

# Comparison of Online Education and Face-to-face Education in terms of Student Satisfaction in Physiology Education

## Fizyoloji Eğitiminde Uzaktan Eğitim ve Yüz-Yüze Eğitimin Öğrenci Memnuniyeti Açısından Karşılaştırılması

Hasan ŞİMŞEK (ORCID: 0000-0001-5573-4923)

Aksaray University Faculty of Medicine, Aksaray, TÜRKİYE

Corresponding Author: Hasan ŞİMŞEK, E-Mail: hasansimsek47@gmail.com

### Abstract

**Aim:** The coronavirus disease 2019 (COVID-19) has become a rapidly spreading pandemic all over the World. Social isolation is the most effective prevention option after vaccination. Many habits have changed in our lives due to social isolation during the pandemic. In terms of education, globally, the traditional education system has turned into an online education system. Physiology is a compulsory course that has an important place in health education and is a fundamental science for understanding pathophysiology, health assessment, and pharmacology. With the transition to the online education system, it is necessary to determine the effectiveness of physiology education. The aim of this study is to determine the effectiveness of online education and face-to-face education on students in physiology education and to measure students' satisfaction.

**Methods:** The research was conducted with 916 students studying at 29 universities in different provinces of Türkiye through an online survey. This survey was self-designed based on a 3-point Likert scale. The survey was applied to 50 students and the questions in the form were finalized according to the answers received. The answers given were grouped under the four titles of Demographic Information, Educational Information, Access to Online Education and Perspective on Online Education in Physiology. The obtained data were interpreted by being subjected to statistical analysis.

### Keywords:

COVID-19, Physiology Education, Medical Education, Online Education, Face-to-Face Education

### Anahtar sözcükler:

COVID-19, Fizyoloji Eğitimi, Tıp Eğitimi, Uzaktan Eğitim, Yüz-Yüze Eğitim

Gönderilme Tarihi

Submitted: 19.07.2022

Kabul Tarihi

Accepted: 08.09.2022

**Results:** In the comparison of online education and face-to-face education, the preferences of the students have been face-to-face education. The number of students who consider online education sufficient in understanding physiology lessons, in general, are few (n=242, 26.4%), those who see it incompletely are more (n=367, 40.1%), while 1/3 gave neutral views (n=307, 33.5%). The majority of participants have the opinion that "face-to-face education is more effective in terms of increasing knowledge in physiology education compared to online education" and "It is more difficult for me to focus on physiology courses during online education compared to face-to-face education".

**Conclusions:** The perceived stress level of medical school students who experienced the summative type online exam for the first time was found to be high before and after the exam. Online exam methods will be a field that

is frequently applied and developed in the coming years. For this reason, there is a need for more studies in which the factors that cause stress in medical students during online exams are determined.

To cite this article: Şimşek H. Comparison of Online Education and Face-to-face Education in terms of Student Satisfaction in Physiology Education. World of Medical Education. 2022;21(65): 109-118

## Özet

**Amaç:** Koronavirüs hastalığı 2019 (COVID-19), tüm dünyada hızla yayılan bir pandemi haline gelmiştir. Sosyal izolasyon, aşı tedavisinden sonraki en etkili önlem seçeneğidir. Pandemide sosyal izolasyona bağlı olarak hayatımızda birçok alışkanlık değişkenlik göstermiştir. Eğitim açısından da küresel olarak, geleneksel eğitim sistemi çevrimiçi bir eğitim sistemine dönüşmüştür. Fizyoloji, sağlık eğitiminde önemli bir yere sahip olan ve patofizyoloji, sağlık değerlendirmesi ve farmakolojiyi anlamak için gerekli olan bir temel bilim zorunlu dersidir. Online eğitim sistemine geçişle birlikte fizyoloji eğitiminin etkinliğinin belirlenmesi gerekmektedir. Bu çalışmanın amacı, fizyoloji eğitiminde uzaktan eğitim ve yüz-yüze eğitimin öğrenciler üzerindeki etkinliğini belirlemek ve öğrenci memnuniyetini ölçmektir.

**Yöntem:** Araştırma, Türkiye'nin farklı illerindeki 29 üniversitede öğrenim gören 916 öğrenci ile çevrimiçi anket yoluyla gerçekleştirilmiştir. Bu anket, 3'lü Likert ölçeğine göre araştırmacı tarafından tasarlanmıştır. Hazırlanan anket formu 50 öğrenci üzerinde uygulanmış ve alınan cevaplara göre formda yer alan sorulara son hali verilmiştir. Verilen cevaplar demografik bilgiler, eğitim bilgileri, online eğitime erişim ve fizyolojide online eğitime bakış açısı olmak üzere 4 başlık altında toplanmıştır. Elde edilen veriler istatistiksel analizlere tabi tutularak yorumlanmıştır.

**Bulgular:** Online eğitim ile yüz yüze eğitim karşılaştırıldığında öğrencilerin tercihleri yüz yüze eğitim olmuştur. Fizyoloji derslerini anlamada çevrimiçi eğitimi yeterli bulan öğrenci sayısı genel olarak daha az ( $n=242$ , 26,4%), eksik görenler daha fazla ( $n=367$ , 40,1%) hesaplanmıştır; 1/3'ü ( $n=307$ , 33,5%) ise tarafsız görüş bildirmiştir. Öğrencilerin çoğunluğu "yüz yüze eğitimin çevrimiçi eğitime göre fizyoloji eğitiminde bilgi artırmada daha etkili olduğu" ve "Çevrimiçi eğitimde fizyoloji derslerine odaklanmanın yüz yüze eğitime göre daha zor olduğu" görüşündedir.

**Sonuç:** Tüm dünyada eğitim sistemi bu COVID-19 pandemisinden ciddi şekilde etkilenmiş ve alternatif öğrenme yöntemleri ile devam etmiştir. Fizyolojide çevrimiçi eğitim, özellikle öğrenciler için derslere istedikleri zaman ve istedikleri yerde katılabildikleri için avantajlıdır. Yüz yüze eğitim modelinde ise öğrenciler fizyoloji eğitiminden daha fazla verim almaktadır. Günümüz koşullarında online eğitim ön plana çıktığı için online eğitimin dezavantajlarına odaklanılması ve bu engellerin kaldırılması için gerekli adımların atılması öğrencilerin online eğitime bakış açısını olumlu yönde etkileyecektir.

## INTRODUCTION

Corona Virus Disease 2019 (COVID-19), which was first seen in China, was declared a pandemic on March 12, 2020 (1). The COVID-19 pandemic has shaken humanity to its core. During COVID-19 pandemic, the most effective preventive criterion after vaccination is social distance. Many countries have taken full closure measures in order to implement social distance. Due to this situation, the closure of schools and universities has made education uncertain at all levels (2). The COVID-19 pandemic has caused changes in education/training activities all over the World. The pandemic has caused a sudden transition from traditional face-to-face education to online education in education systems, especially in medical faculties (1). In addition practical courses in health sciences education, especially

physiology, anatomy and biochemistry laboratories in medical education, it has clinical and bedside education that requires physical contact with faculty and student. This is a determinant of perceived attitudes towards e-learning (3). Physiology is a compulsory course that has an important place in health education and is a fundamental science for understanding pathophysiology, health assessment, and pharmacology (4).

Since the COVID-19 is highly contagious, making it difficult to attend classes in the face-to-face education system, the patient-based and theoretical/practical-based medical education process was affected. One of the effective methods to overcome this obstacle is to make live online video lessons (5). Most medical schools have quickly adapted to online courses,

with live clinical contact shifted to the virtual space. However, they have expressed concerns about clinical internships and evaluations at some universities (6).

Evidence shows that online education can play an effective role in active learning. With the transition from traditional face-to-face education to online education, various challenges arise for students as well as educators. Therefore, it is imperative to understand students' satisfaction with online education for the effective implementation of the online education model (1). Online education has difficulties, such as the educator's ability to prepare an effective lesson and at the same time fail to provide a suitable environment for the student's dedication and commitment (7).

The online education model has taken an effective role in the teaching and learning process during the COVID-19 pandemic. However, students' satisfaction is extremely important in the effective implementation of online education, especially in institutions where it is newly adopted. It is not yet known to what extent the online education model, which became active during the epidemic, is effective in physiology, one of the health sciences. The aim of this study is to investigate how effective the online education model is from the point of view of the students in physiology teaching and to what extent the students are satisfied with the online education model.

## **METHODS**

This study was conducted with active undergraduate students studying in faculties providing physiology education (medical school, dentistry, nursing, midwifery, physiotherapy and rehabilitation (PR), veterinary and others) in existing universities in Türkiye by using the online survey (Google forms) method. Ethical approval was obtained from Aksaray University Human Research

Ethics Committee (Protocol no: 2021/04-91, Date: 26.04.2021).

The study was conducted with 950 students studying at 29 universities in different cities of Türkiye. All the students voluntarily participated in the survey. At the beginning of the survey, consent was obtained from the "informed consent form". A blank question was added to the study as a control and the participants were asked not to answer this question. 34 participants who marked the blank question were excluded from the study. The study was completed with 916 participants. This online survey was carried out from May 17 to July 07, 2021. This survey was self-designed based on 3-point Likert scale. The survey was pre-tested on 50 students for standardization. Some of the questions in the online survey were modified from a survey prepared by Bączek et al (8).

The answers given were grouped under the titles of "Demographic Information, Educational Information, Access to Online Education and Perspective on Online Education in Physiology". Age and gender information of students were requested under the "Demographic Information" title. Under the title of "Education Information", the information of the university, faculty, and class was requested. Under the "Access to Online Education" title, information about the electronic device used, the advantages and disadvantages of online education were asked. 14 questions were asked under the title of "Perspective on Online Education in Physiology". Totally, 22 questions were asked under these 4 titles.

IBM SPSS Statistics for Windows, Version 26.0. (Armonk, NY: IBM Corp ) (9) package program was used to evaluate the data obtained for this study. For summarizing all analysis results, frequencies with percentages were used for categorical variables.

## RESULTS

### *Demographic Information and Educational Information*

Age range findings of the participants in this study, 65.6% (n=601) were in the 17-20 age range; 31.9% (n=292) were in the 20-24 age group; 2.5% (n=23) are in the 25 years and over group. The majority of the students were

females (68%, n=623) (Table 1).

The highest proportion of the study participants were from B.Sc. Medical School (36%, n=330) and 1st and 2nd academic years i.e. 64.7%, n=593 and 26.3%, n=241 respectively. The educational information of the participants is given in Table 1.

**Table 1.** Demographic and Education Information of the Participants

		n	%
Age	17-20	601	65.6%
	21-24	292	31.9%
	>25	23	2.5%
Gender	Male	293	32.0%
	Female	623	68.0%
Faculty	Medical School	330	36.0%
	Dentistry	37	4.0%
	PR	39	4.3%
	Nursing	96	10.5%
	Midwifery	54	5.9%
	Veterinary	107	11.7%
	Others	253	27.6%
Class	1	593	64.7%
	2	241	26.3%
	3	52	5.7%
	4	21	2.3%
	5	9	1.0%

### *Perspective on Online Education in Physiology*

About the advantages of online education, most of the students agree on "Accessing the courses registrations wherever I want later". Among online education advantages, the lowest yes response is the "More comfortable interaction in online courses" (Table 2). The participants

were able to tick more than one option.

Similar to each other, the answer to the 6 questions we asked to determine the disadvantages of online education were mostly "yes" (Table 2). The participants were able to tick more than one option to fill out this question.

**Table 2.** Advantages and Disadvantages of Online Education

		n	%	
Advantages	Easy access to online course materials	No	508	55.5%
		Yes	408	44.5%
	Learning at my own pace	No	490	53.5%
		Yes	426	46.5%
	More comfortable interaction in online courses	No	833	90.9%
		Yes	83	9.1%
	Accessing the courses registrations wherever I want later	No	117	12.8%
		Yes	799	87.2%
	The environment in which I listen to the lecture is comfortable	No	517	56.4%
		Yes	399	43.6%

		n	%	
Disadvantages	Low interaction with the teachers	No	321	35.0%
		Yes	595	65.0%
	Technical problems	No	256	27.9%
		Yes	660	72.1%
	Low interaction with the classmates	No	326	35.6%
		Yes	590	64.4%
	Poor learning opportunities in out-of-university	No	368	40.2%
		Yes	548	59.8%
	Lack of discipline study	No	299	32.6%
		Yes	617	67.4%
	Social isolation	No	466	50.9%
		Yes	450	49.1%

In the comparison of online education and face-to-face education, the preferences of the students have been face-to-face education. The majority of participants have the opinion that "face-to-face education is more effective in terms of increasing knowledge in physiology education compared to online education" and "It

is more difficult for me to focus on physiology courses during online education compared to face-to-face education". The preferences of the participants about the comparison of online education and face-to-face education are shown in Table 3.

**Table 3.** The Preferences of the Participants About the Comparison of Online Education and Face-To-Face Education in Physiology Education

		n	%
<b>Online education is more effective than face-to-face education in terms of increasing knowledge in physiology education.</b>	Disagree	446	48.7%
	Neutral	351	38.3%
	Agree	119	13.0%
<b>Face-to-face education is more effective than online education in terms of increasing knowledge in physiology education</b>	Disagree	167	18.2%
	Neutral	254	27.7%
	Agree	495	54.0%
<b>I enjoyed the physiology classes I took with online education</b>	Disagree	275	30.0%
	Neutral	320	34.9%
	Agree	321	35.0%
<b>Teachers explain the physiology lesson more effectively in online education</b>	Disagree	349	38.1%
	Neutral	407	44.4%
	Agree	160	17.5%
<b>Video lectures are effective in practical physiology lessons</b>	Disagree	285	31.1%
	Neutral	317	34.6%
	Agree	314	34.3%

		n	%
<b>With online education, my interest in physiology has increased</b>	Disagree	388	42.4%
	Neutral	346	37.8%
	Agree	182	19.9%
<b>In general, online education is sufficient for me to understand physiology courses</b>	Disagree	367	40.1%
	Neutral	307	33.5%
	Agree	242	26.4%
<b>It is more difficult for me to focus on physiology courses during online education compared to face-to-face education</b>	Disagree	179	19.5%
	Neutral	227	24.8%
	Agree	510	55.7%
<b>With the transition to online education, my performance in physiology courses has increased</b>	Disagree	460	50.2%
	Neutral	335	36.6%
	Agree	121	13.2%

Suggested ones in order to make the presentations more understandable for students in online education; Adding videos to presentations, alternative presentation programs

(Prezi, etc.), adding more images to presentations. In addition, the majority of students think that the duration of one lesson is sufficient in online education (Table 4).

**Table 4.** Suggestions About Presentations and Duration of Courses

		n	%
<b>Adding videos to presentations</b>	No	179	19.5%
	Yes	737	80.5%
<b>Alternative presentation programs (Prezi etc.)</b>	No	498	54.4%
	Yes	418	45.6%
<b>Adding more images to presentations</b>	No	227	24.8%
	Yes	689	75.2%
<b>The duration of a specified course is sufficient for online education in physiology.</b>	Disagree	174	19.0%
	Neutral	274	29.9%
	Agree	468	51.1%
<b>The duration of a course determined for online education in physiology should be increased.</b>	Disagree	412	45.0%
	Neutral	307	33.5%
	Agree	197	21.5%

### **Access to Online Education**

The majority of the participants made an access with the computer to online physiology courses

(n=642, 70.1%). The majority of the students stated that they regularly attend online courses (Table 5).

**Table 5.** Participation Status of Participants in Online Training

		n	%
<b>With which electronic device do you participate in online education?</b>	Computer	642	70.1%
	Smartphone	239	26.1%
	Tablet	35	3.8%

		n	%
<b>I regularly attended live classes in online education for physiology lessons.</b>	No	97	10.6%
	Yes	504	55.0%
	Sometimes	315	34.4%

## DISCUSSION

COVID-19 infection caused by the new type of coronavirus (SARS-CoV-2) has quickly become a global public health problem (10). As of 16 Aug 2022, infected patients were present in 222 countries, and there were > 590 million confirmed cases, with more than 6.4 million fatalities (11).

The COVID-19 pandemic situation is more serious and lasted longer than the recent pandemic situations. It has brought about many important changes in our lives. The education system all over the world has been seriously affected by this COVID-19 pandemic and has continued through alternative learning media and technology. Among these, the online education system has come to the fore. Medical education, unlike many other faculty education, it has clinical and bedside education that requires physical contact with faculty and student. In this study, we share the opinions of students who took physiology courses, especially medical students, on online education during the COVID-19 pandemic.

One of the major obstacle to the success of online education in low- and middle-income countries is the inability of financially disadvantaged students to have smart devices (Laptops, Tablets and Smartphones) to access online teaching-learning (12). Since Türkiye is a developing country, it is one step ahead of the countries mentioned in this regard. In our study, it was determined that all of the students had a smart device, especially a computer/laptop, to access online education.

The students' perspective on online learning depends on a variety of factors, such as the content, the platform's user interface, the learning community, and learning performance. Satisfaction with the faculty also significantly affects online course results (13). It has been determined that most of the students regularly

follow both theoretical and practical physiology courses. This findings show that students care about physiology courses regardless of the faculty they study. However, there are some criteria regarding the advantages and disadvantages that affect students' participation in online education.

The efficiency of learning is important for medical students, given the abundance of course materials they have to deal with. Online education provides this efficiency and is a factor that draws students to external electronic resources and interactions outside the classroom environment. In electronic resources, previously known topics can be skipped and unknown topics can be repeated over and over (14). A great majority of the students (9 out of 10 students) stated that the most important advantage of online education is "the ability to access the course records later and from anywhere". In this context, it should be taken into attention that this situation can greatly affect the students' view of the online course, as students learn the course content more than once and wherever they want.

When asked about the extent to which they were satisfied with the physiology online education in general, 26.4% of the students stated that they were satisfied, and almost one out of every three students gave a neutral opinion. Almost half of the students stated that they were not satisfied with the physiology online education in general. The reason for this situation can be considered as the technical inadequacy of this online education system and the insufficient level of student-student or student-teacher interaction. Student-student and student-teacher interaction was seen by Binks et al as an important factor for student participation in courses. Being able to interact with educators can make an important contribution to online education.

Interaction and social learning are elements that we argue are essential to create the experience the modern medical student seeks (14).

The main factors affecting online education's general trend are poor instructional design, inadequate internet connectivity, or audiovisual media quality (15). In terms of interaction, teachers should consider options to prepare presentations more effectively (add more images, add videos, alternative presentation programs, etc.), as well as increase interaction such as question and answer. As the students stated in the study, they expect such additions in the presentations and thus the presentations will be more interesting for them.

In a study by Snekalatha et al., according to the feedback they received from students, it was found that "the home environment was felt to be more distracting than the classroom and was not considered suitable by many students to take online exams" (16). According to the feedback they received from the students, Tuma et al found that "online learning is difficult compared to face-to-face learning and requires moderate technical skills" (15). Most of the students, while participating in online education from out of school environment, faced the problem of focusing due to the distractions around them, whether from family or from the environment. The difficulty for students to interact with their teachers, thus losing their focus, also dampens the excitement from clinical practice in medicine (17). More than half of the students stated that they had difficulty focusing on the lesson during online education. As the reasons for this situation, as stated by the students in the disadvantages of online education may be that students have poor learning opportunities in out-of-university, lower interaction with their teachers and classmates, and lack disciplinary study. More than ever, it is recommended that teachers use additional tools that encourage and motivate students to study. In the same way, while planning online learning, some effective pedagogical factors should be taken into account, such as providing greater interaction

between students and educators, facilitating active learning, and providing more educational support than usual (18). In order to overcome the obstacles that occur in the education system due to social isolation, students should also strive to adapt to both synchronous and asynchronous activities with the educators. It is recommended that students study the subject before online courses and create a disciplined program for themselves. Accordingly, there may be an increase in their performance, which decreased with the transition to online education, which the general majority of the participants stated.

This study provides important practical information on how to further increase satisfaction and commitment to online education in physiology in developing countries such as Türkiye. In this sense, university administrations and policymakers should promote the online learning system among students and teachers, especially solve problems such as technical infrastructure problems, and make arrangements to facilitate a gradual transition from traditional learning to online learning.

This study was conducted with 916 students. We found that these students who took physiology education mostly showed similar attitudes and desires about online education. However, this study was conducted in only one country (Türkiye). For this reason, the data obtained cannot be generalized for other countries. The obtained data about the advantages and disadvantages of online education needs to be confirmed by studies to be carried out in different country.

## CONCLUSIONS

As a conclusion, in many countries, there has been a rapid transition from traditional face-to-face education to online education in order not to disrupt education. Getting feedback on physiology online education from students will make a significant contribution to the successful execution of physiology online education.

According to the feedback received from the students, the online education system is considered advantageous in that they can attend the classes whenever and wherever they want. However, online education is seen as a disadvantage especially due to the lack of technical infrastructure, lack of interaction, and social isolation comparing to face-to-face education. The factors that affect the students' perspective on online education in general are the technical infrastructure, the teaching style of the teachers, the student-teacher and student-student interaction. These factors should be evaluated together in order for students to adopt online education and increase their satisfaction.

### ***Practice Points***

1. In the comparison of online education and face-to-face education, the preferences of the students have been face-to-face education.
2. Online education plays an important role in the continuity of the education system in the COVID-19 era.
3. Online education is advantageous because students can reach online education whenever and wherever they want.
4. Due to the "low interaction" and "social isolation", it was difficult for the students to focus on the courses.
5. Trainer' focus on education, especially in a way that will increase interaction, will increase focus and success in online education.

### ***Acknowledgment***

The author would like to thank Can Ateş for his statistical data comments in the study.

### ***Disclosures***

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

### ***Declaration of Interest***

The author declares no conflicts of interest.

## **REFERENCES**

- 1.Sharma K., Deo G., Timalisina S., et al. Online learning in the face of COVID-19 pandemic: Assessment of students' satisfaction at chitwan medical college, Nepal. Kathmandu Univ Med Journal COVID-19 Special Issue 2020; 70(2): 40-7
- 2.Sahi P. K., Mishra D., Singh, T. Medical education amid the COVID-19 Pandemic. Indian pediatri 2020; 57(7): 652–657
- 3.Olum R., Atulinda L., Kigozi E., et al. Medical education and e-learning during COVID-19 pandemic: Awareness, attitudes, preferences, and barriers among undergraduate medicine and nursing students at Makerere university, Uganda. J Med Educ Curric Dev 2020; 7: 2382120520973212
- 4.Anderson L. C., & Krichbaum, K. E. Best practices for learning physiology: Combining classroom and online methods. Adv Physiol Educ 2020; 41(3), 383–389
- 5.Alsoufi A., Alsuyihili A., Msherghi 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
- 6.Singh K., Srivastav S., Bhardwaj A., et al. Medical education during the COVID-19 pandemic: a single institution experience. Indian pediatri 2020; 57(7): 678–679
- 7.Evans D.J.R., Bay B.H., Wilson T.D., et al. Going virtual to support anatomy education: a STOPGAP in the midst of the COVID-19 pandemic. Anat Sci Educ 2020; 13: 279–283
- 8.Bączek M., Zagańczyk-Bączek M., Szpringer M., et al. Students' perception of online learning during the COVID-19 pandemic: A survey study of Polish medical students. Medicine (Baltimore) 2021; 100(7): e24821

9. IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.
10. Gul M., Inci S., Aktas H. et al. Hidden danger of COVID-19 outbreak: evaluation of subclinical myocardial dysfunction in patients with mild symptoms. *Int J Cardiovasc Imaging* 2021; 37: 2957–2964
11. WHO Coronavirus (COVID-19) Dashboard. Accessed: 19 Aug 2022. <https://covid19.who.int>
12. Universities tackle the impact of COVID-19 on disadvantaged students. Available from: <https://en.unesco.org/news/universities-tackle-impact-covid-19-disadvantaged-students>. Accessed: 19 Aug 2022.
13. Elshami, W., Taha, M. H., Abuzaid, M., Saravanan, C., Al Kawas, S., & Abdalla, M. E. Satisfaction with online learning in the new normal: perspective of students and faculty at medical and health sciences colleges. *Medical Education Online* 2021; 26(1): 1920090
14. Binks, A. P., LeClair, R. J., Willey, J. M., et al. Changing medical education, overnight: the curricular response to COVID-19 of nine medical schools. *Teach Learn Med* 2021; 33(3): 334-342
15. Tuma, F., Nassar, A. K., Kamel, M. K., Knowlton, L. M., & Jawad, N. K. Students and faculty perception of distance medical education outcomes in resource-constrained system during COVID-19 pandemic. A cross-sectional study. *Ann Med Surg* 2021; 62: 377-382.
16. Snekalatha, S., Marzuk, S. M., Meshram, S. A., Maheswari, K. U., Sugapriya, G., & Sivasharan, K. Medical students' perception of the reliability, usefulness and feasibility of unproctored online formative assessment tests. *Adv Physiol Educ* 2021; 45(1): 84–88
17. Nimavat, N., Singh, S., Fichadiya, N., Sharma, P., Patel, N., Kumar, M., Chauhan, G., & Pandit, N. Online medical education in India-different challenges and probable solutions in the age of COVID-19. *Advances in medical education and practice* (2021); 12: 237–243.
18. Lima K. R., das Neves B. S., Ramires C. C., et al. Student assessment of online tools to foster engagement during the COVID-19 quarantine. *Adv Physiol Educ* 2020; 44(4): 679–683