



**Teacher education**

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**The Role of Distance Learning in Shaping Modern Medical Education**

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***Abstract.** The aim of the study is to analyse the impact of distance learning on the development of medical education, identify the main advantages and disadvantages of this learning format, and identify the main problems arising during its implementation. In particular, attention is focused on the adaptation of educational processes to new digital technologies and the challenges facing teachers and students at medical universities. The main areas of research are the assessment of the effectiveness of distance learning for theoretical training and the integration of practical skills into this format. **The research methods are based** on an analysis of recent scientific publications on the use of distance learning in medical education, as well as on our own observations of the integration of such technologies into the educational process at medical universities. Methods of comparative analysis, systematisation and synthesis of data on the effectiveness of distance learning technologies were used, as well as qualitative research, including surveys of students and teachers. **Results.** The introduction of distance learning in medical universities has revealed both positive and negative consequences. The main advantages include: convenient access to educational materials, the ability to study at any time, and an increase in student independence. However, the biggest challenges are the difficulty in transferring practical skills, limited interaction between students and teachers, and the problem of student motivation in the absence of personal contact. The use of virtual simulators and simulation platforms helps to partially solve the problem of practical training, but cannot completely replace physical presence in clinical classes.*



**Conclusions.** Distance learning in medical universities is an important tool for theoretical training, but the development of clinical skills requires blended learning that combines online resources with traditional forms of training. For the successful implementation of distance learning, it is important to ensure adequate technical infrastructure, access to high-speed internet, and ongoing training for teachers to work with new platforms. Taking into account the specifics of medical disciplines and the needs of students is key to the further development of this model of education.

**Keywords:** distance learning, medical education, virtual simulators, blended learning, pedagogical technologies, online platforms.

### **Роль дистанційного навчання у формуванні сучасної медичної освіти**

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***Анотація.** Мета* дослідження полягає в аналізі впливу дистанційного навчання на розвиток медичної освіти, визначенні основних переваг і недоліків цього формату навчання та виявленні основних проблем, що виникають при його впровадженні. Зокрема, акцентовано увагу на адаптації навчальних процесів до нових цифрових технологій та викликах, які стоять перед викладачами і студентами медичних університетів. Оцінка ефективності використання дистанційного навчання для теоретичної підготовки та інтеграція практичних навичок у цей формат становлять основні напрямки дослідження. **Методи дослідження** базуються на аналізі останніх наукових публікацій з питань використання дистанційного навчання в медичній освіті, а також на власних спостереженнях за інтеграцією таких технологій у навчальний процес медичних університетів. Використовувались методи порівняльного аналізу, систематизації і синтезу даних щодо ефективності застосування дистанційних технологій, а також якісні дослідження, що включають опитування студентів і викладачів. **Результати.** Впровадження дистанційного навчання в медичних університетах виявило як позитивні, так і негативні



наслідки. До основних переваг належать: зручність доступу до навчальних матеріалів, можливість навчання в будь-який час, а також підвищення рівня самостійності студентів. Проте найбільшими викликами є важкість у передачі практичних навичок, обмежена взаємодія між студентами і викладачами, а також проблема мотивації студентів у відсутності особистого контакту. Використання віртуальних симуляторів і платформ для симуляцій допомагає частково вирішити проблему практичного навчання, але не здатне повністю замінити фізичну присутність на клінічних заняттях. **Висновки.** Дистанційне навчання в медичних університетах є важливим інструментом для теоретичної підготовки, однак для розвитку клінічних навичок необхідне комбіноване навчання, яке поєднує онлайн ресурси з традиційними формами навчання. Для успішної реалізації дистанційного навчання важливо забезпечити належну технічну інфраструктуру, доступ до високошвидкісного інтернету та постійну підготовку викладачів до роботи з новими платформами. Врахування специфіки медичних дисциплін та потреб студентів є ключовим для подальшого розвитку цієї моделі освіти.

**Ключові слова:** дистанційне навчання, медична освіта, віртуальні симулятори, комбіноване навчання, педагогічні технології, онлайн платформи.

**Problem statement.** In today's ever-changing world, distance learning has become an important element of educational systems in various countries, especially in medical universities, where traditional teaching methods often require significant changes to meet modern requirements and challenges [1, 2]. In the context of globalisation and digitalisation of education, as well as due to unforeseen circumstances such as the COVID-19 pandemic, distance learning has become particularly important. In medical universities, where most of the learning process usually takes place through direct communication with patients, clinical classes and practical skills, this process has its own specific difficulties [3, 4]. Despite these



challenges, distance learning technologies are becoming an important part of medical education, opening up new opportunities to enrich the learning process, expand access to education and improve its quality [5].

Important to study in detail the application of distance learning technologies in medical universities, as this topic is directly related to the training of future medical professionals who are able to work effectively in the context of global changes in the healthcare system [6, 7]. It is essential to note that medical education includes specific components, both theoretical and practical, which are difficult to transfer to a distance learning format [8]. On the one hand, medical disciplines require in-depth knowledge of anatomy, physiology, and pharmacology; on the other hand, students must acquire practical skills for working with patients, which requires direct contact with clinical practice. The use of modern technologies, such as virtual simulators, online lectures, and interactive learning platforms, opens up opportunities for effective learning but also poses new challenges for medical universities [9, 10].

One of the key aspects of this problem is that not all academic disciplines can be effectively transferred to the online space. In particular, medical universities focus on practical skills and training with real patients, where the emotional and psychological components of doctor-patient interaction are important at every stage [11, 12]. In such cases, distance learning technologies are only a supplement to traditional teaching methods and cannot completely replace practical classes. However, it is the use of the latest technologies in the educational process that makes it possible to significantly improve the quality of education and make it more accessible to students, even in remote regions [13].

The adaptation of students and teachers to new forms of learning is another important issue. Given the rapid development of distance learning technologies, not all participants in the educational process are able to adapt to these changes. In particular, teachers may encounter difficulties in using new platforms, mastering new distance learning methods, and creating interactive, interesting courses for students. Students,



in turn, may face motivation problems, especially when the learning process requires more independent work and organisation [14, 15, 16]. One more thing to think about is not just how well distance learning works, but also how to make sure students and teachers can chat. Distance learning often misses out on that important face-to-face interaction, which helps build deeper knowledge and skills, especially in medical subjects. During online learning, the ability to quickly adjust the learning process is reduced, and difficulties arise in assessing students' practical skills [17, 18, 19, 20].

It is important to note that although distance learning technologies in medical universities open up new opportunities, their application requires high technological equipment, technical training and support from organisations that provide the educational process. Without a clear and effective infrastructure, even the best online platform will not be able to realise the full potential of distance learning. Therefore, the issue of technical support, access to high-speed internet and information security is an important factor for the implementation of distance learning. In general, distance learning in medical universities poses new challenges for educational institutions, requiring a careful approach to the development of curricula, adaptation of teaching materials and continuous improvement of teaching methods. A medical education system focused on innovative technologies must take into account the specifics of the profession, the needs of students, and the capabilities of modern digital technologies.

### **Analysis of recent research and publications**

In the last few years, distance and blended learning in medical education has been seen as a necessary measure and then as an institutionally established model for organising the educational process [21, 22]. Studies show that online formats have ensured the continuity of teaching theoretical disciplines and some practice-oriented activities (in particular, clinical case analysis, communication training, formative assessment), but at the same time raised questions about the quality of clinical skills development, academic integrity, and the validity of competency assessment in a digital environment [23, 24, 25].



The article by Rita Mustika et al. (2021) analyses the relationship between the online learning environment and the well-being of medical students during the COVID-19 pandemic, using the example of students at the Faculty of Medicine, Universitas Indonesia [26]. Cross-sectional survey using the Online Learning Environment Scale (OLES) to assess the quality of distance learning and the PERMA Profiler to measure psychological well-being (positive emotions, engagement, relationships, meaning, achievement). The results showed that students generally perceived online learning positively and had a relatively high level of well-being, although at the same time they reported moderate negative emotions, including loneliness and anxiety. Almost all components of the online environment were statistically related to well-being, with personal relevance of learning and the assessment and feedback system emerging as the most important predictors. Differences were also found depending on gender and year of study: senior students showed lower levels of satisfaction with online learning and well-being. A well-designed distance learning environment can support the well-being of medical students, but it requires targeted pedagogical and organisational solutions to reduce negative psychological effects.

The scientific work of Qingming Wu et al. (2022) is a review study of the use of virtual simulation (VS) in the training of medical students [27]. They analysed 92 recent publications on the use of VS in undergraduate medical education to describe trends and approaches to using this technology. VS, including the use of virtual reality (VR), has become an important tool in medical student education, helping them to practise medical procedures and acquire skills in a safe and controlled environment. The use of VR for training is growing every year, with most studies focusing on surgical training, emergency and paediatric medicine, and basic medical sciences. Guided by Kirkpatrick's performance evaluation model, many studies have demonstrated the effectiveness of VS in improving students' knowledge and skills.



Oqba Alkuran et al. (2023) investigates the impact of distance e-learning (DEL) on medical education during the COVID-19 pandemic in Jordan [28]. During lockdown, all medical institutions in the country switched to DEL. Senior students participated in the study and evaluated their learning experience during this period. The study found that DEL is an important tool in modern medical education, but it should be used as a supplementary method rather than a replacement for traditional learning. For the successful integration of DEL into medical education, additional work is needed to familiarise students with digital tools and to implement DEL as a supplement to clinical training.

Gross S. et al. (2025) examined whether blended learning (face-to-face + online module) is more effective than traditional face-to-face lectures in improving communication skills in medical students [29]. Researchers at the University of Basel conducted a randomised controlled trial among second-year students: after the same face-to-face lecture on medical communication, the students were divided into two groups. The intervention group additionally completed an interactive online video module (animated explanations, interactive 'doctor-patient' video scenarios, gamification elements, and mandatory full video viewing) and then took a knowledge assessment; the control group only took the knowledge assessment without the educational videos. Blended learning resulted in significantly higher knowledge (an average of 73.6 versus 56.7 points; a difference of about +17 points,  $p < 0.001$ ) and higher satisfaction with the electronic part of the course (4.3 versus 3.5,  $p < 0.001$ ). Also, in their responses to the scenarios, students from the intervention group more often used patient-centred communication techniques (in particular, WEMS and NURSE) and less often gave 'closed' answers that reduce the space for patient expression. Adding a well-designed interactive online video module to face-to-face learning significantly improves the acquisition and application of communication techniques and increases student satisfaction; this approach may better prepare students for



patient-centred care, although further research is needed to optimise the design and evaluate the impact in real-world practice.

A study by N. M. Sydorova et al. (2025), conducted among teachers of medical higher education institutions in Ukraine during the war, revealed important aspects of distance learning [30]. Teachers at civilian and military educational institutions had similar views on online formats, but there were differences in the military segment due to restrictions on access to online resources and a lower propensity for purely distance learning. Most respondents pointed to the effectiveness of short online courses (master classes, seminars) and expressed a need for courses on cybersecurity, particularly for military teachers, where this aspect was rated significantly higher than in the civilian sector. In addition, most respondents pointed to the importance of developing teachers' technical skills and using more reliable platforms for online classes. Recommendations include improving technical infrastructure, clearly defining organisational rules, and implementing effective tools to ensure cybersecurity in wartime.

### **Isolation of previously unresolved parts of the general problem.**

Despite the achievements in integrating distance learning into medical universities, some aspects remain unresolved. One of them is the problem of effectively combining theoretical and practical training, as medical skills require practical experience, which is difficult to transfer to an online format. Another important issue is the adaptation of teachers to new technologies and platforms, which often limits the effectiveness of learning. Student motivation is also a problem, as distance learning reduces the level of interaction with teachers and classmates. In addition, unequal access to high-speed internet in different regions creates additional barriers for students. These issues require further research and the development of new approaches to combining theory and practice, improving teacher training and ensuring equal access to technology.

**Formulation of the objectives of the article (statement of the task).** The aim of this article is to analyse modern distance learning technologies in medical



universities, identify their advantages and disadvantages, and highlight the main challenges facing medical education in the context of digitalisation. The research aims to assess the effectiveness of implementing distance learning technologies for the theoretical training of students and to identify opportunities for integrating practical skills into this learning format. Particular attention will be paid to the adaptation of teachers to new platforms and methods, as well as the impact of distance learning on student motivation and effectiveness. An important aspect is the study of access to technologies, in particular high-speed internet, for students from different regions. The results of the study are important for improving medical education, contributing to the development of new approaches to distance learning and improving the process of training medical personnel in the context of modern challenges.

### **Presentation of the main material of the study.**

The analysis of the current state of medical education indicates a fundamental paradigm shift: distance learning (DL) is transforming from a temporary anti-crisis measure into a systemic component of the professional training of doctors. The implementation of DL technologies in medical universities is not merely a translation of traditional lectures into a digital format, but a complex pedagogical reconstruction that requires a revision of the interaction between the teacher and the student. Our research suggests that the effectiveness of this format depends heavily on the type of academic discipline and the specific technology used.

The digitisation of the educational process has proven highly effective in the context of theoretical training. For preclinical disciplines such as medical history, medical biology or social hygiene, the use of learning management systems (LMS) such as Moodle, Blackboard or Canvas allows large amounts of information to be structured, providing asynchronous access to materials. This approach promotes the development of self-regulated learning skills, which are critical to a doctor's lifelong professional development. In addition, the integration of multimedia content - video lectures, interactive atlases, and 3D visualisations of anatomical structures -



significantly improves the perception of static material compared to traditional textbooks. This allows students to visualise complex physiological processes and anatomical topography with a level of detail that is difficult to achieve in a conventional classroom setting [31].

The transition to clinical disciplines reveals the main contradiction of distance medical education: the gap between theoretical competence and practical skill. To address this, modern medical universities are increasingly integrating simulation technologies and virtual reality (VR/AR). Virtual simulators and "Virtual Patient" platforms play a crucial role here. These technologies allow students to practice clinical reasoning, history taking, and decision-making in a risk-free environment. For instance, branching scenarios in virtual cases allow a student to see the consequences of their diagnostic decisions without harming a real patient. Nevertheless, our analysis confirms that while virtual simulation is effective for cognitive and some psychomotor skills, it cannot fully replace bedside teaching. The tactile aspects of palpation, the nuances of auscultation, and the emotional complexity of real-time empathy require physical presence. Therefore, the most justified pedagogical model is "blended learning," where DL covers the theoretical basis and cognitive simulations, while face-to-face time is exclusively dedicated to hands-on practice and patient interaction [32, 33, 34].

The rapid digitalisation of education has drastically altered the role of teachers, shifting the traditional focus from knowledge transmission to fostering interactive learning environments. Teachers now face the challenge of managing digital platforms while also adapting to new pedagogical tools. The rise of online and hybrid models of learning has made it necessary for educators to master new technological tools, often adding to their already overwhelming workload. The constant need to update and refine technical skills has led to what is known as 'digital fatigue,' where educators feel exhausted by the continuous cycle of adapting to new technologies without sufficient institutional support or training. This leaves them ill-equipped to fully utilise the



potential of digital platforms, thereby reducing the effectiveness of the learning process [35].

Furthermore, the pedagogical burden is shifting significantly. In traditional classroom settings, teachers primarily focus on the transfer of knowledge. However, in digital spaces, their role has transformed into one of moderation and facilitation. This shift requires teachers to provide personalised feedback, guide discussions, and adapt to diverse student needs in a virtual environment. Without the right training or institutional support, teachers may struggle to engage students effectively, leading to a decline in the quality of distance education. The success of online learning, therefore, heavily depends on the design of the curriculum and the teacher's ability to manage the virtual classroom, using tools that foster engagement rather than simply present information passively [36, 37].

Student motivation is closely tied to the structure of the educational process in a digital format. A passive learning experience - such as watching long video lectures or reading lengthy texts without interaction - leads to disengagement and a rapid decline in interest. On the other hand, interactive learning formats that incorporate elements of gamification, live discussions, and collaborative projects can stimulate curiosity and maintain cognitive engagement. Moreover, real-time formative assessments, such as quizzes or peer evaluations, enable teachers to monitor students' progress continuously and provide immediate feedback, which is crucial in maintaining motivation and promoting active learning.

Despite these advances, the digital divide remains a significant challenge. Access to high-speed internet and powerful computing devices is not equal across regions, especially in rural or underdeveloped areas, as well as in regions affected by conflicts or war. This inequality creates a major barrier for students who do not have access to the necessary technology to engage fully with digital learning platforms. For instance, students in war zones or economically disadvantaged areas may struggle to attend online classes due to unreliable internet connections or a lack of access to



devices. As a result, these students are left behind, unable to benefit from the opportunities that advanced digital tools, such as VR simulations or cloud-based applications, offer for enhancing the learning experience [38, 39, 40].

The digital divide, therefore, does not only affect students' ability to engage with content but also exacerbates existing disparities in educational quality. As resource-intensive applications become more commonplace in educational settings, institutions must address these inequalities to ensure that all students, regardless of their location or socio-economic status, can access the same high-quality education. Thus, the future of education hinges not only on technological innovation but also on creating more inclusive and equitable systems that bridge the gap between those with access to advanced digital tools and those without.

An essential component of distance learning infrastructure in medical universities is the use of synchronous communication platforms, among which Zoom, Microsoft Teams, and Google Meet occupy leading positions [42, 43]. These tools have evolved from simple video conferencing services to comprehensive educational environments that allow for real-time direct contact between teachers and students. Their functionality, in particular screen sharing and interactive whiteboards, is indispensable for analysing visual clinical data such as X-rays, ECGs or histological slides, allowing the teacher to focus the audience's attention on specific pathological changes. The 'discussion room' feature available in these systems enables problem-based learning (PBL) and small group work, which is standard in medical education, allowing students to collectively solve clinical case studies before presenting them to the general audience. These platforms serve as an important bridge that compensates for the lack of physical presence, ensuring the continuity of the pedagogical process during lectures, practical seminars, and oral exams. Ultimately, the effective combination of these synchronous tools with asynchronous LMS and simulation technologies creates a hybrid ecosystem that, despite existing challenges, remains the most viable model for modern medical education.



**Conclusions.** Distance learning has evolved from a temporary measure into a strategic component of medical education. While digital tools are highly effective for theoretical training and fostering self-regulated learning, the development of clinical skills requires a blended learning model where online resources supplement, rather than replace, face-to-face practice. A significant shift in the teacher's role towards facilitation was identified, highlighting the need for continuous professional development to prevent digital fatigue. Additionally, technical infrastructure and the digital divide remain critical barriers that must be addressed to ensure equitable access to education.

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