



## ORIGINAL ARTICLE

# Blended form of education as an innovative approach in the training of medical students: The experience of Ukraine



Natalia M. Kalyniuk\*, Valentyn V. Franchuk, Petro R. Selskyy, Nadiia V. Humenna, Olena I. Hladii

I. Horbachevsky Ternopil National Medical University, Ternopil, Ukraine

Received 31 January 2024; accepted 23 July 2024

## KEYWORDS

Blended form of education;  
Program results of education;  
Higher medical education;  
Interdisciplinary integration;  
Quality of education

## Abstract

**Introduction:** The complex socio-economic challenges faced by the state of Ukraine during the last 2 years and the introduction of martial law in the country made it impossible for students to study, which was accepted in peacetime, and led to new requirements for the organization of students' educational activities in a blended (auditory-distance) manner.

**Materials and methods:** To achieve the goal, a set of methods was applied: theoretical analysis, comparison, justification, generalization, systematization of theoretical and practical material, study of the main international and national legal acts in the context of the relationship between the Bologna Process and the guaranteed right of an individual to education, formation, and systematization of conclusions. Five databases were searched (January 1, 2000–January 1, 2023) for systematic reviews of blended versus no blended learning approaches for healthcare education. The study was designed as a two-armed, prospective, single-blind, randomized trial. The subjects who met the inclusion criteria have the experience of obtaining higher medical education in 3 forms of education: traditional, distance, blended. A convenience sampling method was used. Data were collected at the start and end of the semesters. Data were analyzed using descriptive and inferential statistics.

**Results:** In medical education, "inverted learning" is actively used: lectures are online, and practical classes are offline. In the absence of the possibility of conducting offline classes, it is advisable to conduct the practical part of educational programs in academic subjects in synchronous and asynchronous modes of online classes.

**Conclusion:** The introduction of a blended form of education in institutions of higher medical education requires the dynamic development of new means and mechanisms for organizing the educational process. This requires all kinds of resources, both intellectual and technological, both from the medical education institution and from the direct participants in the educational

\* Corresponding author at: Department of Higher Education Pedagogy and Social Sciences, I. Horbachevsky Ternopil National Medical University, c. Ternopil, st. Vyshnevetskoho No 9, ap.95, Ternopil 46004, Ukraine.

E-mail address: [kalunyknm@tdmu.edu.ua](mailto:kalunyknm@tdmu.edu.ua) (N.M. Kalyniuk).

## PALABRAS CLAVE

Forma de educación semipresencial; Resultados del programa educativo; Educación médica superior; Integración interdisciplinaria; Calidad de la educación

process – the teacher and the student. It is a multifaceted work related to the search for the optimal balance between traditions, rich historical experience, and innovation and is combined in a blended form of education.

© 2024 The Authors. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## La educación semipresencial Como enfoque innovador en la formación de estudiantes de medicina: la experiencia de Ucrania

### Resumen

**Introducción:** Los complejos desafíos socioeconómicos que enfrentó el Estado de Ucrania durante los últimos dos años y la introducción de la ley marcial en el país imposibilitaron a los estudiantes estudiar, lo que fue aceptado en tiempos de paz, y dieron lugar a nuevos requisitos para la organización de los estudiantes. 'actividades educativas de forma semipresencial (auditiva-distancia).

**Materiales y métodos:** Para lograr el objetivo se aplicó un conjunto de métodos: análisis teórico, comparación, justificación, generalización, sistematización del material teórico y práctico, estudio de los principales actos jurídicos internacionales y nacionales en el contexto de la relación entre el Proceso de Bolonia y la garantía. Derecho de un individuo a la educación, formación y sistematización de conclusiones. Se realizaron búsquedas en cinco bases de datos (desde el 1 de enero de 2000 hasta el 1 de enero de 2023) en busca de revisiones sistemáticas de enfoques de aprendizaje mixto versus no mixto para la educación sanitaria. El estudio se diseñó como un ensayo aleatorizado, prospectivo, simple ciego, de dos brazos. Los sujetos que cumplían los criterios de inclusión tenían la experiencia de haber obtenido educación médica superior en tres formas de educación: tradicional, a distancia, semipresencial. Se utilizó un método de muestreo por conveniencia. Los datos se recogieron al inicio y al final de los semestres. Los datos se analizaron mediante estadística descriptiva e inferencial.

**Resultados:** En la educación médica, se utiliza activamente el «aprendizaje invertido»: las conferencias se realizan en línea y las clases prácticas, fuera de línea. En ausencia de la posibilidad de realizar clases fuera de línea, es recomendable realizar la parte práctica de los programas educativos sobre materias académicas en modo sincrónico y asincrónico. de clases en línea.

**Conclusiones:** La introducción de una forma mixta de educación en las instituciones de educación médica superior requiere el desarrollo dinámico de nuevos medios y mecanismos para organizar el proceso educativo. Esto requiere todo tipo de recursos, tanto intelectuales como tecnológicos, tanto de la institución de educación médica como de los participantes directos en el proceso educativo: el docente y el alumno. Es un trabajo multifacético relacionado con la búsqueda del equilibrio óptimo entre tradiciones, rica experiencia histórica e innovación y se combina en una forma mixta de educación.

© 2024 The Authors. Publicado por Elsevier España, S.L.U. Este es un artículo Open Access bajo la licencia CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Given that the right to education is enshrined in both international and national legal frameworks, it should be regarded as a specific type or measure of individual activity aimed at personal development through the acquisition of knowledge, skills, competencies, experiences, attitudes, beliefs, and abilities. This process combines individual learning processes for future medical specialists with training, including scientific guidance and counseling, within higher education medical institutions, ultimately shaping their professional identities. The Bologna Declaration unequivocally emphasizes the primacy of realizing the human right to education. It emphasizes the creation of a European

space for higher education as a key means to foster citizen mobility, employment, and the overall development of the continent.<sup>1</sup> Ukraine's development is intrinsically linked to European integration, guided by core values of global culture. The relevance of investigating the tools and mechanisms for applying blended learning in training future medical specialists arises from the imperative to introduce innovative ideas into educational practice.

Blended learning has become an indispensable method of acquiring education in the context of martial law in Ukraine. It has facilitated the theoretical component of the educational process and broadened the use of digital and online technologies for students in medical educational institutions. Numerous works by both domestic and foreign

scientists are dedicated to exploring various aspects, forms, and methods of distance education, as well as the integration of online tools and platforms into the educational landscape. Recent scientific investigations have been directed towards examining the impact of military conflicts and socio-economic upheavals on the formation, functioning, and development of national medical education systems. Researchers have delved into understanding the scale of support, obstacles, and targeted interventions within professional medical education during times of military operations, confrontational situations, and other extreme circumstances.<sup>2</sup> Additionally, there is a growing emphasis on the development and application of conflict medicine (providing medical aid in acute situations and zones of military operations) and its implications for the evolution of medical science and education within the context of these mentioned factors.<sup>3</sup>

Innovative approaches to the development of medical education systems, with a heightened focus on practical training (as seen in the USA, Canada, and EU countries), selection criteria for applicants, the duration and structure of educational programs, and methods of teaching medical disciplines in a distance format, are being analyzed.<sup>4</sup> There is a particular emphasis on individual research, interpretation, and the application of information in practice by small groups of students.<sup>5</sup>

The problem of training higher education students in the form of blended learning has been studied in various aspects by scholars from different countries.<sup>6,7</sup> Researchers have concluded that existing approaches often do not align with the demands of education in the current stage due to the significant influence of factors such as stress, time constraints, and sources of distraction.<sup>8</sup> Other scholars are analyzing the current competencies of medical professionals in the field of digital healthcare. They emphasize the need for flexibility, motivation, and ethical assessment of students, particularly considering the accessibility of the Internet and digital tools.<sup>9</sup>

Scholars who have researched blended learning as an innovative approach to teaching students have come to the following conclusions: (1) blended learning led to significant improvements in motivation, mood, and satisfaction compared to traditional learning<sup>10</sup>; (2) blended learning can be better than traditional learning approaches in improving knowledge retention<sup>11</sup>; (3) blended and e-learning are valuable modalities to provide flexibility and deliver learning units based on the latest evidence<sup>12</sup>; (4) the blended learning instructional methods, in comparison with traditional lectures, enhanced the students' knowledge, problem-solving ability, and learning satisfaction in the public healthcare course<sup>13</sup>; (5) blended learning may indeed increase the level of education and stimulate effective learning for postgraduate healthcare professionals<sup>14</sup>; (6) using a blended learning model with multiple educational modalities resulted in significant improvement in learners' performance<sup>15</sup>; (7) this study shows that using a blended education approach in evidence-based medicine courses can improve students' learning motivation, autonomy, and satisfaction<sup>16</sup>; (8) blended learning may be an effective teaching strategy<sup>17</sup> and etc. At the same time, there are

scholars who outline the problems of blended learning, for example: instructional design challenges, technological literacy and competency challenges,<sup>18</sup> self-regulation challenges, alienation and isolation challenges, and belief challenges<sup>19</sup>; implied a work overload, worsened social relationships.<sup>20</sup>

The purpose of the article is to identify specific features and ways to modernize the educational process in institutions of higher medical education during the training of future specialists in the medical field with the aim of achieving programmatic learning outcomes; to show the application of various methods and techniques of organizing the educational process in combination with unique, including digital, platforms in the study of subjects of the social and humanitarian cycle to improve the quality control of education for students of higher education in a mixed regime under martial law.

## Methods

To achieve the goal, a set of methods was applied: theoretical analysis, comparison, justification, generalization, systematization of theoretical and practical material, study of the main international and national legal acts in the context of the relationship between the Bologna process, and the guaranteed right of a person to education in the process of obtaining higher medical education, formation and systematization of conclusions.

Five databases were searched (January 1, 2000–January 1, 2023) for systematic reviews of blended versus no blended learning approaches for healthcare education. The study was designed as a two-armed, prospective, single-blind, randomized trial. The subjects who met the inclusion criteria have the experience of obtaining higher medical education in 3 forms of education: traditional, distance, blended. A convenience sampling method was used. Data were collected at the start and end of the semesters. Data were analyzed using descriptive and inferential statistics.

## Results

The difficult conditions of wartime have made their adjustments. In addition to the formation of critical thinking, adaptability, and creativity, persuasion and time management come to the fore.<sup>21</sup> In turn, the use of critical thinking and interactive methods, project technologies and mental maps are designed to develop systemic thinking as well. Educational communication "teacher–student" reaches a new level, which involves constant involvement in joint activities during the lesson. Encouraging the exchange of ideas, on the basis of existing knowledge, their creative application in new situations proposed by the teacher takes place.

However, it is worth noting that distance learning alone is not the most suitable method for teaching students in medical institutions of higher education. To combine theory with practice, algorithms for performing certain skills are compiled, which can also be in digital format. Therefore, the educational systems of many countries today emphasize

the importance of blended learning, cloud-based e-learning, mobile learning, and the use of artificial intelligence, virtual reality, and augmented reality technologies. The development of the latter began to receive great attention in Ukraine. More common blended learning thanks to digital technologies makes it possible to combine traditional learning with elements of electronic (e-learning), distance (online-learning), and mobile (m-learning) learning, and it was this that became the basis for the emergence of one of the forms of electronic learning "inverted learning" (f-learning).<sup>22</sup>

In medical education, "inverted learning" is actively used: lectures are online, and practical classes are offline. Carrying out the experimental part of the practical work offline in modern laboratories equipped with all the necessary equipment contributes to creative self-realization and the acquisition of practical skills, which are most needed in the wartime period. In the absence of the possibility of conducting offline classes, it is advisable to conduct the practical part of training programs in academic subjects in synchronous and asynchronous modes of online classes. When presenting lecture material, the teacher can fully use the academic freedom that gives him the opportunity to change the order of studying the topics of the corresponding course: combine certain topics, shortening their content, and instead focus on basic knowledge and skills. At the same time, it is important for the teacher to form an interest in innovative activities, which leads to a gradual rejection of knowledge in the style of *pret-a-porter*, that is, "ready-made" knowledge, by involving students in the generation of ideas by various means, gaining the experience of participating in brainstorming, scientific hackathons. By the way, it was at one of the hackathons that the technology of 3D printing of prostheses was invented, which is now actively used in the world.<sup>23</sup>

In parallel with this, the creative approach of the teacher in the performance of professional duties creates opportunities for his personal and professional development. In particular, independently and creatively acquire information, carry out anticipatory planning of online or offline classes, organization of training in both synchronous and asynchronous modes, development of assessment materials, etc. A modern teacher has information about popular sites, channels, devices, and blogs. For didactic provision of classes, you can use online boards Padlet, Linoit, sites for creating dynamic Power Point presentations, Prezi.Next, Canva, services for submitting educational videos – YouTube, Windows Live Movie Maker, for knowledge assessment – Google Forms, Online Nest Pad, [LearningApps.org](https://www.learningapps.org/), WordWall, etc. In any case, the main thing is flexibility in organizing classes in new real conditions.<sup>24</sup>

Considering the combination of offline and online learning, the future of professional, including medical, education looks significant. On the one hand, this provides the educational system with sufficient flexibility to respond to any interruptions or force majeure circumstances, and on the other hand, this combination provides the necessary opportunities for students to receive a coherent education in combination with technological skills. Researchers, when examining the prospects of distance education, identify 3 main aspects: (1) learning regardless of geographical location; (2) regulation of learning rates; (3) definition of

an individual curriculum. They believe that distance learning will become an integral part of education in the future, and its mechanisms will improve, which will affect the spread and development of distance education in Ukraine in general.<sup>25</sup>

Blended learning technology is an educational approach that combines distance learning, face-to-face learning, and online learning through the use of computers, mobile devices, specially developed educational programs, resources, and platforms anytime, anywhere. This approach provides control over when, where, how quickly, and how students of higher education learn the educational material. Blended learning allows for the use of both traditional methods and modern information and communication technologies. For Ukrainian higher education institutions today, the mixed model of education, which combines the technologies of the distance learning system with traditional systems, is most suitable. Practice shows that the introduction of blended learning in higher education has presented the educational community with the problem of organizing quality education of professionals in the conditions of a combination of different forms of learning. One of the ways to solve this problem is to determine the structure, content, and methods of remote work of higher education students, so that they can study effectively in accordance with the planned results of the educational program.

The modern model of blended learning consists of a system that includes the strategy of a higher education institution for the development of e-learning, the organization of educational processes using information and communication technologies with the support of special education services, and the interaction of teachers and students of higher education with the methods and content of e-learning. Regarding the organization of the educational process in the conditions of the digital transformation of education, it is advisable to single out such models of blended learning that can be implemented in the information and educational environment of higher education institutions, such as the Face-to-Face Model, Rotation Model, Flex Model, Online Lab, Self-Blend Model, Online Driver Model.<sup>26,27</sup>

Blended learning can be a fundamental component of the educational process carried out in the classroom, complementing the work of the teacher, as well as providing an opportunity for students of higher education to acquire knowledge independently. In the educational process carried out by teachers of higher education institutions, it is possible to highlight many options for the implementation of blended learning. The demands of curriculum development with blended learning technologies require teachers to be able to make good use of online technologies and acquire new skills, namely digital literacy.

It is also appropriate to determine the 4 most important key competencies that teachers should have in the course of implementing the tasks of blended learning in institutions of higher education of a medical profile according to the current recommendations on the implementation of blended learning in institutions of professional pre-higher and higher education: (1) technological integration – the ability to effectively combine online and offline teaching; (2) use of data – the ability to monitor the progress of higher education students using digital tools to monitor educational

activities and learning outcomes of higher education students; (3) personalization – the creation of an educational environment that allows students of higher education to realize their goals, pace, or ability to create learning methods; (4) online interaction – the ability to build effective online interaction with students of higher education and students of higher education among themselves.<sup>28</sup>

Today, the blended education system, which effectively integrates distance education and traditional education with the use of educational digital tools, serves as a theoretical basis for reforming higher education, improving quality, taking into account world experience. In the mixed educational process, the educational, cognitive, and research opportunities of higher education students are expanded, there is an interactive interaction between teachers and higher education students. To some extent, it stimulates the formation and development of key competencies, technical systems, necessary for solving various professional tasks. Blended learning allows higher education students to study independently at any time, at a convenient pace and in a convenient location.

The implementation of blended learning as a technology that organizes the curriculum has many positive benefits for medical education. The basis of effective medical education should be the construction of an educational environment using modern digital technologies. Today, many institutions of higher education in the medical direction are implementing some elements of blended learning (learning in small groups using the capabilities of digital applications and virtual environments, transfer of theoretical video materials to the digital space, practical skills using pedagogical technologies in the educational process).

By introducing the blended learning model into the curricula of medical institutions of higher education and developing the information and communication competencies of both teachers and students of higher medical education, the latter can develop the following competencies: (1) application of information and communication technologies in professional education and everyday life; (2) operational orientation in the professional and non-professional information space; (3) obtaining and using various and specialized information in accordance with one's own professional and personal needs; (4) intelligent use of a computer and computer tools when solving various cultural and professional tasks; (5) creation of information models of special and general theoretical content and their review with the help of digital technologies.<sup>29</sup>

Blended learning fundamentally does not deny, moreover, does not reject traditional learning, but organically complements and updates its curriculum. A blended learning approach can have a significant impact on the acquisition and retention of higher education students. Research shows that blended learning reduces dropout rates, improves learning, and increases engagement.

Blended learning combines the benefits of classroom and online learning, allowing higher education students to learn at their own pace. When studying in a heterogeneous group, it is practically impossible to apply an individualized approach to the education of students of higher education. Blended learning models can help incorporate principles of individualization, taking into account timing, learning

methods, and personal preferences, but implementing a blended learning model requires major changes.<sup>30</sup>

## Discussion

In order to improve the educational process in conditions of blended at the I. Horbachevskyy Ternopil National Medical University using the Moodle platform. For the convenience of students, the Moodle platform contains all the necessary educational materials for each of the topics of one or another academic discipline. Moreover, they are presented in various formats: file, web page, video, active link to an Internet resource, etc., test tasks are developed for each topic, and a video accompanying the lecture is additionally recorded for the lecture classes and an active link is provided. The above provides the possibility of free access to studying educational materials at a time convenient for the student of higher medical education.

This ensures the effectiveness of the educational process in the conditions of mixed learning, in which students of higher medical education independently perform online activities in order to prepare for the next face-to-face class based on previously acquired knowledge. The above gives reason to assert that the quality training of future medical specialists in the conditions of blended learning is a significant, coordinated combination of distance and face-to-face teaching and learning, which uses the advantages of both approaches.

As part of the research, it became necessary to make a comparison between traditional, distance and blended learning. It is impossible to train future specialists in higher medical education in the traditional form of education in Ukraine due to the conditions of martial law since the beginning of 2022. To this end, we conducted a survey of 260 sixth-year students of the I. Horbachevskyy Ternopil National Medical University who participated in the experiment and had the opportunity to study in three forms of education: I. Traditional learning (01.09.2018–23.02.2022); II. Distance learning (24.02.2022–30.06.2022); III. Blended learning (15.08.2022–31.12.2023). Therefore, the results of their survey were divided into 3 parts, depending on their practical experience in different forms of education.

The research consisted of answering the following 2 questions: What is the most effective form of learning (traditional, blended or distance)? Which of the chosen forms is the most acceptable for students and which one would they choose? This part of our research was to analyze the responses of medical students to each of these forms of education and to determine their possible future choice of one of them.

Students at each stage of their education had equal access to the opportunity to obtain quality higher medical education. The main difference at different stages of acquiring knowledge, skills, and abilities is the form of education. The research procedure was to investigate the effectiveness of all forms of education in the process of training future healthcare professionals in higher education institutions as accurately as possible.

In December 2023, students were surveyed. This was done to determine the most effective form of education and



**Table 1** Results of the survey of students on the 1st stage of their studies (traditional form of education).

Question No		Excellent	Good	Satisfactory	Unsatisfactory
Q 1		140	60	30	0
Q 3		180	50	20	10
Q 4	Lecturer and student	200	50	10	0
	Student and student	200	50	10	0
Q 5		240	10	10	0
Q 6		180	10	50	20
Q 7		190	40	20	10

the need to get feedback from medical students on the effectiveness and satisfaction with a particular form of education. Possible answers, except for Question 2, were: excellent, good, satisfactory, unsatisfactory.

The questions for the survey were as follows: 1 (Q1). How do you assess the educational process? 2 (Q2). Could you briefly describe the pros and cons of the respective form of education; 3 (Q3). Assess the quality of the content of academic disciplines; 4 (Q4). Assess the level of meaningful communication during the course of study: between the teacher and the student and among students; 5 (Q5). Rate the feedback you received from the teacher after completing a particular course; 6 (Q6). Assess the content of the courses and the assessment methods used during your studies; 7 (Q7). Assess the level of support provided during the course (technical and from the teacher). The systematic results of the survey are presented in Tables 1–3.

Question 2 was descriptive and aimed to get students' feedback on the learning process. A summary of the most frequent answers to question 2 is shown in Table 4. The answers are divided according to the form of education, i.e., traditional, distance, or blended.

Since the traditional form of study is the most common in most universities around the world, we decided to conduct a study on the hypothetical choice of the most optimal form of study for 6th-year students, regardless of the influence of external factors. The following questions were asked of the students to get this answer: (1) What form of education would you choose? (2) Justify your choice.

The results were as follows: Traditional learning – 82, Distance learning – 27, and Blended learning – 151 students.

Question 2 was a descriptive question, so here is a summary of the answers most often given by students who chose blended learning: a new form of learning; a convenient way of learning; an interesting way of learning; and a variety of learning materials.

Students who chose blended learning, which was the majority, emphasized the importance of interaction between the teacher and students; blended learning motivates them better because the results of their learning are visible during the lessons with the teacher.

In the course of this research, in order to compare the academic results obtained by students in traditional and blended learning. We analyzed information from the statistics obtained from the report of the Rector of I. Horbachevsky Ternopil National Medical University for 2021 (traditional learning) and 2023 (blended learning).<sup>31</sup> The results of the 6th year students of medical faculty passing the Licensing Integrated Exam are taken as a basis. In 2022, the Licensing Integrated Exam was not held in the distance learning mode due to the introduction of martial law in Ukraine. The systematic results in percentage terms are shown in Table 5.

The percentage data shown in the comparative table indicate that the results of students' academic performance are actually at the same level in both traditional and blended learning approaches to training future doctors. Thus, according to the results of exams, the success rate of students who studied in a blended learning environment (2023) is 0.9% higher.

It is worth paying attention to the position of the teaching staff regarding the choice of the form of study. During the oral survey, the university lecturers did not express dissatisfaction with the traditional learning. They noted that the traditional learning requires less time to prepare teaching materials and develop a course. The most time-consuming for our medical university lecturers, who have practical experience of teaching in 3 different forms of education, is the blended learning mode. This issue requires further research.

In the blended form of education in institutions of higher medical education in today's conditions, its positive features

**Table 2** Results of the students' survey on the 2nd stage of their studies (distance learning).

Question No		Excellent	Good	Satisfactory	Unsatisfactory
Q 1		170	60	30	0
Q 3		200	40	5	15
Q 4	Lecturer and student	160	80	20	0
	Student and student	190	60	10	0
Q 5		220	0	30	10
Q 6		200	0	35	25
Q 7		220	40	0	0

**Table 3** Results of the students' survey on the 3rd stage of their studies (blended learning).

Question No		Excellent	Good	Satisfactory	Unsatisfactory
Q 1		240	20	0	0
Q 3		220	30	0	10
Q 4	Lecturer and student	250	10	0	0
	Student and student	250	10	0	0
Q 5		250	10	0	0
Q 6		240	20	0	0
Q 7		230	30	0	0

**Table 4** Advantages and disadvantages of the respective form of education.

Traditional learning		Distance learning		Blended learning	
Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
High-level training materials		High-level training materials	Lack of communication with the lecturer	High-level training materials	Little time to complete tests and assignments
Easy and comfortable learning experience		Easy and comfortable learning experience	Lack of oral and conversational tasks and exercises	Easy and comfortable learning experience	
	The classroom system takes a lot of time to move between departments and academic buildings	Free choice of place of study	Little time to complete tests and assignments	Free choice of place of study	
Communication between students, lecturers and students, and the university administration		Communication between students		Communication between students, lecturers and students,	
Extracurricular activities				Frequent repetition of explanations	
				Ability to work in groups	

should be singled out.<sup>15</sup> In particular, future medical professionals have at least some control over working using technologies for personalization and methodological instructions for practical training or their independent work. This provides an integrated learning experience, that is, remote and face-to-face instruction are essentially aligned. From practical experience, based on method-analysis, it is possible to form conclusions that blended learning in medical professions looks more effective, or at least as

effective, as the traditional form of learning to acquire knowledge. After all, blended learning combines traditional face-to-face and distance (online) learning and therefore can reduce the disadvantages of both formats. For example, the lack of personal contact with peers and teachers during e-learning is compensated by face-to-face classes, and the lack of time for independent work during face-to-face learning is compensated by the online environment. Moreover, the organization of the educational process in

**Table 5** Comparative table of academic results obtained by students in traditional and blended learning.

Specialty «Medicine»	Year of passing the integrated licensing exams			
	2021		2023	
	Number of 6th-year students	% of exams passed	Number of 6th-year students	% of exams passed
	451	97.8	373	98.7

institutions of higher medical education in the conditions of mixed learning allows to achieve programmatic learning outcomes by overcoming the gap between theory and practice and has the potential in higher medical education to improve the clinical skills of future specialists in the medical field, such as the skills of clinical reasoning, critical thinking, or documentation.

The introduction of blended form of education in institutions of higher medical education requires the dynamic development of new means and mechanisms for organizing the educational process. In particular, ensuring the high-quality achievement of program learning outcomes in the course of training future specialists in the medical field from theoretical disciplines requires all kinds of resources, both intellectual and technological, both from the side of the institution of higher medical education and from the direct participants in the educational process – the teacher and the student. This is a multifaceted work related to the search for an optimal balance between traditions, rich historical experience, and innovations and is combined in a mixed form of education. However, only in this case, a new look at higher medical education will have not only theoretical but also practical significance, and the program results of training can be compared with the goals.

The prospects for further research in the search for optimal combinations of forms, means and methods of learning, pedagogical technologies for the implementation of such models of blended learning that will fully provide a quality environment, returning Ukrainian youth who were forced to go abroad. And, this is a significant contribution both to national competitiveness in the information age and to partnership with the European Higher Education Area. It is for this purpose that the main emphasis is placed on the responsibility of educational institutions for student success, on the level of their provision of relevant services, programs, and strategies, on the motivated direction of the student to use the programs, methods, means, and opportunities offered by the educational institution.

## Contributions

The authors of this article acknowledge equal contributions to this article. All authors read and approved the final manuscript.

## Ethical aspects

Not necessary because since the research is aimed at conducting an analysis of the organization of the educational process.

## Financing

No financing.

## Informed consent

Not applicable.

## Declaration of competing interest

The authors declare that they have no conflict of interest.

## References

1. Kalyniuk N, Melnychuk I, Makhnitsky A, Dudikova L, Hrynkova R, Halimov A, Bloshchynsky I. El Proceso de Bolonia y garantías constitucionales del derecho personal a la educación. Dilemas Contemporáneos: Educación, Política y Valores. 2019;23. <https://doi.org/10.46377/dilemas.v3i11.1062>.
2. Allsop S, Hollifield M, Huppler L, Baumgardt D, Ryan D, Eker M, Spear M, Fuller C. Using videoconferencing to deliver anatomy teaching to medical students on clinical placements. *Translat Res Anat*. 2020;19. <https://doi.org/10.1016/j.tria.2019.100059>.
3. Dias SB, Diniz JA. Blended learning in higher education: different needs, different profiles. *Proc Comput Sci*. 2012;14: 438–46. <https://doi.org/10.1016/j.procs.2012.10.050>.
4. Tonbuloglu B, Tonbuloglu I. Trends and patterns in blended learning research (1965–2022). *Educ Inf Technol (Dordr)*. 2023 Apr 3:1–32. <https://doi.org/10.1007/s10639-023-11754-0> Epub ahead of print. PMID: 37361774; PMCID: PMC10068210.
5. Tahir I, Van Mierlo V, Radauskas V, Yeung W, Tracey A, Silva da R. Blended learning in a biology classroom: pre-pandemic insights for post-pandemic instructional strategies. *FEBS Open Bio*. 2022 Jul;12(7):1286–305. <https://doi.org/10.1002/2211-5463.13421> Epub 2022 May 23. PMID: 35488491; PMCID: PMC9249331.
6. Ashraf MA, Yang M, Zhang Y, Denden M, Tlili A, Liu J, Huang R, Burgos D. A systematic review of systematic reviews on blended learning: trends, gaps and future directions. *Psychol Res Behav Manag*. 2021 Oct 1;14:1525–41. <https://doi.org/10.2147/PRBM.5331741> PMID: 34629910; PMCID: PMC8493276.
7. Naciri A, Radid M, Kharbach A, Chems G. E-learning in health professions education during the COVID-19 pandemic: a systematic review. *J Educ Eval Health Prof*. 2021;18:27. <https://doi.org/10.3352/jeehp.2021.18.27> Epub 2021 Oct 29. PMID: 34710319; PMCID: PMC8609102.
8. Malik S. Merits and demerits of blended education: a review. *J Res Admin*. 2023;5(2):54–61. <https://journalra.org/index.php/jra/article/view/93>.
9. Bader S, Oleksiienko A, Mereniuk K. Digitalization of future education: analysis of risks on the way and selection of mechanisms to overcome barriers (Ukrainian experience). *Futurity Educ*. 2022;2(2):21–33. <https://doi.org/10.57125/FED/2022.10.11.26>.
10. Lozano-Lozano M, Fernández-Lao C, Cantarero-Villanueva I, Noguerol I, Álvarez-Salvago F, Cruz-Fernández M, Arroyo-Morales M, Galiano-Castillo N. A blended learning system to improve motivation, mood state, and satisfaction in undergraduate students: randomized controlled trial. *J Med Internet Res*. 2020 May 22;22(5), e17101. <https://doi.org/10.2196/17101> PMID: 32441655; PMCID: PMC7275253.
11. Lockey A, Bland A, Stephenson J, Bray J, Astin F. Blended learning in health care education: an overview and overarching meta-analysis of systematic reviews. *J Contin Educ Health Prof*. 2022 Oct 1;42(4):256–64. <https://doi.org/10.1097/CEH.0000000000000455> Epub 2022 Sep 5. PMID: 36070399.
12. Bobbink P, Teixeira CM, Charbonneau L, Chabal L, Guex C, Probst S. E-learning and blended-learning program in wound care for undergraduate nursing students. *J Nurs Educ*. 2022 Jan;61(1):53–7. <https://doi.org/10.3928/01484834-20211203-03> Epub 2022 Jan 1. PMID: 35025679.
13. Kang HY, Kim HR. Impact of blended learning on learning outcomes in the public healthcare education course: a review of flipped classroom with team-based learning. *BMC Med Educ*.



- 2021 Jan 28;21(1):78. <https://doi.org/10.1186/s12909-021-02508-y> PMID: 33509176; PMCID: PMC7845047.
14. Westerlaken M, Christiaans-Dingelhoff I, Filius RM, Vries de B, Bruijne de M, van Dam M. Blended learning for postgraduates; an interactive experience. *BMC Med Educ.* 2019 Jul 30;19(1):289. <https://doi.org/10.1186/s12909-019-1717-5> PMID: 31362735; PMCID: PMC6664728.
  15. Mann AW, Cunningham J, Tumolo A, King C. Evaluating a blended learning model for medical student ECG teaching. *South Med J.* 2023 Jan;116(1):57–61. <https://doi.org/10.14423/SMJ.0000000000001496> PMID: 36578120.
  16. Zhang Y, Liu J, Liang J, Lang J, Zhang L, Tang M, Chen X, Xie Y, Zhang J, Su L, Wang X. Online education isn't the best choice: evidence-based medical education in the post-epidemic era—a cross-sectional study. *BMC Med Educ.* 2023 Oct 10;23(1):744. <https://doi.org/10.1186/s12909-023-04746-8> PMID: 37817252; PMCID: PMC10563228.
  17. Du L, Zhao L, Xu T, Wang Y, Zu W, Huang X, Nie W, Wang L. Blended learning vs traditional teaching: the potential of a novel teaching strategy in nursing education - a systematic review and meta-analysis. *Nurse Educ Pract.* 2022 Aug;63, 103354. <https://doi.org/10.1016/j.nepr.2022.103354> Epub 2022 Apr 29. PMID: 35580368.
  18. H. Saturska, A. Shulhai, N. Markiv-Bukovska, N. Terenda, N. Panchyshyn, Y. Petrashyk. Ukrainian public health system's response to the challenges posed by the armed invasion of the Russian Federation in the territory of Ukraine // *Akkon Schriftenreihe Band 6. Global Health in the Network of International Research Collaborations. Akkon Hochschule für Humanwissenschaften / Institute for Research in International Assistance (IRIA).* May 2023. pp. 112–123.
  19. Wang C, Omar Dev RD, Soh KG, Mohd Nasiruddin NJ, Yuan Y, Ji X. Blended learning in physical education: a systematic review. *Front Public Health.* 2023 Mar;9(11), 1073423. <https://doi.org/10.3389/fpubh.2023.1073423> PMID: 36969628; PMCID: PMC10034186.
  20. López-Fernández I, Burgueño R, Gil-Espinosa FJ. High school physical education teachers' perceptions of blended learning one year after the onset of the COVID-19 pandemic. *Int J Environ Res Public Health.* 2021 Oct 24;18(21), 11146. <https://doi.org/10.3390/ijerph182111146> PMID: 34769673; PMCID: PMC8583385.
  21. Bilavych HV, Didukh IJa, Stynska VV, Prokopiv LM, Fedchyshyn NO, Savchuk BP, Ya Fedonyuk L. Development of inclusive education in Ukraine in the context of world trends. *Wiadomości lekarski.* 2022;4(1):891–9. <https://doi.org/10.36740/wlek202204125>.
  22. Bloshchynskyi I, Borakovskyy L, Prihodko G, Novikova T, Moroz N, Kalyniuk N. The comparative analysis of the English and German term-formation in the legislative documents (Based on the Schengen Border Code). *Int J Soc Cult Lang.* 2021;9(3):73–81.
  23. Garcia-Aretio Lorenzo. The blended learning revolution in distance education. *RIED Revista Iberoamericana de Educación a Distancia.* 2018;21. <https://doi.org/10.5944/ried.21.1>.
  24. Dietrich N, Kentheswaran K, Ahmadi A, Teychené J, Bessiére Y, Alfenore, Hébrard G. Attempts, successes, and failures of distance learning in the time of COVID-19. *J Chem Educ.* 2020;97(9):2448–57. <https://doi.org/10.1021/acs.jchemed.0c00717>.
  25. Maika N, Kalyniuk N, Sloma V, Sheremeta L, Kravchuk L, Stefanyshyn K, Kravchuk L. Basic of medical products Reimbursement: a Comparative-legal analysis to Ukraine: an update. *Biomed Pharmacol J.* 2021;14(2):761–9. <https://doi.org/10.13005/bpj/2180>.
  26. Dobiesz V, Schwid M, Dias R, Aiwonodagbon B, Tayeb B, Erickson T. Maintaining health professional education during war: a scoping review. *Med Educ.* 2022;56(8):793–804. <https://doi.org/10.1111/medu.14808>.
  27. Dudikova L, Melnychuk I, Hnatyk K, Fodor K, Didenko O, Luzan P. Research of ethical competence of future doctors at medical universities. *Postmodern Openings.* September. 2021;12(3): 311–35. <https://doi.org/10.18662/po/12.3>.
  28. Fares J, Fares M, Fares Y. Medical schools in times of war: Integrating conflict medicine in medical education. *Surg Neurol Int.* 2020;Jan 3(11):5. [https://doi.org/10.25259/SNI\\_538\\_2019](https://doi.org/10.25259/SNI_538_2019).
  29. Fedchyshyn N, Vykhreshch A, Bilavych H, Horpinich T, Yelahina N, Klishch H. Development of medical students' foreign language lexical competence in the virtual learning environment. *Annales de l'universite de craïova – annals of the university of Craiova. Lingvistic.* 2020;1(2):71–80.
  30. Franchuk VV, Myroshnychenko MS, Hnatjuk MS, Kalyniuk NM, Humenna NV, Narizhna FV, Franchuk UYa, Hladii OI, Franchuk MV. Implementation of the decision tree method in expert analysis of the medical errors in obstetric practice. *Pol Med J.* 2023;LI (2):128–34. <https://doi.org/10.36740/merkur202302104>.
  31. TNMU's annual report on the status of the national higher education institution for 2023. <https://www.tdmu.edu.ua/en/about/public-information/>.