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Bohdan Melnyk*

Postgraduate Student, Assistant

Bogomolets National Medical University

01601, 13 Taras Shevchenko Blvd., Kyiv, Ukraine

<https://orcid.org/0000-0003-2232-8181>

Research-innovation aspect of modern medical (dental) education in a mixed learning environment

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Abstract. The National concept for the development of higher education in Ukraine during the war is aimed at involving digital education in the educational process and promoting the development of virtual educational mobility. The relevance of the study is due to the unstable state of modern medical education in Ukraine, the need to use digital technologies and involve a mixed form of education in the generally accepted concept of conducting the educational process. The purpose of the study is to identify how teachers and students of the dental speciality of higher medical institutions of Ukraine implement the concept of mixed learning as of the beginning of 2023. The paper uses the following methods of research: descriptive, historical-typological, and terminological principles analysis, through which it was possible to implement the research-innovative aspect of modern dental education during the war on the territory of Ukraine. The study examines the historical features of the formation of a mixed form of education in the Ukrainian educational field. Key aspects of using the blended learning model in modern higher medical education in Ukraine are highlighted. The main online platforms used in mixed learning environment and relevant software for mixed learning are considered. A thorough analysis of the state of the modern educational process in Ukrainian universities, where future dental specialists receive education, was conducted, and the prospects for using a mixed form of education for dental students in medical educational institutions were examined. The results of the study can be used by researchers and teachers for further research on the subject raised, in particular, to identify and eliminate the shortcomings of various forms of training

Keywords: doctor's competencies; educational process; self-motivation; educational field; digital technologies

*Corresponding author

INTRODUCTION

The educational system of Ukraine at the beginning of 2023 is functioning despite the continuation of martial law in the country, which began on February 24, 2022 (Order of the Cabinet of Ministers of Ukraine No. 181-r..., 2022). Given the difficult conditions of the educational process, it is necessary to examine the mixed form of education that is relevant to modern Ukraine. The involvement of information and communication technologies in the educational process determines the problems of investigating the form of education of a new generation, combining conventional and interactive components.

In the modern world, blended learning has become widespread – an educational approach that combines conventional full-time classroom learning with technological online learning and is one of the main trends in the development of higher education (Antonivska & Sarnovska, 2021). The examination of the mixed form of education was conducted by Ukrainian researchers S.M. Kyselov *et al.* (2020), stating that full-time learning in combination with remote mode, which determines the use of modern interactive technologies has become an indispensable link in ensuring the success of the pedagogical process for



future medical specialists. Investigating the state of modern higher education in a mixed form of education for teachers of higher medical institutions will provide a thorough understanding of the relevance of this form of the educational process at the time of the war in Ukraine and in the future. In this regard, it is necessary to examine the state of mixed education in higher medical institutions in Ukraine at the beginning of 2023.

According to K.P. Osadcha *et al.* (2022), in Ukraine, the form of blended learning began to be actively used during the COVID-19 pandemic in 2020. During the COVID-19 pandemic, higher education institutions in Ukraine faced new challenges – a rapid transition from full-time inpatient training to distance learning, and rapid adaptation to new learning conditions. According to the results of the survey of students and teachers, the following problems were identified: insufficient technical security of universities and students, the appearance of psychological difficulties due to restrictions in live communication and a substantial increase in the volume of homework and educational material allocated for self-study (Berezna & Prokopenko, 2020).

Based on the responses of teachers and students, it was determined that the quality of distance education is not inferior to full-time education, and also contributes to the development of self-organisation and access to education, regardless of place of residence or social status. Teachers have a slightly updated role in the learning process, where they act as mentors-consultants, coordinate the learning process, improve the teaching of the discipline, increasing creativity and skills in accordance with new needs and learning conditions. The survey showed that the humanitarian, natural, technical, and mathematical faculties of Ukrainian universities quickly adapted to the situation. However, specialities that require considerable space, special conditions, and professional equipment (physical culture, choreography, musical art) have faced great difficulties (Berezna & Prokopenko, 2020).

A study by Y. Krylova-Grek and M.P. Shyshkina (2021) was aimed at investigating distance learning issues from the perspective of students during the COVID-19 pandemic in 2019-2020. The results indicate the need to coordinate the training load and ensure a balance of tasks. In addition, the psychological consequences of digitalisation of learning have to be considered, in particular, the lack of personal communication and socialisation. The study also determined that students need additional advice from teachers. It is important to create a unified learning environment in which the learning process is coordinated. Some problems can be solved through proper coordination and organisation of distance learning, developing modern advanced training courses considering new educational requirements, and including these courses in teacher training programmes. According to student reviews, blended learning is the most effective method and can serve as an alternative to the conventional system (Podoliak, 2022). Blended learning allows students to provide more theoretical material and focus on developing practical skills.

It is necessary to examine in more detail the new introductions to the mixed form of education since that time on the territory of Ukraine and investigate the issue of readiness and relevance for teachers of higher medical institutions of Ukraine to use the blended form of education in the conditions of war on the territory of the state. S. Hrastinski (2019) argues that the term “blended learning” refers to an education system that combines the conventional form with the experience of online learning. It is necessary to thoroughly investigate the use of a mixed form of education in Ukrainian institutions of higher medical education.

According to the researcher S.A. Herman (2021), considerable attention of representatives of modern higher medical education in Ukraine is paid to the introduction of electronic medical courses as part of a mixed training format since this is one of the indicators of improving the quality of educational processes. However, it is worth investigating in more detail the issue of a mixed form of higher education in Ukraine in the medical, and in particular, dental, speciality, since with the beginning of the war, a substantial part of educational institutions switched to a mixed form of the educational process.

L. Nazarenko (2020) claims that the application in practice of scientific and methodological foundations of a mixed form of education provides the student community with a qualitatively new level of educational process, which contributes to the deep assimilation of knowledge. According to the researcher, the expediency of integrating components of a mixed form of the educational process into the practice of educational institutions is confirmed by the fact that such a concept teaches participants in the educational programme about self-control and self-motivation. In this regard, it is necessary to thoroughly examine the impact of a mixed form of education on the success of mastering knowledge, skills, and abilities among dental students.

The investigation of the research-innovation aspect of modern medical education of future dentists in the context of mixed education in Ukraine is the basis for continuing research on this issue by researchers in the educational field of Ukraine. The purpose of this study is to determine the current state and effectiveness of using the blended learning model by higher medical educational institutions, focusing on the field of dentistry.

MATERIALS AND METHODS

The paper uses the following methods of investigating the research-innovation aspect of modern medical, in particular, dental, education in the conditions of mixed learning on the territory of Ukraine: descriptive method, historical-typological method, terminological principle of research, and methods of analysis, synthesis, abstraction, and generalisation. Using the method of description, the basic characteristics of mixed training of students of medical faculties of higher educational institutions, in particular, dental speciality, and the main provisions of the methodological foundations for the introduction of the above-mentioned form of training, which should be used by teachers

of educational medical institutions, were examined. Using the historical and typological method, the study investigated the conceptual system of mixed education during the COVID-19 pandemic and since the beginning of a full-scale war on the territory of Ukraine. The historical aspects of innovative medical education, namely dental education in Ukraine, were also examined using the historical-typological method. The terminological principle of the study contributed to the examination of the terminological base of the research-innovation aspect of modern medical education in higher educational institutions, and the establishment of a causal relationship between the terminological basis of research, on which this paper is based.

Using the method of analysis, scientific literature was examined to collect and thoroughly examine the theoretical base of Ukrainian and American researchers who were engaged in the investigation of the combination of online learning and conventional form of education in a mixed form. Synthesis, analysis and abstraction were the main methods for developing ways to develop mixed learning in Ukraine, and for identifying key aspects of using the mixed form of the educational process in the context of the war in Ukraine. The generalisation method is used to form the conclusions of the conducted research on the modern medical education of future dental specialists based on the material obtained in the process of scientific search.

A substantial part of the work on investigating the current state of modern dental education in a mixed form of training was the development of the database of scientific material devoted to the research subject. The study examined a substantial number of features of the software used in blended learning and presented and analysed online resources and platforms intended for educational processes that combine conventional and online learning.

RESULTS

Early forms of blended learning always contained a large number of disadvantages and educational limitations for students' education and their professional development. Notably, the vast majority of such training in the 20th century took place in the form of radio and television broadcasts due to the availability of equipment materials and the lack of additional material costs on the part of the student community. However, the lack of quick communication contact between the teacher and the receiver of educational services was the cause of inconvenience. However, in the 21st century, due to the rapid development of digital technologies and computer technology, the creation and use of multimedia formats for conducting educational activities have become available. As a result – convenient audio and video broadcasts, teleconferences, online training, involvement of the podcast segment and virtual reality (VR), augmented reality (AR), and mixed reality (MR) (Pregowska *et al.*, 2021). It was the COVID-19 pandemic that contributed to the introduction of modern forms of education for schoolchildren and students of higher educational institutions and was a substantial impetus for the use of online

learning first on the territory of Ukraine, and then a mixed form (blended learning) of educational services.

Mentioning the technologies of virtual, augmented and mixed reality, it is worth noting the great potential of these technologies for training future dentists. The use of virtual reality software is a new area in the development of specific training tools for medical education. Virtual reality can be used for scenarios of complex modelling and standardisation of the general field (an example of the latter is the use of virtual reality in exams of dental students). However, a substantial disadvantage of developing software of this type is the serious financial cost and the lack of direct evidence of a real improvement in the mixed-type educational process using VR (Fertleman *et al.*, 2018).

The effectiveness of using augmented reality software in medical education is still being evaluated. Augmented reality applications in the key of medical education, in particular, dental education, allow students of medical institutions to examine the content, context, and situational nuances during training of this nature. It is believed that the method of using augmented reality technologies in medical education is reliable and effective, and it is also able to reproduce authentic simulations and increases the level of memorisation of educational material and the productivity of the educational process in general (Barsom *et al.*, 2016).

The form of training that will include mixed reality is quite complex, but real. The essence of the use of mixed reality in medical education is the use of modern technologies and their combination with the concepts of mixed education, to display the corresponding programmes in applications on students' devices (computers, phones, other gadgets) (Nicola & Stoicu-Tivadar, 2018). Such a strategy of using digital progress to train dental workers is an effective and realistic way to improve the mixed form of education. The technology of blended learning involves the internationalisation of the educational transition from the conventional form to integrated, that is, mixed learning, namely, the inclusion of organisational educational mechanisms through which the creation and maintenance of a virtual academic environment take place (Zahoruiko & Krasulia, 2021). Mixed educational training of university students has a number of advantages, the main ones of which are given below (Fig. 1).

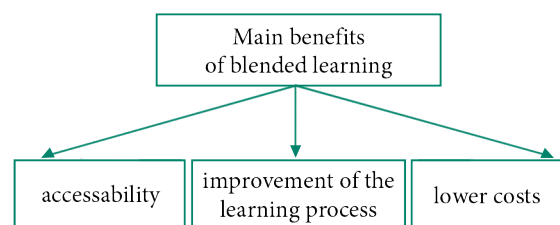


Figure 1. Benefits of blended learning

Source: J. Stein and C.R. Graham (2020)

Mixed technologies of modern training in institutions of higher medical education require free access to the internet, skills in working with digital technologies, and a high

level of self-organisation among both students and teachers. In accordance with the conditions of mixed learning, general

methods of improving the educational process can be used in educational institutions, which are given below (Table 1).

Table 1. The main methods of teaching educational material in a mixed form of education in institutions of higher medical, in particular, dental, education

No.	Training methods	Explanation of the method
1	Information-receptive	The teacher provides students with an understanding of the material presented in the learning process.
2	Reproductive	The teacher helps in mastering the presented material for the possibility of further reproduction and application by students, using hints or independently.
3	Problematic	The teacher suggests the problem and independently solves it in front of students, identifying the process and course of their thoughts.
4	Heuristic	Applicants for education, under the guidance of teachers, independently perform the solution of tasks, analysing, comparing, and drawing conclusions. As a result, students form conscious knowledge of a given subject.
5	Research	The teacher and students solve the problem that they jointly proposed. Students independently acquire knowledge and skills in the process of completing tasks.

Source: B.M. Melnyk *et al.* (2022)

Through the described methods, teachers of higher medical educational institutions will contribute to the assimilation of didactic material by dental students, who will eventually be able to apply the acquired knowledge in practice. Notably, the use of online platforms in the context of mixed training of medical professionals allows considering the needs of students themselves. One of the advantages of learning on platforms of this format is the ability to host a large number of students simultaneously, quick access to the educational process, the ability to attach educational materials and the necessary links to information resources for students (Kumar *et al.*, 2021). An example of an online platform for training dental students is the interactive educational resource Nearpod. When teachers use the Nearpod platform, the success of students of higher medical education increases substantially, considering the conditions of mixed education, since the Zoom lecture platform was used as part of synchronous learning, and Nearpod as a variant of asynchronous sessions (Messina *et al.*, 2022).

In Ukraine, a similar online platform is used – MS Teams (Vizir *et al.*, 2021), which allows teachers to receive quick feedback from the student community during the educational process, and also helps to adjust the learning process itself for students. The MS Teams online platform in a mixed form of training for students of higher medical institutions allows teachers to use MS Forms tests, MS Teams text tasks, and OneNote task formats, which simplify the educational process for teachers and students of medical universities in Ukraine. Using the MS Forms tests, the teacher sees the progress of the students' work, who writes a detailed answer to the question asked. Using the MS Teams task format, the task is sent to students as a Word text file with additional materials included.

Notably, in this case, the task can be opened simultaneously by students and teachers. In turn, the OneNote service allows the teacher to create tasks for the student audience within a short time frame in text, drawing format, or .pdf file. Another online training platform for medical university students is LIKAR_NMU, which was primarily used for international students, and during the war began to be used for internally displaced students (Slipchuk, 2022).

Blended learning can include online social networking platforms, such as WhatsApp, because the use of this platform, according to students, facilitates group discussions and provides flexibility in study time, encourages the involvement of dental education students in training sessions (Bagewadi, 2021). Ukrainian dental students mainly use group chats on Viber or Telegram, or communicate via e-mail (Belikov *et al.*, 2022). The substantial popularity of using educational films and videos from the YouTube platform in the pedagogical process is notable since such content substantially stimulates the educational motivation of the student community (Dascalu *et al.*, 2021). A substantial part of such a scientific resource is the teacher of an educational institution, who recommends a specialised product since links and video materials that are distributed on online training platforms in a mixed learning environment must be checked by teachers before the distribution process. Investigating the issues of medical education of dentists in the conditions of mixed education in Ukraine, the main positive and negative aspects of using a mixed form of education in medical higher educational institutions of Ukraine, where future dental specialists receive education, were formed. These aspects are formed considering the current martial law on the territory of the country at the beginning of 2023 (Table 2).

Table 2. Aspects of the positive and negative impact of mixed forms of education on the educational process of higher education institutions in Ukraine of medical, in particular, dental speciality

No.	Aspects of the impact of mixed learning on the educational process	Nature of the impact	
		Negative impact on learning	Positive impact on learning
1	Flexibility	Uncontrolled communicative flow of participants in the educational process, as the strict time limits of academic communication are erased.	Training takes place in synchronous (video conference, audio communication, chat, messages, social media) and asynchronous (video and audio materials, blog, Wikipedia, discussion forums, e-portfolio, social media, email) modes.
2	Individualisation	Students linger on difficult-to-understand material, not keeping up with the pace of the educational programme, because they do not have the opportunity to ask clarifying questions to teachers at the moment.	It is possible to select a convenient pace of learning and time limits for investigating subjects.
3	Interactivity	There is no live contact between students and teachers.	The ability to attract viewing of multimedia, podcasts, and forums.
4	Evaluation system	Lack of control over the direct performance of tasks by the teacher.	Automatic verification of task completion results ensures transparency of the assessment.
5	The level of independence and self-control among students	Lack of external control reduces the level of self-discipline.	The students get the opportunity to increase their level of self-motivation and self-control.
6	Interaction between teacher and student	There is a high probability of feeling isolated from teachers and classmates.	The student gets the opportunity to communicate directly with classmates and teachers in instant messengers and forums.
7	Technical difficulties	Insufficient level of computer technology proficiency among teachers complicates the work or them.	Students and teachers automatically master the technical skills and means of modern education.
8	Health	The load on vision increases, posture worsens due to prolonged working in front of the computer.	The probability of acute respiratory viral infections and similar respiratory diseases is reduced.
9	Security	In homes (private sector or high-rise buildings) where participants in the educational process live, there may not be a specially equipped shelter and the travel time to it may be quite long.	During online lectures, students and teachers have the opportunity to use the two-wall rule or go down to the shelter in case of an air alarm. In case of face-to-face meetings, it is possible to use the shelter that is available on the territory of the university.

Source: compiled by the author

Considering all the above-mentioned aspects of the impact of blended learning, it is worth noting the innovations that have been implemented to train future dentists with its help. An example of such an implementation is the MMS (MyMOOCspace) mobile learning application, which works according to gamification concepts and supports the motivational aspect of the student community in a mixed learning environment. The use of the MMS application in the studies of other researchers showed a positive effect of attracting video resources (Ramirez-Donoso *et al.*, 2021). 3D modelling deserves special attention while teaching using mixed form of education. Dental students who managed to use the 3D modelling system in a mixed learning environment eventually received the highest score for performing dental examinations on exams (Carreon *et al.*, 2020).

In addition to applications and 3D modelling, the studies on gamification as a promising industry in the context of mixed training of medical university students are gaining momentum. In the initial courses, the use of gamification is associated with the development of students' professional writing skills, but a small number of positive reviews in the student community is notable (El Tantavi *et al.*, 2016).

In turn, the use of specific games that were used to develop diagnostic skills in young professionals and helped both students and teachers to observe the success of acquiring skills and abilities in their speciality, received a large number of positive reviews. For example, the special educational game "RealTeeth" allows medical university students investigating dentistry to simulate interviews with patients and perform diagnostics. At the end of the game, a young specialist may be offered a task according to the results of the game (Sanchez *et al.*, 2019). The use of gamification in a mixed learning environment combines a large number of leading concepts for improving the educational process for students of medical institutions, in particular, future dental specialists.

Notably, the state of functioning of modern education in the conditions of forced mixed learning is an important issue in the scientific circles of teachers and researchers in Ukraine. Employees of higher educational medical institutions of Ukraine and researchers are convinced of the advantages of a number of aspects of combining online training and the conventional form of teaching educational material to dental students. Despite the martial law that has

been going on in the territory of the Ukrainian state for the past year, educational processes continue to function and provide high-quality education for medical university students. Ukrainian youth, in accordance with the established time frame and conditions of war, receive up-to-date knowledge, skills, and abilities necessary for successful future medical practice.

DISCUSSION

Mixed education has become a common phenomenon in higher education institutions in many countries during the 21st century, so a substantial number of researchers have examined this issue. Studies devoted to the field of modern medical, in particular, dental, education in the context of mixed learning, examine the concepts, the main advantages and disadvantages of this form of education, and the historical prerequisites for the introduction of a mixed form of education in the educational process.

According to L. Caraivan (2011), the concept of mixed learning in the world appeared in the early 1990s as an alternative to online learning, as students were not motivated enough to learn independently, while actively introducing a mixed form of education began only in the early 2000s. However, the demand for mixed education began with the COVID-19 pandemic and increased on the territory of Ukraine with the beginning of a full-scale war.

According to R. Haridy *et al.* (2020), in fact, the COVID-19 pandemic has seriously complicated the educational process for dental education applicants. Due to the spread of coronavirus infection, a mixed form of training began to be actively used for students who were trained as dentists, which included a mixture of online training, virtual modelling, and visits to tactile laboratories, along with conventional clinical training, which involved real patients in the process. Based on the results of the study in 2023, organising training using mixed-form methods really creates a substantial number of educational opportunities for dental students.

In turn, researchers M. Saritepeci and H. Cakir (2015) argue that the blended learning system in higher education institutions is extremely effective compared to classical learning in university classrooms or online learning. Comparing the data with the results obtained at the beginning of 2023, the effectiveness of the mixed form of the educational process in Ukraine is quite high and is due to a number of factors that are crucial for the training of Ukrainian students and teachers.

A study on the mixed form of the educational process by researchers M. Tayebnik and M. Puteh (2013) notes a large percentage of the advantages of this education system in comparison with the exclusively conventional or distance form. However, comparing the results of the 2013 study with the results obtained in this study at the beginning of 2023, the effectiveness of this form of the educational process has increased.

Using IT industry knowledge and technology to train future dentists, according to T.Y. Chang *et al.* (2020), is an important area of the educational process for both teachers

and medical students. Researchers believe that online lectures are becoming an integral part of future dental education. Based on the results of the 2023 study, it is worth agreeing with this, since in mixed training, which is practised on the territory of Ukraine by higher medical educational institutions, online training is included in the educational process of dental students.

A. Godlewska *et al.* (2019) believe that active learning through communicative foundations with classmates contributes to the high-quality assimilation of educational material, even in cases where students did not attend the lecture part of training. Given the study of the beginning of 2023, among other things, the mixed form produces the probability of students experiencing a sense of isolation from teachers and other participants in the educational process.

A mixed approach to learning is common, however, according to K. Smith and J. Hill (2019), the key to the model of combining online learning and conventional form is technological progress and the use of digital technologies that are constantly evolving. Considering the results of the analysis of pedagogical views in Ukraine, the involvement of technologies in the educational process is an important component of successful and relevant training of dental students.

In turn, F. Derbel (2017) argues that conventional learning, supplemented by online learning, is an innovative concept of education around the world. Virtual educational mobility is provided for students by the opportunity to use online materials and work at the student's own pace, without isolation from the teacher's presence. Notably, considering the results obtained in the study of 2023, the problem of the pace of learning and the feeling of isolation of the student from teachers is an important and relevant issue that requires special attention from researchers and educational workers.

K. Nijakowski *et al.* (2021) also note that the effectiveness of a mixed form of education in dentistry proves students' satisfaction with this form of education. According to the results of the study by the authors, students of the dental speciality emphasise the advantages of mixed training in improving educational efficiency and using the individual pace of educational processes, but a substantial disadvantage in the mixed form of training was recognised as the restriction of social contacts. Comparing with the results of the 2023 study presented in this paper, Notably, Ukrainian students have a decrease in this indicator, but the decrease in social contacts also negatively affects the productivity and quality of training of future dentists.

A.S. Qutieshat *et al.* (2020) draw attention to the results of their own study, which indicates an increase in the academic performance of students who studied in a mixed form of education. Notably, the mixed form of education, as shown by the study in Ukrainian medical educational institutions, also shows an increase in the academic performance of educational participants. Blended learning is one of the most effective types of educational process in many countries of the world. Results of the study by N.R. Alsalmi *et al.* (2021), which was conducted

based on Ajman University, showed that the success of dental students can vary depending on the gender of the applicant in favour of women.

Similar results were shown by the study conducted by R. Ullah *et al.* (2021), which confirms the propensity of women to perform better in a mixed learning environment. However, regarding this criterion of academic performance of students studying in a mixed form in Ukrainian institutions of higher education, it is impossible to comment on this aspect, due to the lack of a sufficient number of studies on the direct relationship of such a trajectory of academic performance with gender in dental students.

According to S. Jeganathan and P.S. Fleming (2020), mixed learning at the level with the conventional form of the educational process has effective methodological foundations and shows high results in students' knowledge acquisition, and both approaches, that is, both mixed and conventional learning, receive positive feedback from participants in the educational process. Considering the results of the study at the beginning of 2023, teachers of higher medical education institutions prefer a mixed form of education, referring to the unstable situation in Ukraine.

Training of modern medical dental specialists in Ukraine, as in many countries of the world, is mainly based on the concepts of improving the quality of education and therefore focuses on the use of a mixed form of education in higher medical institutions of education. As the results obtained by other researchers and of this study show, in Ukraine, the educational process in the conditions of mixed learning ensures high efficiency and effectiveness, the overall success of dental students, which, in turn, ensures satisfaction with the educational process of teachers in this area.

CONCLUSIONS

As a result of the study, the specific features of education and the formation of mixed education in the world and in higher education institutions of Ukraine were examined. The paper highlighted the basic aspects of applying the concepts of mixed learning in the realities of war on the territory of Ukraine. Early forms of blended learning had drawbacks and educational limitations but with the development of computer technology, multimedia learning formats such as audio and video broadcasting, teleconferencing, online learning, and virtual, augmented, and mixed reality technologies became available. The COVID-19 pandemic has contributed to the widespread introduction of these modern forms of education in Ukraine.

In the study, the main online educational platforms used in educational medical institutions of Ukraine, India, and the United States of America were examined, as a result of which it was possible to determine the effectiveness and relevance of using a symbiotic complex of conventional and online training for students of medical universities of

Ukraine using online educational platforms and software. Analytical work was also conducted on the state of the educational process in higher educational institutions of the country during the war and the possible prospects for the use of mixed education by educational institutions in the future were investigated.

Blended learning in Ukraine helps medical university students get a high-quality education, considering innovations such as mobile applications, 3D modelling, and gamification. Platforms and social networks such as MS Teams, LIKAR_NMU, WhatsApp, Viber, Telegram, and YouTube contribute to the efficiency and flexibility of the learning process. The use of the MMS mobile application and 3D modelling system improves the educational results of dental students. Gamification is gaining momentum in medical education, in particular, in the development of professional writing and diagnostic skills.

As a result of investigating the current state of use of mixed learning concepts in higher medical educational institutions, a high level of commitment of the university teaching staff to this method of conducting the educational process was identified, and the effectiveness of using mixed learning based on increasing the level of education among students in the dental industry. The mixed learning model has also shown a substantial level of efficiency in protecting the physical health of teachers and students since the mobility of participants in the educational process of a mixed form of education is much higher than the conventional one.

The main positive aspects of using the blended form of education include the speed of access to the educational process, convenience for students and teachers, and the ability to adjust the educational process based on feedback from the student community. On the other hand, there are some negative aspects, such as the need for teachers to check educational materials before distributing them, and possible difficulties in organising students' independent work. Due to the current martial law on the territory of Ukraine at the beginning of 2023, mixed education is of particular importance, as it allows to ensure the continuation of the educational process for internally displaced and foreign students.

The completed study on the state of medical education, in particular, the dental industry, in the conditions of using mixed education in higher educational institutions of Ukraine is the basis for further examination of this issue. Researchers should pay attention to the examination of the use of virtual, mixed, and augmented reality in the context of mixed learning of medical students.

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CONFLICT OF INTEREST

None.

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Богдан Миколайович Мельник

Аспірант, асистент

Національний медичний університет імені О.О. Богомольця

01601, бульв. Тараса Шевченка, 13, м. Київ, Україна

<https://orcid.org/0000-0003-2232-8181>

Дослідницько-інноваційний аспект сучасної медичної (стоматологічної) освіти в умовах змішаного навчання

Анотація. Національна концепція розвитку вищої освіти в Україні під час війни спрямована на залучення цифрової освіти в навчальний процес, а також на сприяння розвитку віртуальної освітньої мобільності. Актуальність дослідження зумовлено нестабільним станом сучасної медичної освіти в Україні, необхідністю використання цифрових технологій та залучення змішаної форми навчання до загальноприйнятої концепції ведення освітнього процесу. Мета дослідження – з'ясувати, як педагоги та студенти стоматологічного напрямку вищих медичних закладів України реалізують концепцію змішаного навчання станом на початок 2023 року. У роботі використано такі методи наукового дослідження: описовий, історико-типологічний, термінологічний принцип дослідження та аналіз, за допомогою яких вдалося розкрити дослідницько-інноваційний аспект сучасної стоматологічної освіти під час війни на території України. У роботі вивчено історичні особливості становлення змішаної форми навчання в українській освітній сфері. Висвітлено ключові аспекти використання моделі змішаного навчання в сучасній вищій медичній освіті України. Розглянуто основні онлайн-платформи, які використовуються в умовах змішаного навчання, а також актуальне для змішаного навчання програмне забезпечення. Здійснено ґрунтовний аналіз стану сучасного освітнього процесу в українських університетах, де здобувають освіту майбутні спеціалісти стоматологічної справи, а також вивчено перспективи використання змішаної форми навчання для студентів стоматологічного профілю в медичних закладах освіти. Результати та підсумки роботи можуть використати науковці та педагогічні працівники для подальшого дослідження порушеної тематики, зокрема для виявлення та усунення недоліків різних форм навчання

Ключові слова: компетенції лікаря; навчальний процес; самомотивація; освітня сфера; цифрові технології