International Journal of Web-Based Learning and Teaching Technologies
Volume 17 • Issue 1

Fast Track to Full Online Education in the Medical Field:

Evaluating Effectiveness and Identifying Problems From the COVID-19 Experience

Vladimir Beketov, I.M. Sechenov First Moscow State Medical University (Sechenov University), Russia*
Irina Menshikova, I.M. Sechenov First Moscow State Medical University (Sechenov University), Russia
Anastasiya Khudarova, I.M. Sechenov First Moscow State Medical University (Sechenov University), Russia

ABSTRACT

The research explores the key issues specific to the online learning format. The scholars surveyed 1540 students and teachers to collect the data. The purpose was to identify and find solutions to the distance learning problems in medical faculties. The research highlighted that 68% of students were dissatisfied with communication. Many educators have introduced ineffective teaching methods. Inadequate application of the programs prevents educators from introducing effective situation modelling, presenting medical and clinical case scenarios. It should ensure effective online communication with patients and other medical practitioners. The majority of students (62%) and teachers (68%) reported problems in these areas. The proposed online learning methods can be effective in teaching subjects such as general surgery, anatomy, pathological anatomy, topographic anatomy and operative surgery, and pathophysiology. The results can help educators to improve medical education.

KEYWORDS

Distance Learning Tools, Human Anatomy and General Surgery, Medical Students, Online Platforms, Quality of Communication, Technical and Academic Difficulties

INTRODUCTION

One of the most important consequences of the COVID-19 pandemic was the forced transition to total distance learning at all levels of education. The rate of spread of the disease and the number of deaths left no choice (Marinoni et al., 2020; Tandon, 2020). Global changes have led to the fact that distance learning has become in demand and has begun to develop at a tremendous rate. The main problems that arose in this transition had to be solved: the search for learning services and applications for online communication. In the context of the pandemic, it was necessary to look for new ways of effective and safe learning, which would preserve the effectiveness of the educational process and help not to interrupt it (Koreneva et al., 2020).

The radical introduction of distance learning forms has made quite significant adjustments to the functioning of university educational and administrative structures. For example, medical faculties in Indonesia, according to researchers' findings, were severely affected by the COVID-19 pandemic, of which the medical faculty of Universitas Kristen Indonesia is the most affected. It is pointed out

DOI: 10.4018/IJWLTT.315824 *Corresponding Author

that the administration of the faculty had to fundamentally change the paradigm of the teaching and management staff within 1–3 weeks to change from the former lecture in class to a modified online lecture (Daroedono et al., 2020).

Distance learning forms require a more conscious attitude of students to the learning process, personal motivation, and, for the most part, independent completion of assignments. Self-education is about the transition from the classical form to distance learning. Many people find it difficult to adapt to the digitalization of lessons and meetings between students and teachers; all have different attitudes to innovative technologies, the quality of knowledge obtained in a new way, and the preservation of the moral aspects of teaching processes. All these problems have had a strong impact on changing the modern curriculum and have completely changed it (Soldatova, 2018). For students at medical universities, online classes were the only form of education within the limits of the lockdown (Osipova & Goreva, 2014; Potomkova et al., 2006; Serditova & Belotserkovsky, 2020). At the same time, in the field of medicine, practical knowledge in the subject area is decisive, and clinical excellence cannot be replaced by other forms of experience (Maksimenko et al., 2019).

Modern computer and network technologies have expanded the horizons and tools of education. However, in the field of medicine, the need for practical and personal clinical experience remains irreplaceable. The question of the possibilities and limits of acceptability of online education in medicine remains open (Mian & Khan, 2020; Shearer et al., 2020). Physicians can gain most of their knowledge from textbooks or technical visualization, but practice remains extremely limited (Venkatesh et al., 2020; Zimina et al., 2019). It is necessary to find out how effective such an approach is when applied to clinical specialties?

Student interest in learning has been significantly reduced because no personal contact with teachers was promoted. Medical education has faced different issues due to the need for students to communicate with teachers. Students experience confusion studying new subjects and applying knowledge in practice without teacher support. For medical students, it is difficult to do specific tasks. Many teachers reported attention problems in students in distance learning and poor concentration (Adnan & Anwar, 2020). In some cases, students reported overload and stress. Medical teachers give students complex tasks, but students do not have enough time to study the material and improve the clinical skills learned in the classroom (Sundarasen et al., 2020).

Moreover, communication with patients is an important element in medical student education. Medical practice plays a vital role in teaching senior students. Real-life practices and patient examinations are crucial for learning, making a diagnosis, and developing a treatment regimen (Mian & Khan, 2020). Medical students need to conduct research and understand medical test results, watch videos of surgery, be present during medical procedures, observe and perform manipulations, and ensure treatment under the supervision of a medical professional (Wang et al., 2020).

The main problem reported by students is the inadequate course content delivered online. The teachers were unable to integrate the practical material into online learning. Many clinical disciplines can only be learned in the traditional classroom environment. Some of the clinical skills are difficult to teach using online learning platforms (Chen et al., 2020). The scholars admit that distance learning requires high-quality learning courses to replace traditional classrooms and clinical practice (Mian & Khan, 2020).

Until recently, online learning tools were used only as an auxiliary for conveying information, in which it was an educator who played an important role. Nowadays, the significant risks of mass and intensive introduction of fully digital educational courses include the questionable level of effectiveness of such presentations even in the presence of favorable external and internal factors of influence (Fedchyshyn et al., 2020). Although more and more research has begun to emerge, pointing to new ways of using virtual tools for patient guidance or online medical education, the boundaries of the application of digital content in medicine are still unclear. There are still unanswered questions about the length and scope of distance learning offered, rethinking the teaching–learning dynamics, and the teacher's role in conveying information (Machado Júnior & Pauna, 2020).

LITERATURE REVIEW

The quarantine restrictions and the transition to distance learning have created new opportunities for researchers to investigate the opportunities and limitations of online education. The findings revealed that many universities (90%) were closed during the COVID-19 pandemic, and two-thirds of education establishments switched to online education. Web platforms, virtual classrooms, and video meeting rooms such as Google and Zoom were used for training (Marinoni et al., 2020). Changing global trends toward digital systems and e-learning have made technology an integral part of people's lives. Distance education has become a system to get rid of the financial, physical, and geographic boundaries that could affect students' ability to learn (Murzaliev, 2021). Researchers point out that online learning has many positive qualities that will affect the level of comfort during learning. Among them are: convenient schedules for educational work, convenient tools for information search, and a large amount of available knowledge and learning materials. All this makes the distance learning program quite comfortable and convenient for students (Kuznetsov & Nikitina, 2020). Even before the spread of the coronavirus, information technology was an important part of the educational program, and with the spread of the pandemic, it became a central part of the curriculum. The transition from classical systems to more interactive methods has accelerated and can be said to be the basis for future ways of developing the educational system (Kolesova, 2020). Thanks to advances in technology and social media, distance learning is a new approach that is rapidly evolving for undergraduate, graduate, and medical students. However, researchers from Jordan point out the importance of such a component as student experience using online applications, which, with its growing volume, has a positive effect on the dynamics of implementing distance learning (Al-Balas et al., 2020).

Changing the educational curriculum has been the basis for various studies and experiments. One of them examines the principles of interactive learning, the ability to digitize, and the development of new and the application of old techniques of computer-based learning. A comparison has been made between the digitalization and internalization of higher education institutions, in particular concerning the mobility of the curriculum. This factor is called the main factor in the program of the new learning system (Murzaliev, 2021). The shift from a traditional classroom, requiring the physical presence of a student, to a virtual environment can negatively affect the skills and psychological state of both students and teachers. Many researchers highlight increased anxiety among students and stress (Sarvestani et al., 2019). The students reported they experienced psychological problems such as depression, stress, and anxiety. More than half of the participants (62%) experienced psychological problems (Tandon, 2020).

Modern technology provides learning opportunities to medical students. Digital technologies ensure communication between medical professionals in different countries. The most popular methods include videoconferences, online consultations, and telemedicine (Trelease, 2016; Vladzimirsky & Andreev, 2018). The blended method of teaching involves modern technologies and traditional teaching. Researchers underline that interactive masterclasses and visualization should be linked to practical assignments (Lyulenova et al., 2021). Therefore, medical teachers should develop and introduce quality approaches to distance learning.

Many scholars highlight that distance learning has more advantages than disadvantages under pandemic restrictions. Online learning is a highly effective alternative to traditional classrooms. It creates the framework for the wider implementation of web-based technologies in education. The findings revealed that distance learning was an effective tool for lectures, but it was an ineffective method for teaching practical skills and performing interactive assignments (Redmond et al., 2020). Some scholars admit that there is no difference between traditional and distance learning. Online learning does not influence the quality of theoretical knowledge acquisition. Nevertheless, some scholars question the quality of the practical skills developed using online learning platforms (Redmond et al., 2020).

The popularity of distance learning has been growing over the last few years. The most widespread modes are mobile learning, artificial intelligence, augmented reality, and information visualization. The attempts to introduce these learning modes in education have been made by teachers, and the results proved the effectiveness. The research shows that students are apt to move to distance learning. In order to motivate students to use high-quality online platforms, the university staff needs to explore the opportunities modern technologies provide for medical universities. Teachers must effectively organize training sessions and ensure the use of appropriate equipment and technical means (Kasyanenko et al., 2019). The present research underlines the need to shift from the traditional classroom to distance learning under the pandemic restrictions. In the future, scholars recommend adapting virtual learning practices into a full-time medical curriculum (Taha et al., 2020; Tang et al., 2018).

In addition to the fact that online learning has a number of undeniable advantages, the transition to it has also presented challenges that have made the change very difficult. First and foremost, the researchers point out that the use of new, previously unknown technologies has greatly impacted teachers' ability to implement the curriculum. In their view, changes in classroom practices, homework, and interactions with students have made the instructional program much more difficult for teachers (Centers for Disease Control and Prevention, 2020). At the same time, many teachers, in another study, noted that although the transition was difficult, many forms of e-learning proved to be significantly more effective than classical programs. They noted the effectiveness of email, online communication programs, messengers, and Internet testing services (Halpin, 2020).

According to the teachers, student understanding of the educational program has deteriorated. However, they became more comfortable with learning. Students developed their ability to allocate time, identify the main elements of the training program, develop skills in using new information services, and develop the ability to search for information and to process it (Hudaiberdiev et al., 2020). For many of today's explorers, changing the form of learning can be a major way to advance education. The study of automated systems shows how they can streamline and create quality learning programs that will, in the end, focus not on an average program but on the personal skills, characteristics, and abilities of the student (Adorni et al., 2019).

The research analyzed the clinical programs and mid-term certification. It highlighted several important issues associated with the knowledge quality in therapeutic teaching:

- search for new teaching methods and the development of professional competencies
- the self-study based on online simulations, which replace face-to-face consultations and communication with patients (Agranovich et al., 2012)

Setting Goals

The research examines the challenges and problems of the transition to distance learning in medical universities. These issues are important for educators because online education reduces the effectiveness of training in medical students and the quality of healthcare in the future. The challenges are caused by the nature of clinical specialties. The problems of online education require an effective solution to be applied to mass online education promoting the knowledge of medicine and hygiene as well as for future educational practices under post-pandemic conditions.

The present research identifies the problems experienced by medical students learning clinical specialties caused by the transition to online learning. The research objectives are the following:

- identify problems of clinical specialties in Russian universities in the transition to distance learning
- explore changes in student learning in India
- explore changes in education in Great Britain
- compare problems and identify key issues facing educational institutions in crisis

METHODS AND MATERIALS

Study Design

The objective of the study was to identify the most important problems of the transition process to distance learning through the prism of personal experience and medical student perceptions. Also, the research should reveal aspects of the higher effectiveness of distance learning in comparison with the classroom in the described conditions. The study is divided into two consecutive parts. The first proposed a survey based on a questionnaire. The survey included six closed and open-ended questions, presented in Appendix 1. The second part of the study uses an additional survey.

As an additional study, we used the work of a supervisory committee made up of teachers and students, seven people from both of these groups. The members of the supervisory committee were selected according to the level of individual educational and academic observation and according to the survey of other study participants on a five-point scale. The members of the supervisory committee were those who scored the highest number of points in the voting and had the highest number of high academic achievements. Observers were required to attend online lectures and hands-on lessons and rate them according to seven criteria. An eight-point scale was used for the assessment. The purpose of the analysis carried out in this way was to refute or confirm the results obtained in the course of a direct survey from the point of view of a more objective external expert observation.

In the third stage of the study, a special pyramid of needs for the education and training of competent specialists was drawn up. Maslow's pyramid of life needs was taken as the basis. It described:

- needs for experience peak formation (the maximum professional level that a specialist can achieve)
- the ability to achieve a qualitative level of professional competence
- development of social skills
- the ability to acquire the necessary skills
- availability of useful information
- access to the necessary computer technology (computer, Internet, special programs)
- availability of sufficient time and resources

Students and faculty needed to assess how much of today's distance learning could meet these professional needs. The assessment criteria were developed by the members of the supervisory committee using the Delphi method during three consecutive sessions of the survey and discussion of the proposed criteria and attempts to apply them to the already existing learning outcomes of students from 4 universities prior to the start of this study. Universities were selected by top-ranking methods in the context of medical education. The evaluation criteria were deemed acceptable after a final consensus was reached by the review committee members. The data were collected by the supervisory commissions from September 2020 to May 2021.

Questionnaires that were incomplete or incorrectly completed or contained comments or information not related to the objectives of the study were not analyzed. The content of erroneous questionnaires does not exceed 9% of the total number of completed questionnaires. The questionnaires were analyzed using the Second Prism software and were subsequently visualized using the Microsoft Excel 2019 software package. The analysis of the questionnaires took about three weeks, as they were subject to detailed review. In order to systematize and verify these results, 24 teachers were involved (six from each university) who were not the study respondents. The teachers were selected by the university administration on a voluntary basis.

Participants

The survey participants were students from 4 Russian medical universities: Moscow Medical University REAVIZ, Pirogov Russian National Research Medical University, North-Western State

Medical University, and Kazan State Medical University. The sample was formed by a random sampling honeycomb from fourth-year students in the General Medicine specialization and amounted to 1,420 students. Based on the total number of medical students studying at these universities, the permissible sampling error does not exceed $p = 4.83$. Thus, the sample used can be considered sufficiently representative for research purposes (see Table 1).

Table 1. Characteristics of student respondents (n = 1420)

catergory	option	*f*	%
gender	male	689	48.5
	female	731	51.5
age	> 20	394	27.7
	21–23	511	35.9
	< 23	515	36.4
field of study	based on secondary general education	573	40.3

Participant training was based on both a full-time study program approved by universities and an online program containing the same amount of training material and training schedule. The participants were tasked with comparing two different learning modes. For the purpose of additional professional assessment, the sample also includes 120 university teachers, professors, and heads of specialized educational departments of these universities. The survey is presented to the participants via email. It was necessary to indicate your university, academic course, and specialty to confirm the participant's identification as a student or teacher.

Ethical Issues

No personal information obtained during the preparation of the study was passed on to third parties, nor was it stored at the end of this study. All participants were aware of the purpose and content of the study within the required competence and gave their informed consent to participate and use some of their personal information on a confidential basis.

Research Limitations

The results of the study, despite the steps taken to objectify them, contain the personal opinions of students about online learning, which are based on their personal academic achievements, experience, and psychological characteristics. The design of the experiment was aimed at applying a methodology that maximizes the objective value of the results obtained, which does not completely exclude the influence of the personal opinions of the participants.

RESULTS

The research revealed that the quality of education was influenced by inadequate teaching modes adopted during the transition period. Moreover, 71% of teachers reported technical problems teaching online. Many educators reported poor video or sound quality, teaching platform failures and operating systems breakdowns, poor quality of software programs, and poor Internet connection. The research admitted difficulties in downloading teaching materials, viewing them by students and data assessment problems. Some other problems included poor self-organization of students, which affected academic performance. Organizational problems were of high concern for more than half of the educators (68%)

teaching online. It is important to note that this may be associated not only with the competence and skills of the teacher but also with problems that arise in distance learning.

The scholars found communication problems between students and teachers. The main factor that influenced interaction was teacher overload during the transition period (see Table 2). Nevertheless, the effectiveness of online learning was admitted by teachers (54%). In time, teachers and students were able to adapt to the online format and develop effective online teaching strategies. More than half of the teachers (53%) wanted to return to the traditional classroom. The teachers highlighted the following problems in their questionnaires:

It is difficult to switch to a new and unfamiliar form of education. We have not taught students remotely before and knew little about new programs and online teaching methods. We experience technical problems and breakdowns: students do not hear and cannot watch lectures and seminars. It makes the process very difficult.

We cannot control students' attention during online lessons. We do not see students' reactions and do not sure whether they are listening to the lectures or not, and how they respond. It is difficult to control the quality of students' independent work.

It was difficult for us to organize training having no prior knowledge in online teaching. We have not previously worked with online platforms and were unable to organize activities during the transition period. We cannot demonstrate how to perform medical manipulations, control students' knowledge and how students perform physical manipulations.

Table 2. Results of the teacher survey

Question	Yes	No	Question	Factor
Were you ready for online learning?	24%	76%	What factors influenced the quality of education the most?	1. Lack of skills to learn in online environments 2. Poor training and inability to work remotely
Did you have any organizational problems?	68%	32%	How can you assess the university's resources used for online teaching?	1. Most universities had inadequate resources for online learning 2. Dependence on teacher resources
Do the results meet your expectations?	57%	43%	What were the key problems when you started learning remotely?	1. Technical problems 2. Poor self-organization of students 3. Communication problems between students and teachers.
Would you like to continue learning online?	47%	53%	What was the most difficult in the transition to distance learning?	1. Student unwillingness to learn independently 2. Lack of live communication
Were there any technical problems?	71%	29%	What communication problems have been experienced?	Lack of effective interaction between students and teachers, difficulties in the dissemination of information
Do you consider this mode of training effective?	54%	46%	What has changed in teaching modes?	1. Focus on self-learning 2. Use of online platforms

The implementation of distance learning forced many educators to research new teaching methods. The main problem was to develop a framework for online learning that inspired the self-learning of students. For this reason, the survey analyzed teacher and student opinions. Online learning should enhance students' interaction and increase the communication between teachers and learners. Internet problems and poor communication with teachers were the main problems identified by students (see Table 3). Consequently, 55% of participants admitted that the quality of education did not meet their expectations. Technical problems were identified by 69% of students as important. About half of the respondents (53%) were not ready to move to online education. Nevertheless, they were more ready to learn online than teachers. The majority of students (72%) highlighted that distance education was ineffective, but 61% of respondents would like to continue learning online. The scholars explained positive reactions to online learning through their adaptation to online learning and the conveniences of the online format. Students and teachers admitted the importance of self-study in online learning. In questionnaires, students reported the following problems:

There were difficulties with the organization of online learning. The university and the teachers made a lot of mistakes teaching online.

Inadequate personal contact with teachers. We could not contact them and get feedback. It was often difficult to sort out the materials sent by the teachers.

We started using Zoom for lectures. Online learning was convenient because we had not gone to lectures across the city early in the morning. It was difficult to do practical assessments. I cannot understand whether I perform functions correctly or [if] should I change something.

Sounds or videos are constantly dropping out. We experienced constant technical problems, interrupted teaching, the Internet connection failed, and the application closed. It was impossible to acquire information when the Internet failed; audio kept stopping crashes.

Table 3. Results of the student survey

Question	Yes	No	Question	Factor
Were you ready for online learning?	47%	53%	What factors influenced the quality of education the most?	Lack of good organization of the educational process and interaction with teachers
Did you have any organizational problems?	62%	38%	How can you assess the university's resources used for online teaching?	Universities have invested resources in the development of a good learning environment, but the results have not been satisfactory in a year since the transition took place
Do the results meet your expectations?	45%	55%	What were the key questions when you started learning remotely?	1. Technical problems 2. Poor self-organization and a lack of teacher feedback.
Would you like to continue learning online?	61%	49%	What was the most difficult in the transition to distance learning?	1. Adapt to new, unfamiliar learning conditions 2. The transition to self-study

Table 3 continued on next page

Table 3 continued

Question	Yes	No	Question	Factor
Were there any technical problems?	69%	31%	What communication problems have been experienced?	There was no effective contact with teachers similar to those used in full-time education
Do you consider this mode of training effective?	28%	72%	What has changed in teaching modes?	1. Teachers use online platforms 2. The transition to self-learning

The survey helped to identify four main factors that influenced the quality of distance learning:

1. lack of knowledge on distance learning and inadequate university resources to teach students online
2. poor communication between students and teachers
3. technical problems
4. difficulties with online learning are caused by poor interaction between students and teachers

The scholars conducted the experiment to confirm the validity of the results and identify current and forthcoming problems. The observation committee was formed, including fourteen participants: seven senior students and seven teachers. The observation commission analyzed the problems that arose during distance learning to confirm or deny the survey results. The commission attended and assessed online lessons from October 2020 to May 2021. The seven criteria were used to analyze the survey results. Each criterion was evaluated using the eight-point scale:

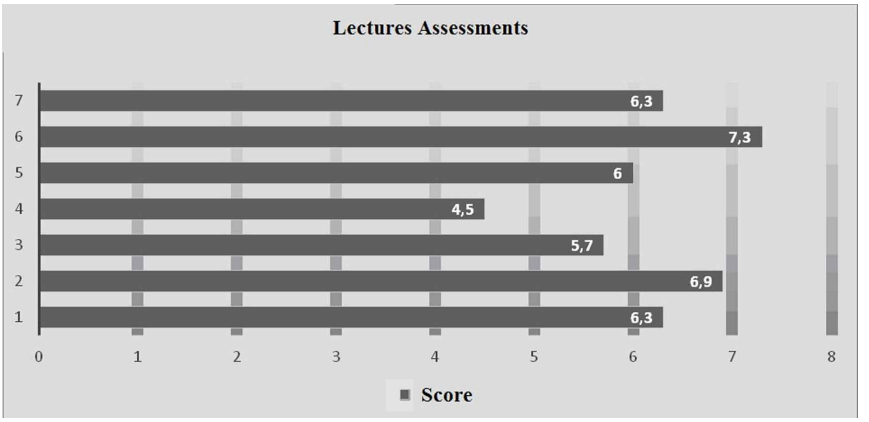
1. quality of knowledge acquisition
2. interaction between teachers and students
3. student learning activity
4. teaching quality
5. interaction between students during the lesson
6. quality of knowledge-sharing by the teacher
7. student self-preparation

The survey assessed lectures and practical assignments. Students and teachers rated the quality of lectures 6.3 out of 8 points. The interaction with teachers was rated higher, 6.9 out of 8 points, but the activity of students during lectures was 5.7 out of 8 points. The lowest score (4.5 points) was assigned for technical quality. The interaction of students got 6 points, and the level of knowledge acquisition rated 7.3 out of 8 points. Student self-preparation received 6.3 points.

The results suggested that the quality of lectures was high (see Figure 1). The main problems were identified in the technical aspect of teaching. The results of technical factors received the lowest scores. Student and teacher interactions received high scores, and the results denied the prior findings stating that there had been poor communication between students and teachers. The research identified that students could communicate with teachers during the online lesson but could not do it after the online training. This factor causes communication difficulties. The quality of knowledge sharing was

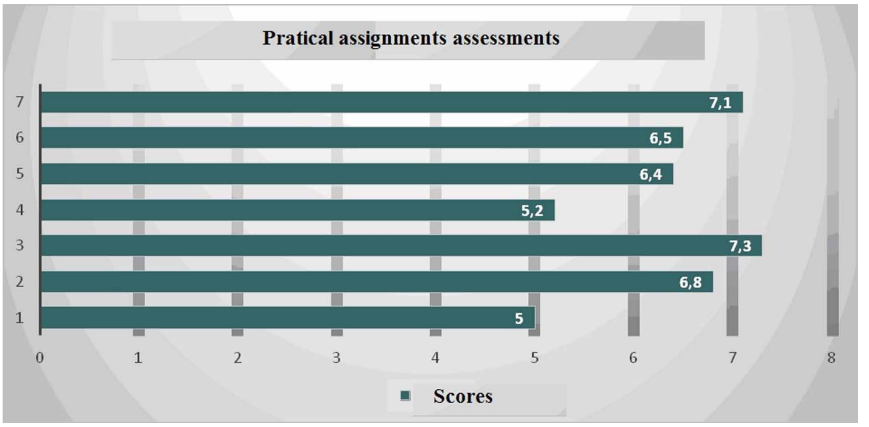
assessed high. The findings contradicted the prior results on the poor quality of education in distance format. The scholars explain that online lectures do not require special skills to be conducted, and students are satisfied with online teaching.

Figure 1. Lectures assessments



The results of practical assessments differ from the lectures (see Figure 2). The quality of knowledge sharing has significantly decreased in practical assignments, scoring 5 out of 8 points in comparison with lectures. Nevertheless, student activity has increased significantly, rating 7.3 out of 8 points in comparison with lectures. The technical quality of online classes was high, and the differences between the results and observations were not significant and were rated 5.2 out of 8 points. The interaction between students improved, and the results differences were not considered significant and were rated 6.4 out of 8 points. The level of independent training of students has significantly increased. It was rated 7.1 out of 8 points. Knowledge sharing has significantly decreased and was rated 6.5 out of 8 points.

Figure 2. Practical assignments assessment



The quality of lectures is high, but the quality of practical assignments is rated low. Medical students admit that learning clinical specialties in an online learning environment has become difficult. It was difficult for students to develop clinical skills without practice, receive adequate training without supervision and avoid contact with patients. The technologies available to students and teachers do not allow them to organize effective practice and master clinical specialties. The findings revealed that the lecturing process was also ineffective because of technical problems such as poor Internet connection and communication difficulties.

Students at medical universities should acquire complete, high-quality, and relevant knowledge and clinical competencies. It is important for university students and further medical practice. The new techniques can be used to improve the qualifications and knowledge of practicing doctors (Serditova & Belotserkovsky, 2020; Usacheva & Chernyakov, 2020; Verbitsky, 2010). For teaching medicine, web technologies are used to assist students in mastering clinical specialties in a medical university. Role-playing, simulation games, and project-based and individual training may be introduced into practice. Online training provides advantages, including expert consultants who teach medical specialties online (Dremova & Konoplya, 2012; Gewin, 2020; Venkatesh et al., 2020). In order to develop the most effective methods of teaching online, the scholars chose specialties that experienced the most difficulties shifting online. The medical specialties include human anatomy and general surgery. The research recommended a framework for practical assignments to be improved.

Human Anatomy

The practical assignment included the study of the human skull anatomy based on drawings and 3D models of the skull structure (see Table 4). The Biodigital website (2021) was used to teach the anatomy of the human skull. The students learned the human anatomy, acquired the relevant information, and examined the structure and the differences between the female and male bodies. The site was used by the teacher to visualize the structure and functions of the human body. Students could examine the model after the online training. The AnatomyLearning application was also used. This application allowed students to study the skull structure and test their knowledge.

Table 4. The first practical assignment on human anatomy

Subject	Tasks	Practical assignments
The human skull: practice	• learn the skull functions • examine the skull structure • knowledge testing	• examine the 3D structure, parts, and functions of the human skull • using videos to review the actual skull and its parts • test knowledge using a simple game format

The game testing based on a short quiz was included in the curriculum. The students had to answer questions and get a score. The teacher appraised students who received higher scores. Students who received fewer points had to prepare additional assignments and write essays or reports on the subject. The research admitted that when students could not examine the human body, 3D models and interactive methods of information visualization became the most effective and accessible tools for students.

The second practical assignment was an interactive online lesson (see Table 5). Students analyzed the clinical cases. They had to examine a patient with an acquired or congenital abnormality or disease. Students were provided with the test results, such as patient CT scans and X-rays. They identified the disease and then suggested and planned treatment. The students shared their hypotheses; the teacher explained to them the treatment proposed to this patient, including medication and its effectiveness.

Students examined patients and analyzed disorders. Thus, they identify possible problems a patient may face in real life and examine the treatment effectiveness.

Table 5. The second practical assignment on human anatomy

Subject	Tasks	Practical assignments
The human skull: practice	• examine clinical cases • identify the problem and find solutions • assess treatment effectiveness	• examine clinical cases, review CT and X-rays • survey students on the possibilities of solving the problem and treating the disease • learn about the decisions of professional doctors and assess treatment disadvantages and benefits

General Surgery

Surgery is one of the most important areas of medicine (see Table 6). Students have to acquire knowledge and skills on how to use a scalpel, sew up incisions following surgery and perform different manipulations. The development of such practical skills online is difficult. The simplest and best way is to use medical replicas. Students need practice. Medical replicas cannot replace the real human body, but medical replicas can be temporarily used in distance learning.

Table 6. The practical assignment in general surgery

Subject	Tasks	Practical assignments
General Surgery	• learn to make cuts • developing suturing skills	• students use video to examine the different types of cuts and stitches • use 3D surgical simulation preview • the students are asked to make different cuts and suturing. Students record the process and send it to the teacher for assessment

The scholars admit that the proposed practice is ineffective in actual patient cases, but it can be successfully used in online learning in order to help students develop clinical competence during the COVID-19 pandemic. The research tries to find the right solutions to problems faced by medical universities. Teaching clinical specialties is one of the challenging tasks for educators. Different options are being considered, such as personification, implementation of interactive methods, web resources, simulators, visualization technologies, remote meetings, and lectures. The proposed approach to teaching will help to develop clinical competencies and improve practical skills in medical students (Levanov et al., 2016). Educators should introduce different activities for students to motivate them and ensure the transition to online education is effective. Therefore, knowledge management should play a key role in distance learning (Shearer et al., 2020).

In medical universities, the successful transition to distance learning is influenced by the approach developed by the university. The most effective is the systematic approach including:

- the atmosphere in which students can safely switch to online learning
- development and implementation of training plans
- working teams used for communion purposes

- effective tools for knowledge acquisition and online teaching
- improving motivation of students in learning
- the quality of training materials
- education needs assessment

(O'Doherty et al., 2018)

The implementation of online learning should be based on video lectures and practical assignments that can effectively replace traditional classrooms (Chen et al., 2020). The research highlights that educators should improve student motivation to learn online. Many teachers admit low motivation for students to learn. It is difficult for teachers to inspire students' interest and attention. The same problem was confirmed by the supervisory commission, which rated the activity of students 5.7 out of 8 points, and the quality of interaction between students and teachers rated 6.8 and 6.9 out of 8 points, respectively. Therefore, there is a need to develop an effective methodology to increase students' involvement in medical training.

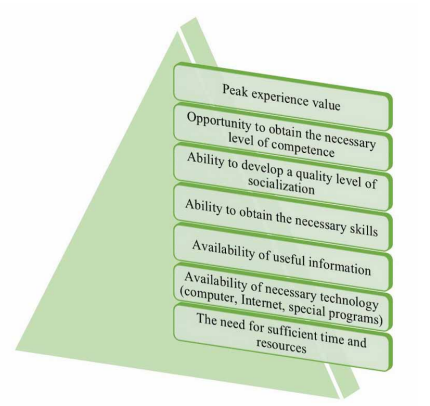
Self-organization is considered one of the main factors investigated by scholars (70% of all the research; Zimina et al., 2019). The lack of interest in acquiring new knowledge plays a significant role in academic performance, attending lectures and practical lessons, developing skills, and creating quality competence in clinical specialties (Agranovich et al., 2012). Distance learning depends on student desires to acquire knowledge, work independently, and organize the educational process (Patil & Chaudhari, 2016).

The scholars admit that it is important to develop a framework to increase student activity by introducing practices such as:

1. attracting students to prepare lectures
2. introducing interactive games and tests
3. introducing options to select topics that they will research for the next lesson
4. analyzing clinical cases, identifying the etiology, and finding solutions
5. conducting masterclasses, web meetings with patients and medical practitioners
6. developing web resources interesting and informative for students
7. using programs and sites containing 3D models, visualizations, and other information to improve student knowledge

Students should be actively involved in distance learning. Sufficient motivation and interest in knowledge acquisition are important. The level of skills development depends on the self-organization of students. Modern technologies offer educators the opportunity to examine clinical cases, but distance learning depends on student interest in knowledge acquisition. An additional study was conducted on the ability of distance learning to meet the educational needs formed in society. This pyramid was created on the basis of Maslow's famous work, in which he described the needs of life and was supplemented by the authors of this work (see Figure 3).

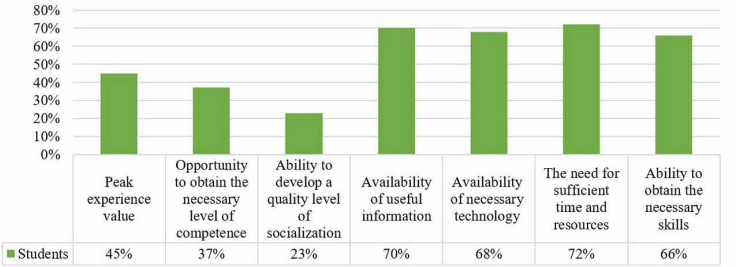
Figure 3. Pyramid of online work needs for specialist training



In total, the pyramid included the following concepts: peak experience, the ability to obtain the necessary level of competence, the ability to develop a qualitative level of socialization, the ability to obtain the necessary skills, the availability of useful information, the availability of necessary technology (computer, Internet, special programs), the need for sufficient time and resources. After that, students and teachers were asked to assess to what extent distance learning could meet student needs.

The survey among students showed that distance learning is able, at a sufficient level, to meet most of their needs. Thus, the survey showed that, in their opinion, distance learning is able to meet the need for access to useful information (70%) and time and resources (72%). Slightly less well, online learning copes with access to needed technology (68%) and the ability to obtain needed skills (66%). From this, one can trace that the Internet is able to satisfy the need for a large amount of necessary information, but not all students have access to quality Internet or other necessary technologies (special applications and services, VR and AR technologies, modulation of practical work). Significantly lower was the level of satisfaction with the need to obtain peak experience (45%), sufficient competence (37%), or socialization (23%; see Figure 4).

Figure 4. Results of a survey among students about satisfaction of needs

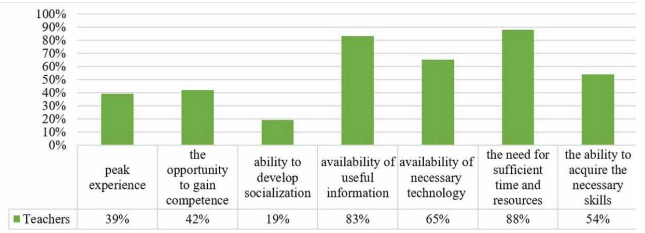


From this, one can see that distance learning cannot fully meet the basic professional needs, which form a sufficiently competent specialist in their field. That is, when studying in the online format, it is possible to get a sufficient level of information, and necessary skills and to use all available time

and resources. It is possible to form a specialist with a good level of competence but able to satisfy all the stages of the pyramid of needs.

The results of the survey among teachers showed that distance learning can satisfy the need for sufficient time and resources very highly (88%). That is, instructors are of the opinion that students have a high amount of free time to devote to learning. Another need that is very well satisfied is the availability of useful information (83%). Modern technology and the Internet give access to a lot of information. Against this background, one can see a great difference between the ability to develop socialization (19%) and the peak value of experience (high level of competence; 39%). These indicators are significantly lower than those indicated by the students and show a high level of teacher distrust regarding computer technology and such a drastic transition to distance learning. This confirms the level of realizing the need to have the necessary technology (65%) and the ability to get a good level of skills (54%). That is, according to the teachers, it is possible to prepare a professional specialist, but their level will not be as high (peak value) as in those trained by the standard program (see Figure 5).

Figure 5. Results of the student satisfaction survey



From all of this, it can be seen that, in teacher and student opinions, there is a possibility to obtain sufficient competencies (teacher evaluation: 42%), but these skills will not be enough to reach the peak level of their professional training and become a high-level specialist. Based on the results obtained, a number of common and distinctive features of the three studied regions' educational transitions were found. Among the main unifying trends should be highlighted: low students' mastering of the material, not homogeneous student readiness for full distance learning, and adaptability of the medical education system to offline admission (see Table 7).

Table 7. Comparing the specifics of implementing distance education for medical students in Russia, India, and Great Britain

Russia	India	Great Britain
The low level of resource provision.	Technical resources are sufficient, but students are characterized by a low degree of readiness for change	Widespread access to online educational programs
Perceiving transformation as something dangerous rather than perspective.	The impact of a number of external factors (the state of the medical complex in a particular region of India, for example) on student satisfaction with distance learning	Students see the online learning format as an opportunity
Neutral impact on student motivation (not found).	Neutral influence on students' motivation (not found)	Increased motivation to study
With the advent of distance learning, students become more flexible with their choice of profession	No dependence was found	Students have become freer in their choice of major to study

DISCUSSION

The difference between distance learning and traditional education is the use of web resources and training programs. The use of Zoom, Google Meet, and other platforms for online learning has become widespread. The scholars admit that medical students should be taught clinical specialties using real-life medical histories and patient examinations. Moodle is one of the online learning platforms used to provide access to training modules, test knowledge, examine real examples and medical cases, and explore medical information in tables. This platform allows educators to control student academic achievements and the quality of the acquired skills and provide feedback on student work (Zimina et al., 2019).

The living standards and technologies available to students and teachers influence e-learning in medical education. For a country like India with a low GDP, technology plays an important role in online learning (Danilenko et al., 2020; Gaffarov, 2021; Patil & Chaudhari, 2016). The research made in India involved 1068 students aged 21–23 years. Most of the students were medical doctors working in public medical establishments. For online activities, interviewees used mobile phones. The research found that 52% of students were unhappy with the learning outcomes. The sample involved medical nurses and doctors. The students admitted having positive experiences with a teacher (78%). More than half of the respondents (54%) were dissatisfied with communication with peers (Dutta et al., 2021).

The research conducted in the UK explored the change in clinical practice teaching. The Imperial College London gained access to the online database of educational information for students. It contains interviews and surveys of patient cases (Mian & Khan, 2020). The scholars admitted that teaching challenges, poor interaction between students, inability to work as a team, and a lack of time and skills were among the main problems that affected online learning (Longhurst et al., 2020). Many medical universities organized education for their teaching staff in the National Health Service. They learned new methods and activities aimed at improving their teaching practices and ensured effective reorganization of the educational process (Mian & Khan, 2020).

As soon as the COVID-19 pandemic began and the transition to distance learning was launched, the UK scholars examined the new approaches to learning under the quarantine restrictions. Data were collected from 14 universities. A thematic analysis approach was used to compare the findings. Among the universities that took part in the research, 10 universities were in England, one was in Wales and Northern Ireland, and two universities were in Dublin, Ireland (Longhurst et al., 2020). The collected data were analyzed by the scholars in order to identify the strengths, weaknesses, opportunities, and threats of moving to the online learning environment. The key issues were the development of new online resources, changes in methodology, and academic collaboration (Ahmed et al., 2020).

Many scholars admitted that the pandemic restrictions had a great influence on the resources used by the universities. Medical universities tried to reduce the negative impact of pandemic restrictions on learning by introducing interactive methods. The exchange of information and technologies between universities is one of the solutions which helps educators to teach online (Longhurst et al., 2020). The UK scholars investigated the impact of COVID-19 restrictions on online learning. The sample involved 40 medical universities and 2,792 respondents. The methodology ensured that the research was unbiased. The findings revealed that medical universities had to improve the quality of online learning (General Medical Council, 2019). Many universities organized teaching training sessions for clinical staff in the National Health Service. They took teaching training courses aimed at improving their teaching practices, introducing new methods of education, and restructuring the educational process (Mian & Khan, 2020).

On the other hand, American scientists point out that there are more opportunities offered by distance education to future physicians than there are threats. Thus, the use of digital educational technologies requires an understanding not only of the platforms themselves and their features but also of their inherent limitations. In a time of uncertainty and heightened clinical demands of this or that case, the approach to medical education must be thought through with attention to the health of

both an educator and a student. In doing so, a student can navigate much more quickly through the arrays of Internet databases when a somewhat non-standard case study, for example, is considered (Hilburg et al., 2020).

The research revealed the disadvantages of distance learning for medical students. Some of them are communication difficulties, poor interaction between teachers and students, lack of resources to conduct the practical examination, and no access to real patient cases. Therefore, students admitted that they had not used a microscope and other devices in medical examinations. Online learning prevented communication with patients and made impossible the analysis of real patient histories. Nevertheless, the scholars highlighted that hands-on experience and visual learning played a very important role in clinical practice (Lyulenova et al., 2021).

The research investigated student attitudes toward online education and its effectiveness compared to traditional classrooms. Most students preferred traditional full-time education (Prashanth & Ismail, 2018). Assessing the quality of distance learning, the research found that traditional classroom was more effective for 50% of the respondents (Miles & Leinster, 2007). The research was based on the comparison of face-to-face education and distance learning (Patil & Chaudhari, 2016).

Some articles assessed the quality of teacher training, rated 3.6 out of 5 points. The findings underlined that the score was high, taking into account the challenges and drawbacks of online education in medical universities. Moreover, the quality of distance education was influenced by poor Internet connection, annoying and distracting factors during online training, and a lack of time spent on online training. Experienced and technically competent teachers, good textbooks, and interactive training sessions, including games and simulations, were the main elements of effective online learning (Tang et al., 2018).

The risk of pandemic instability affected many countries around the globe and forced many medical universities to take measures and introduce new effective practices for clinical skills development. Distance learning technologies replaced classical lectures and practical training sessions. The effectiveness of online learning can be achieved in different ways, such as through problem identification and the implementation of innovative teaching methods (Holmes, 2020). Solving the problems during the transition period will help to improve teaching practices and develop an effective framework for the post-pandemic world (Ahmed et al., 2020). The research found that some teaching methods helped to motivate students and inspired their interest in learning. The best practices help educators to improve the level of knowledge acquired by students and develop effective clinical skills. The recommended methods include blended learning and quizzes to increase the interest of students and reduce negative attitudes toward online learning (Baig et al., 2020; Shaffer & Small, 2004; Watson, 2008).

The research found that blended learning was an effective teaching method for medical students. Teachers work with a small group of students and provide them with interactive, hands-on materials and web lectures. This method is very effective because it builds on interactive models and practical assignments (Ahmed et al., 2020). Educators create and share valuable content to increase student engagement. Innovative teaching methods and techniques are used to develop distance learning and motivate students to learn online. Online simulations and virtual classrooms are effective tools for the online environment. The scholars admit that such tools can be effectively used by educators in the post-pandemic period when students will return to the traditional classroom (Trelease, 2016). It is important to note that the transition to a new form of education has had advantages for students and teachers. The main one is the development of computer literacy and technical skills, the digitalization of education, the introduction of new resources, and the integration of new teaching methods to improve knowledge sharing (O'Doherty et al., 2018). As a result, a comparison of the characteristics of switching to online learning at universities in the UK, Russia, and India was carried out (see Figure 6). It can be traced that Russia and India are characterized by very similar problems that arose during the transition. To a greater extent, it had to do with technical difficulties (lack of necessary technology and problems with Internet connection) and the lack of special teaching methods.

Figure 6. Comparing the features of switching to distance learning in Great Britain, Russia, and India

British Universities	Russian universities	Indian Universities
• Difficulties of communication between students and instructors; • Development of new courses, technologies and teaching methods; • Lack of opportunity to work in groups, social adaptation; • Lack of special devices and technology.	• Lack of appropriate training materials and techniques; • Problems with Internet access for some students and faculty; • Lack of necessary technology in some universities;	• Difficulties of the Internet connection, interfering factors, lack of time; • Decreased motivation of students, inability to distribute their time; • Difficulties with the use of interactive materials; • Problems with the use of computer technology.

CONCLUSIONS

The results of the survey and additional research showed that technical issues were the most significant factor affecting the quality of online learning and the process of transition to distance learning. Numerous digital learning tools have either been underutilized or not used effectively. The significant fact was that the teachers had no practical experience in using such tools. They were highlighted as the main factor by both students and teachers. The quality of the lesson plans from a technical and academic point of view was graded 4.5 points (lectures) and 5.2 points (practical exercises). The second most important problem is the online learning process. Most of the students and teachers were not ready for this form of class: the applied methods and practical training showed low efficiency. The acquisition of knowledge was estimated at 5 points, the effectiveness of teaching methods at 6.5 points (on an 8-point scale); effectiveness of communication practices: 6.9 points; and practical lessons: 7.3 points.

The data on problems in communication between students and teachers indicated in the questionnaire were not confirmed by the research of the supervisory committee. The most important problem is the relatively low quality of communication between students (6 and 6.4 points in lectures and in practice, respectively). It is clear from the results of the study that the skills of clinical surgery should be acquired only in the operating room in practical interaction with patients. The ability of distance learning to meet professional needs was studied. The results showed that the basic needs for information and knowledge are well met, but more in-depth professional training requires other ways of learning.

There is confirmation of the opinion of researchers that the period of adaptation to online learning takes about six months, which excludes the effectiveness of a quick or one-step transition to any fully distance-learning format in the medical field. Online teaching methods need to be designed in advance, educators and students must be trained in the use of online teaching tools, and effective and proven online medical teaching methods that have already been validated in other countries must be implemented. Future researchers should study in detail the effectiveness of distance learning in the context of educating future health professionals and how it might affect their future competencies.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

FUNDING AGENCY

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

REFERENCES

Adnan, M., & Anwar, K. (2020). Online learning amid the COVID-19 pandemic: Students' perspectives. *Journal of Pedagogical Sociology and Psychology*, *2*(1), 45–51. doi:10.33902/JPSP.2020261309

Adorni, G., Alzetta, C., Koceva, F., Passalacqua, S., & Torre, I. (2019). Towards the identification of propaedeutic relations in textbooks. In *International Conference on Artificial Intelligence in Education* (pp. 1–13). Springer. doi:10.1007/978-3-030-23204-7_1

Agranovich, N. V., Khojayan, A. B., Sokhach, A. Y., & Shchetinin, E. V. (2012). Distance learning as a modern form of training for medical personnel. *Medical Bulletin of the North Caucasus*, *26*(2), 90–92.

Ahmed, H., Allaf, M., & Elghazaly, H. (2020). COVID-19 and medical education. *The Lancet. Infectious Diseases*, *20*(7), 777–778. doi:10.1016/S1473-3099(20)30226-7 PMID:32213335

Al-Balas, M., Al-Balas, H. I., Jaber, H. M., Obeidat, K., Al-Balas, H., Aborajooh, E. A., Al-Taher, P., & Al-Balas, B. (2020). Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: Current situation, challenges, and perspectives. *BMC Medical Education*, *20*(1), 341. doi:10.1186/s12909-020-02257-4 PMID:33008392

Baig, M., Gazzaz, Z. J., & Farouq, M. (2020). Blended learning: The impact of blackboard formative assessment on the final marks and students' perception of its effectiveness. *Pakistan Journal of Medical Sciences*, *36*(3), 327–332. doi:10.12669/pjms.36.3.1925 PMID:32292428

Biodigital. (2021). *Official website*. https://human.biodigital.com/results/modules

Centers for Disease Control and Prevention. (2020). *CDC confirms person-to-person spread of new coronavirus in the United States*. https://www.cdc.gov/media/releases/2020/p0130-coronavirus-spread.html

Chen, T., Peng, L., Yin, X., Rong, J., Yang, J., & Cong, G. (2020). Analysis of user satisfaction with online education platforms in China during the COVID-19 pandemic. *Health Care*, *8*(3), 200. doi:10.3390/healthcare8030200 PMID:32645911

Danilenko, D. M., Komissarov, A. B., Stukova, M. A., & Lioznov, M. A. (2020). To be or not to be: Forecast of the development of the COVID-19 epidemic in Russia. *Journal of Infectology*, *12*(3), 6–11. doi:10.22625/2072-6732-2020-12-3-6-11

Daroedono, E., Siagian, F. E., Alfarabi, M., Cing, J. M., Arodes, E. S., Sirait, R. H., Suryowati, T., Sunarti, L. S., Ahmad, L. N., Wiyanto, M., Kurniaty, L., & Hutabarat, R. S. O. (2020). The impact of COVID-19 on medical education: Our students perception on the practice of long distance learning. *International Journal of Community Medicine and Public Health*, *7*(7), 2790–2796. doi:10.18203/2394-6040.ijcmph20202545

Dremova, N. B., & Konoplya, A. I. (2012). *Active teaching methods in the educational process of the university*. KSMU.

Dutta, S., Ambwani, S., Lal, H., Ram, K., Mishra, G., Kumar, T., & Varthya, S. B. (2021). The satisfaction level of undergraduate medical and nursing students regarding distant preclinical and clinical teaching amidst COVID-19 across India. *Advances in Medical Education and Practice*, *12*, 113–122. doi:10.2147/AMEP.S290142 PMID:33564272

Fedchyshyn, N. O., Yelahina, N. I., & Permyakova, O. H. (2020). Distance learning of future doctors in foreign language: Challenges of time. *Medical Education: Scientific and Practical Journal*, *2*, 32–39.

Gaffarov, X. X. (2021). Implementation of therapeutic disciplines and clinical practice under the conditions of the new coronavirus epidemic infections. *Science Progress*, *2*(3), 941–943.

General Medical Council. (2019). *The state of medical education and practice in the UK*. https://www.gmc-uk.org/-/media/documents/the-state-of-medical-education-and-practicein-the-uk---workforce-report_pdf-80449007.pdf

Gewin, V. (2020). Five tips for moving teaching online as COVID-19 takes hold. *Nature*, *580*(7802), 295–296. doi:10.1038/d41586-020-00896-7 PMID:32210377

Halpin, H. (2020). *Human-to-human transmission of coronavirus outside China is worrying, says WHO*. https://www.thejournal.ie/irish-advice-travelling-coronavirus-china-4984300-Jan2020/

Hilburg, R., Patel, N., Ambruso, S., Biewald, M. A., & Farouk, S. S. (2020). Medical education during the coronavirus disease-2019 pandemic: Learning from a distance. *Advances in Chronic Kidney Disease*, *27*(5), 412–417. doi:10.1053/j.ackd.2020.05.017 PMID:33308507

Holmes, F. (2020). *COVID-19 timeline*. British Foreign Policy Group. https://bfpg.co.uk/2020/04/covid-19-timeline/

Hudaiberdiev, S. A., Tillyashaihova, M. A., & Samigova, G. A. (2020). Distance education as innovational technology. *Herald Science and Education*, *23*(101), 59–63.

Kasyanenko, E. F., Rubtsova, L. N., Dimov, I. D., & Bogomolova, V. Y. (2019). Distance and mobile education in medical universities: Problems and prospects. *Modern Problems of Science and Education*, *5*(5 2019), 39. doi:10.17513/spno.29216

Kolesova, O. V. (2020). Distance education: Attempt of phylosophical reflection. *Contemporary Research and Social Problems*, *12*(2), 350–362.

Koreneva, M. V., Leonteva, N. S., Leonteva, L. S., Kuznetsova, V. E., & Bushin, I. A. (2020). Distance learning in the field of Olympic education during the COVID-19 pandemic. *Uchenye zapiski universiteta im. P.F. Lesgafta*, *8*(186), 160–165.

Kuznetsov, A. G., & Nikitina, E. Y. (2020). Transformation of education: Traditional education or distance education? *The Information Society*, *3*, 34–39.

Levanov, V. A., Kamaev, I. A., Tsybusov, S. N., & Nikonov, A. Y. (2016). *Formation of electronic information and educational environment of continuous medical education*. Nizhny Novgorod State Medical Academy.

Longhurst, G. J., Stone, D. M., Dulohery, K., Scully, D., Campbell, T., & Smith, C. F. (2020). Strength, weakness, opportunity, threat (SWOT) analysis of the adaptations to anatomical education in the United Kingdom and Republic of Ireland in response to the COVID-19 pandemic. *Anatomical Sciences Education*, *13*(3), 301–311. doi:10.1002/ase.1967 PMID:32306550

Lyulenova, V. V., Samko, G. N., & Vasilchuk, A. V. (2021). Distance learning during the COVID-19 pandemic at the medical faculty. In *Contemporary Challenges for Medical Education and Their Solutions* (pp. 39–44). KSMU.

Machado Júnior, A. J., & Pauna, H. F. (2020). Distance learning and telemedicine in the area of Otorhinolaryngology: Lessons in times of pandemic. *Revista Brasileira de Otorrinolaringologia (English Ed.)*, *86*(3), 271–272. doi:10.1016/j.bjorl.2020.03.003 PMID:32295739

Maksimenko, E. V., Khripunova, A. A., & Maksimenko, L. L. (2019). The use of innovative pedagogical technologies in the university. In I. A. Wallet (Ed.), *International scientific and practical conference Medical education in the XXI century: New challenges and new opportunities under total* (pp. 82–84). Publishing house of StGMU.

Marinoni, G., van't Land, H., & Jensen, T. (2020). *The impact of COVID-19 on higher education around the world: IAU global survey report*. https://www.iau-aiu.net/IMG/pdf/iau_covid19_and_he_survey_report_final_may_2020.pdf

Mian, A., & Khan, S. (2020). Medical education during pandemics: A UK perspective. *BMC Medicine*, *18*(1), 100. doi:10.1186/s12916-020-01577-y PMID:32268900

Miles, S., & Leinster, S. J. (2007). Medical students' perceptions of their educational environment: Expected versus actual perceptions. *Medical Education*, *41*(3), 265–272. doi:10.1111/j.1365-2929.2007.02686.x PMID:17316211

Murzaliev, M. A. (2021). *Prerequisites and conditions for the development of integration processes in the field of higher education in Kyrgyzstan*. Jalal-Abad State University.

O'Doherty, D., Dromey, M., Lougheed, J., Hannigan, A., Last, J., & McGrath, D. (2018). Barriers and solutions to online learning in medical education: An integrative review. *BMC Medical Education*, *18*(1), 130. doi:10.1186/s12909-018-1240-0 PMID:29880045

Osipova, L. B., & Goreva, O. M. (2014). Distance learning at the university: Models and technologies. *Modern Problems of Science and Education*, *5*, 723.

Patil, A. A., & Chaudhari, V. L. (2016). Students' perception of the educational environment in medical college: A study based on DREEM questionnaire. *Korean Journal of Medical Education*, *28*(3), 281–288. doi:10.3946/kjme.2016.32 PMID:27363503

Potomkova, J., Mihal, V., & Cihalik, C. (2006). Web-based instruction and its impact on the learning activity of medical students: A review. *Biomedical Papers of the Medical Faculty of the University Palacky, Olomouc, Czechoslovakia*, *150*(2), 357–361. doi:10.5507/bp.2006.055 PMID:17426806

Prashanth, G. P., & Ismail, S. K. (2018). The Dundee ready education environment measure: A prospective comparative study of undergraduate medical students' and interns' perceptions in Oman. *Sultan Qaboos University Medical Journal*, *18*(2), 173–181. doi:10.18295/squmj.2018.18.02.009 PMID:30210847

Redmond, C. E., Healy, G. M., Fleming, H., McCann, J. W., Moran, D. E., & Heffernan, E. J. (2020). The integration of active learning teaching strategies into a radiology rotation for medical students improves radiological interpretation skills and attitudes toward radiology. *Current Problems in Diagnostic Radiology*, *49*(6), 386–391. doi:10.1067/j.cpradiol.2019.07.007 PMID:31375296

Sarvestani, M. S., Mohammadi, M., Afshin, J., & Raeisy, J. (2019). Students' experiences of e-learning challenges: A phenomenological study. *Interdisciplinary Journal of Virtual Learning in Medical Sciences*, *10*(3), 1–10. doi:10.30476/IJVLMS.2019.45841

Serditova, N. E., & Belotserkovsky, A. V. (2020). Education, quality and digital transformation. *Higher Education in Russia*, *4*(4), 9–15. doi:10.31992/0869-3617-2020-29-4-9-15

Shaffer, K., & Small, J. E. (2004). Blended learning in medical education: Use of an integrated approach with web-based small group modules and didactic instruction for teaching radiologic anatomy. *Academic Radiology*, *11*(9), 1059–1070. doi:10.1016/j.acra.2004.05.018 PMID:15350588

Shearer, R. L., Aldemir, T., Hitchcock, J., Resig, J., Driver, J., & Kohler, M. (2020). What students want: A vision of a future online learning experience grounded in distance education theory. *American Journal of Distance Education*, *34*(1), 36–52. doi:10.1080/08923647.2019.1706019

Soldatova, G. U. (2018). Digital socialization in the cultural-historical paradigm: A changing child in a changing world. *Social Psychology and Society*, *9*(3), 71–80. doi:10.17759/sps.2018090308

Sundarasen, S., Chinna, K., Kamaludin, K., Nurunnabi, M., Baloch, G. M., Khoshaim, H. B., Hossain, S. F. A., & Sukayt, A. (2020). Psychological impact of COVID-19 and lockdown among university students in Malaysia: Implications and policy recommendations. *International Journal of Environmental Research and Public Health*, *17*(17), 6206. doi:10.3390/ijerph17176206 PMID:32867024

Taha, M. H., Abdalla, M. E., Wadi, M., & Khalafalla, H. (2020). Curriculum delivery in Medical Education during an emergency: A guide based on the responses to the COVID-19 pandemic. *MedEdPublish*, *9*, 1–12. doi:10.15694/mep.2020.000069.1

Tandon, R. (2020). COVID-19 and mental health: Preserving humanity, maintaining sanity, and promoting health. *Asian Journal of Psychiatry*, *51*, 102256. doi:10.1016/j.ajp.2020.102256 PMID:32586624

Tang, B., Coret, A., Qureshi, A., Barron, H., Ayala, A. P., & Law, M. (2018). Online lectures in undergraduate medical education: Scoping review. *JMIR Medical Education*, *4*(1), e9091. doi:10.2196/mededu.9091 PMID:29636322

Trelease, R. B. (2016). From chalkboard, slides, and paper to e-learning: How computing technologies have transformed anatomical sciences education. *Anatomical Sciences Education*, *9*(6), 583–602. doi:10.1002/ase.1620 PMID:27163170

Usacheva, O. V., & Chernyakov, M. K. (2020). Assessment of university willingness to the transition to digital educational environment. *Higher Education in Russia*, *29*(5), 53–62. doi:10.31992/0869-3617-2020-29-5-53-62

Venkatesh, S., Rao, Y. K., Nagaraja, H., Woolley, T., Alele, F. O., & Malau-Aduli, B. S. (2020). Factors influencing medical students' experiences and satisfaction with blended integrated e-learning. *Medical Principles and Practice*, *29*(4), 396–402. doi:10.1159/000505210 PMID:31801145

Verbitsky, A. A. (2010). Contextual competence approach to modernization of education. *Higher Education in Russia*, *5*, 32–37.

Vladzimirsky, A. V., & Andreev, A. I. (2018). Educational aspects of telemedicine. *Journal of Telemedicine and E-Health*, *1–2*(6–7), 43–54.

Wang, C., Cheng, Z., Yue, X.-G., & McAleer, M. (2020). Risk management of COVID-19 by universities in China. *Journal of Risk and Financial Management*, *13*(2), 36. doi:10.3390/jrfm13020036

Watson, J. (2008). *Blended learning: The convergence of online and face-to-face education*. North American Council for Online Learning.

Zimina, V. A., Zhilenkova, Y. I., Stuf, I. Y., Kozlov, A. V., Syasina, T. V., Bolshakova, G. D., Malakhova, M. Y., & Kachanova, E. V. (2019). Problems of using distance learning at a medical university (platform "Moodle"). *International Research Journal*, *12*(2), 93–95.

Vladimir Beketov is a Ph.D., M.D., assistant professor of the Department of Internal, Occupational Medicine and Rheumatology, Clinical Medicine Institute, Tareev Clinic, I.M. Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russian Federation. His research interests include online learning in medical education, COVID-19 impact on the educational process organization.

Irina Menshikova is a MD, PhD, professor at the Department of Hospital Therapy No 1 of I.M. Sechenov First Moscow State Medical University (Sechenov University) in Moscow, Russian Federation. Her research interests include online learning in medical education, COVID-19 impact on the educational process organization.

Anastasiya Khudarova is an assistant of the Department of Polyclinic Therapy, I.M. Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russian Federation. Her research interests include online learning in medical education, COVID-19 impact on the educational process organization.

APPENDIX 1

Questionnaire

1. Were you ready for online learning? (closed-ended question)
2. Did you have any organizational problems? (closed-ended question)
3. Do the results meet your expectations? (closed-ended question)
4. Would you like to continue learning online? (closed-ended question)
5. Were there any technical problems? (closed-ended question)
6. Do you consider this mode of training effective? (closed-ended question)
7. What factors influenced the quality of education the most?
8. How can you assess the university's resources used for online teaching
9. What were the key questions when you started learning remotely?
10. What was the most difficult in the transition to distance learning?
11. What communication problems have been experienced?
12. What has changed in teaching modes?