</sup>. E-learning could not only be based on knowledge transfer, but also be aimed at increasing students' clinical and social skills. However, successful implementation of online learning into the curriculum requires a well-thought-out strategy and a more active approach.

The COVID-19 pandemic has also affected Physiotherapy and Rehabilitation education and practice. Although it created a negative effect on the patient care environment, it also provided an opportunity for adaptation and growth by switching to virtual modalities for patient care and education<sup>7</sup>. The pandemic has allowed PMR to reconsider traditional routines in its education and adapt to new practices to enhance their educational experience. Learning anatomy in PMR education guides the development and preparation of clinical examinations<sup>8</sup>. However, anatomy education has moved away from laboratory conditions due to the COVID-19 epidemic<sup>9</sup>. In this period, online platforms and anatomy atlases are generally used in anatomy education.

Neuroanatomy, a sub-branch of anatomy, is known to be difficult to learn because of the sheer complexity and interconnectedness of the central nervous system<sup>10</sup>. Students are required not only to learn about anatomical structures, but also to understand their topography, spatial relationships, and clinical significance. The inability to participate in cadaver dissections due to the COVID-19 pandemic may hinder students' learning of neuroanatomy, as the reduction of face-to-face contact and direct interactions with both peers and teachers.

In this study, the effects of online education on neuroanatomy learning of PMR students during the COVID-19 pandemic period were investigated. With the results obtained, it is aimed to develop the online education model and to strengthen the neuroanatomy learning of the students.

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## MATERIAL and METHOD

### Research Type

This research was conducted to examine the attitudes of the students studying at the Hamidiye Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation Faculty of Physiotherapy and Rehabilitation of the University of Health Sciences towards neuroanatomy courses in distance education. Ethical approval was obtained from the university's scientific ethics committee numbered 21/56.

### Research Population and Sample

The population of the research consisted of Turkish and international students studying at the Faculty of Physiotherapy and Rehabilitation at the University of Health Sciences. The sample of the research consisted of 91 students who agreed to participate in the research. Of these students, 76 (83.5%) were female and 15 (16.5%) were male. Of the students, 81 (89.0%) were Turkish citizens and 10 (11.0%) were international students.

### Data Collection Type

The data of the students who accepted to participate in the research were obtained with the questionnaire form created by using the "Attitude Scale towards Distance Education". This prepared questionnaire determines the gender of the student and how he or she communicates with the lecturers. Communication options included "I can contact by phone", "text message", "email when I need it" and "lecturers are unreachable". Online follow-up level of all courses in neuroanatomy education, device elements by combining distance education method in the pandemic process, and students' views on the efficiency of theoretical courses and their attitudes towards distance education were evaluated.

### Attitude Scale Towards Distance Education

"Attitude Scale Towards Distance Education" developed by Ađır (2007) has two sub-dimensions and consists of 21 items in total. It was developed by rating it as a 5-point Likert type between [1] (strongly disagree) and [5] (strongly agree). The measurement tool contains 7 negative items [11, 12, 13, 14, 15, 17, 19] whose values should be reversed in data analysis. The lowest score that can be obtained from the scale is 21, and the highest score is 105<sup>11</sup>.

### Online Data Collection

Consent was obtained from the students with an informed form. The survey started after the student gave consent. Student names remained confidential. The questionnaire was uploaded to the forms section of the Microsoft Teams program and a link was sent to all students who took the Neuroanatomy course at the Faculty of Physiotherapy and Rehabilitation via e-mail.

### Statistical Analysis

The distribution of the answers of the students participating in the research was analyzed by number and percentage in the SPSS 22.0 package program. The answers of the students, which differed according to their demographic information, were analyzed with the Chi-square test. Statistical techniques such as percentage, frequency, t-test, and One-Way Analysis of Variance (ANOVA) were used in the analysis of sub-problems. In addition, the correlation of the scale with the added 17 questions was examined with the Pearson test.  $p < 0.05$  was considered significant.

## RESULTS

A total of 91 students, 76 (83.5%) female and 15 (16.5%) males, participated in the survey. 81 of these students (89.0%) were citizens of the Republic of Turkey, 10 of them (11.0%) were international students. Among those who participated in the survey, 79 (86.8%) students take the functional neuroanatomy course for the first time, and 12 (13.2%) students take the course for the second time.

To the question with which device they connect to distance education, 57 (62.6%) students answered with a computer, 33 (36.3%) students with a mobile phone and 1 (1.1%) with a tablet. In addition, the device connecting to distance education was found to be the computer most frequently in both women (61.8%) and men (66%). When asked whether they have problem-free access to the internet where they live, 50 (55%) students said they could access it without any problems, while 25 (27.5%) students had problems. There were 52 (59.4%) students who had to share the remote connection device with their family members during the distance education process. 50 (55%) students had to use mobile phones for homework and exams. 46 (56.7%) of these students were citizens of the Republic of Turkey while 4 (40%) were international students. On the question "3 hours per week of neuroanatomy course was sufficient for distance education", 60 students (66%) found the lecture sufficient, 11 (12.8%) was insufficient, and 20 students (21.2%) were undecided. 55 (60.5%) students who took the neuroanatomy course with distance learning think that they will contribute to their profession.

Being actively participating in the lesson by turning on the microphone during the lesson said that 52 (57.2%) students contributed to their learning of the Neuroanatomy lesson. 63 (69.3%) students answered the question "Sharing the lecture videos beforehand had a positive effect on learning the neuroanatomy course". Providing educational materials in advance made the lecture easier for 76 (83.5%) students to learn the lesson. In distance education, the fact that the camera of the lecturer was always on during the lesson increased the interest of 80 (87.9%) students in the lesson. The active participation of classmates by turning on the microphone during distance education increased the motivation of 52 (57.2%) students.

Attitudes towards distance education were examined according to the number of times the students took the neuroanatomy course. While the average for those who took the course for the first time was 66.72, it was calculated as 55.91 for the students who took the course for the second time.

The difference between the attitudes of those who took the course for the first time and those who took the course for the second time was examined with the Independent Samples Test, and the scores of those who took the course for the first time were significantly higher ( $p < 0.05$ ). The characteristics of the students participating in the study were shown in Table 1. Information about the neuroanatomy course was depicted in Table 2. Descriptive statistical analyzes of the students were classified in Table 3.

## DISCUSSION

The lives of all segments of society have been affected as people are asked to self-quarantine at home to prevent the spread of the virus in the COVID-19 pandemic. The pandemic has also had a significant impact on students' daily routine and education<sup>12</sup>. Therefore, necessary measures should be taken to improve the learning experience by reducing the negative effects caused by the COVID-19 epidemic. Distance learning has confronted students with challenges such as independent learning, time and task management, computer learning, and lack of communication with teachers and peers. During this period, communication and support with teachers can play an important role for students' self-regulated learning and intrinsic motivation<sup>13</sup>. The role of the educator is to consult the relevant

pedagogy to ensure that online learning tools are well equipped to provide students with a clear learning path through the curriculum<sup>14</sup>.

**Table 1.** Description of the characteristics of the students

	f	%
<b>Gender</b>		
Woman	76	83,5
Male	15	16,5
<b>Nationality</b>		
Turkish	81	89
International	10	11
<b>Device</b>		
Mobile phones	33	36,3
Computer	58	63,7
<b>How many times did you take the lesson?</b>		
First time	79	86,8
Transition	12	13,2
<b>I have constant, trouble-free access to the internet where I live.</b>		
No	41	45,1
Yes	50	54,9
<b>I have to share my device with family/household members during the distance education process.</b>		
No	37	40,7
Yes	54	59,3
<b>I have to use my cell phone for homework and exams.</b>		
No	41	45,1
Yes	50	54,9

A high degree of engagement and interaction (active learning), a clear narrative that makes integrative connections easier, and a passionate, enthusiastic lecturer increase student engagement<sup>15</sup>. Therefore, these parameters can be used to encourage student participation in the development of online education models. Practices for providing students with effective online teaching and learning are reviewed. It has been found that technology and communication competencies are the main factors that increase student satisfaction and retention. Motivation and accessibility in online learning were found to be key issues for student participation<sup>16, 17</sup>.

The impact of COVID-19 on surgical training in the Netherlands was evaluated. The study showed a significant impact of the first months of COVID-19 outbreak on the Dutch surgical trainee program with an essential redistribution of residents with a reduction in surgical exposure and training<sup>18</sup>. This study indicated the need for enough guidance for all surgical residents and the possible extension of the surgical training program. Data included an approach to rearrange the clinical learning system, which includes a description of the learners and the environment, the pedagogical principles guiding the approach, and the technological tools used in practice. In addition, the available literature on this topic was researched, an assessment of the work to date was presented<sup>19</sup>. Recommendations for future guidelines for postgraduate medical education online were presented. There may also be other pandemic-related disorders in the background of students' online learning. The first COVID-19 quarantine was shown to affect the health of children and adolescents through an increase in sleep disturbances, according to the results of a large web-based Italian survey<sup>20</sup>. In the later stages of the pandemic, it may be helpful to research and treat disorders, as well as make decisions about environmental health policies relevant to this age group. In short,

besides the evaluation of online education, environmental factors should also be considered.

The impact of the COVID-19 pandemic on medical education was discussed and the knowledge, attitudes, and practices of medical students regarding electronic learning were examined. The data

**Table 2.** Status of neuroanatomy courses

	f	%
<b>The hours of the neuroanatomy course were sufficient in distance education from the pandemic process.</b>		
No	31	34,1
Yes	60	65,9
<b>Sharing Theoretical and Laboratory Lecture videos in advance had a positive effect on my learning Neuroanatomy</b>		
No	28	30,8
Yes	63	69,2
<b>I think that learning neuroanatomy with distance education method will contribute to my profession.</b>		
No	36	39,6
Yes	55	60,4
<b>Preparing the questions about the course after the course topic was covered made it easier for me to learn Neuroanatomy.</b>		
No	11	12,1
Yes	80	87,9
<b>I was able to answer the questions asked by the lecturer during the neuroanatomy distance education course.</b>		
No	37	40,7
Yes	54	59,3
<b>Being actively participating in the lesson by turning on my microphone during the lesson contributed to my learning of Neuroanatomy.</b>		
No	39	42,9
Yes	52	57,1
<b>The fact that the camera of the lecturer was always on during the lesson increased my interest in the lesson.</b>		
No	30	33
Yes	61	67
<b>My classmates' active participation in the lesson by turning on their microphones during the lesson increased my motivation.</b>		
No	39	42,9
Yes	52	57,1
<b>Giving the training materials to us in advance made it easier for me to learn the lesson.</b>		
No	14	15,4
Yes	77	84,6
<b>The practice exams before the midterm and final exams had a positive effect on my learning about Neuroanatomy.</b>		
No	17	18,7
Yes	74	81,3

indicated that pandemic undeniably thought to continue to disrupt medical education and training<sup>21</sup>. Valid solutions such as online training and virtual clinical experience can be provided to reduce this disruption. In dentistry education, which is one of the fields close to medicine, the perspectives of students and faculty members regarding the application of online learning were evaluated<sup>22</sup>. Within this study, students and lecturers showed a predominantly positive outlook on the application of

online learning, stating that it could provide a chance to use online learning in future curriculum even beyond COVID-19. Engzel et al. determined that learning loss occurred due to the closure of schools during the COVID-19 epidemic<sup>23</sup>. The findings showed that students made little progress while learning from home. This may be because in countries where infrastructure is weaker or schools are closed for longer,

**Table 3.** Descriptive statistical analysis of students, \* $p < 0.05$

	Value + s.d.	p
Woman	65,93±14,25	0,344
Man	62,07±15,14	
Turkish	65,46±14,60	0,764
International	64,00±13,20	
<b>I have constant, trouble-free access to the internet where I live.</b>		
No	67,15±13,98	0,269
Yes	63,78±14,68	
<b>I have to share my device with family/household members during the distance education process.</b>		
No	64,16±14,95	0,536
Yes	66,07±14,08	
<b>I have to use my cell phone for homework and exams.</b>		
No	65,15±12,30	0,929
Yes	65,42±16,02	
<b>The hours of the neuroanatomy course were sufficient in distance education from the pandemic process.</b>		
No	69,42±12,65	0,049*
Yes	63,17±14,86	
<b>Sharing Theoretical and Laboratory Videos in advance had a positive effect on my learning about Neuroanatomy.</b>		
No	68,89±12,94	0,112
Yes	63,70±14,80	
<b>I think that learning neuroanatomy with distance education method will contribute to my profession.</b>		
No	74,78±9,80	<0,001*
Yes	59,09±13,55	
<b>Preparing the questions about the course after the course topic was covered made it easier for me to learn Neuroanatomy.</b>		
No	71,73±15,57	0,114
Yes	64,41±14,09	
<b>I was able to answer the questions asked by the lecturer during the neuroanatomy distance education course.</b>		
No	62,89±17,02	0,188
Yes	66,94±12,16	
<b>Being actively participating in the lesson by turning on my microphone during the lesson contributed to my learning of Neuroanatomy.</b>		
No	66,62±17,10	0,452
Yes	64,31±12,04	
<b>The fact that the camera of the lecturer was always on during the lesson increased my interest in the lesson.</b>		
No	67,13±15,71	0,396
Yes	64,39±13,73	
<b>My classmates' active participation in the lesson by turning on their microphones during the lesson increased my motivation.</b>		
No	65,49±15,97	0,914
Yes	65,15±13,23	
<b>Giving the training materials to us in advance made it easier for me to learn the lesson.</b>		
No	74,21±11,68	0,011*
Yes	63,68±14,30	
<b>The practice exams before the midterm and final exams had a positive effect on my learning about Neuroanatomy.</b>		
No	73,35±13,49	0,010*
Yes	63,45±14,03	

s.d.: standard deviation

the losses are even greater. The effect of COVID-19 on students' learning has been determined by empirical studies from different countries<sup>24</sup>. Findings in the case of Wales have demonstrated the dedication of teachers during the pandemic to ensure that learning is not compromised for most students despite unusually challenging conditions. The sudden shift to synchronized online learning during the COVID-19 pandemic in Saudi Arabia has positively changed medical students' perspectives<sup>25</sup>. The principles and learning outcomes of the online learning model can be rigorously and regularly evaluated to monitor its effectiveness.

Neuroanatomy is one of the most challenging courses in anatomy, and students often have trouble grasping complex three-dimensional spatial relationships. Neuroanatomy education is changing with Technology Enhanced Learning now prevalent in modern curricula<sup>26</sup>. Working with the 3D e-learning module has significantly increased students' neuroanatomy knowledge<sup>27</sup>. Educational advances in neuroanatomy have a beneficial effect for students and professionals and their future patients. 3D physical modeling is an effective method for teaching the spatial relationships of brain anatomy by preparing students for the visualization of 3D neuroanatomy<sup>28</sup>.

Online learning approaches can be a versatile way to ensure students are encouraged to learn. In this context, it is necessary to provide neuroanatomy resources that are easily accessible, encourage an inner interest and have a positive effect on knowledge<sup>29</sup>. In this way, it can be ensured that students continue to work on their own during long-term isolation periods. Hybrid learning combining face-to-face learning and e-learning has shown better effects in health education compared to traditional learning<sup>30</sup>.

### Conclusion

As a result, it has been determined that there are difficulties in understanding neuroanatomy lessons with online education. It was observed that those who took the course for the first time were more successful than those who took the course for the second time. By developing online learning technologies, providing online materials in addition to face-to-face training in the post-pandemic period can make the neuroanatomy course more understandable. Hybrid education systems can support more successful careers by increasing the knowledge of anatomy in PMR students.

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### Conflicts of interest

The Authors declare that there is no conflict of interest.

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