

UDC 378.147:378.018.43:61:004

DOI: <https://doi.org/10.11603/m.2414-5998.2026.3.16630>

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HYBRID LEARNING IN MEDICAL EDUCATION: A CONCEPTUAL MODEL OF THE INTERACTION BETWEEN ACADEMIC AUTONOMY, DIGITALIZATION, AND SOCIAL INCLUSION

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ГІБРИДНЕ НАВЧАННЯ У МЕДИЧНІЙ ОСВІТІ: КОНЦЕПТУАЛЬНА МОДЕЛЬ ВЗАЄМОДІЇ АКАДЕМІЧНОЇ АВТОНОМІЇ, ЦИФРОВІЗАЦІЇ ТА СОЦІАЛЬНОЇ ІНКЛЮЗІЇ

Abstract. Modern medical education in Ukraine operates under prolonged crisis conditions, creating an urgent need for flexible educational models capable of ensuring the continuity of the learning process. While hybrid learning has gradually evolved worldwide as part of the digital transformation of education, in Ukraine it has become an essential mechanism for adapting to the challenges posed by the COVID-19 pandemic and the full-scale war. Security risks, power outages, forced displacement of students and academic staff, and unequal access to digital infrastructure have necessitated the search for optimal approaches to integrating theoretical instruction with practical clinical training. The aim of this study was to analyze the characteristics of hybrid learning in medical education and to develop a conceptual model illustrating the interaction between academic autonomy, digitalization, and social inclusion.

The study was conducted at Donetsk National Medical University during the 2024–2025 academic year using a cross-sectional design and an anonymous questionnaire survey. The study included 53 sixth-year medical students (Specialty 222 “Medicine”) who had studied under a hybrid learning model for at least one semester. The questionnaire consisted of 24 items grouped into four sections: access to digital infrastructure, organization of the educational process, assessment and academic engagement, and socio-geographical characteristics. Data were analyzed using descriptive statistical methods.

The findings demonstrated that digitalization is a necessary but insufficient condition for the effectiveness of hybrid learning. Nearly half of the respondents (47.2 %) positively assessed its impact on learning outcomes; however, a substantial proportion emphasized the importance of organizational flexibility and expanding opportunities for clinical training. Video lectures and digital educational resources were identified as the most effective instructional tools (56.6 %), while simulation-based training received high effectiveness ratings from 73.6 % of respondents. At the same time, socio-geographical factors, including forced displacement and limited access to clinical training sites, significantly affected students' ability to participate fully in the educational process.

Based on the findings, a conceptual model of hybrid learning was developed, incorporating three interrelated components: academic autonomy, digitalization, and social inclusion. Academic autonomy ensures the adaptability of managerial decisions and the flexibility of educational organization; digitalization provides the technological environment necessary for implementing hybrid learning; and social inclusion guarantees equitable access to education regardless of students' location or security conditions. The practical experience of Donetsk National Medical University confirms the effectiveness of the proposed model and highlights its potential for implementation in other higher medical education institutions in Ukraine.

Keywords: hybrid learning; medical education; academic autonomy; digitalization; social inclusion; continuity of education; conceptual model; crisis conditions.

Анотація. Сучасна медична освіта в Україні функціонує в умовах тривалих кризових викликів, що актуалізує потребу у створенні гнучких моделей навчання, здатних забезпечити безперервність освітнього процесу. Гібридне навчання, яке у світовій практиці розвивалося поступово як складник цифрової трансформації, в українських реаліях трансформувалося у необхідний механізм адаптації до пандемії COVID-19 та повномасштабної війни. Безпекові ризики, перебої енергопостачання, вимушена міграція здобувачів освіти та викладачів, нерівний доступ до цифрової інфраструктури зумовили пошук оптимальних моделей поєднання теоретичної та практичної підготовки майбутніх лікарів. Метою дослідження став аналіз особливостей функціонування гібридного навчання у медичній освіті та розроблення концептуальної моделі, що відображає взаємозв'язок академічної автономії, цифровізації та соціальної інклюзії.

Дослідження проведено на базі Донецького національного медичного університету в 2024–2025 навчальному році з використанням одномоментного дизайну та анонімного анкетування. У вибірку увійшли 53 студенти VI курсу спеціальності 222 «Медицина», які навчалися за гібридною моделлю не менше одного семестру. Анкета включала 24 запитання, згруповані у чотири блоки: доступ до цифрової інфраструктури, організація освітнього процесу, оцінювання та академічна активність, соціально-географічні характеристики. Статистичний аналіз здійснювався методами описової статистики.

Результати показали, що цифровізація є необхідною, але недостатньою умовою ефективності гібридного навчання. Майже половина респондентів (47,2 %) позитивно оцінила її вплив на засвоєння матеріалу, проте значна частка студентів наголосила на важливості організаційної гнучкості та збільшення обсягу клінічної практики. Водночас соціально-географічні чинники, зокрема вимушені переміщення та обмежений доступ до клінічних баз, істотно впливали на можливість повноцінної участі в освітньому процесі.

Узагальнення результатів дало змогу сформулювати концептуальну модель гібридного навчання, що ґрунтується на трьох взаємопов'язаних компонентах: академічній автономії, цифровізації та соціальній інклюзії. Академічна автономія забезпечує адаптивність управлінських рішень і гнучкість організації освітнього процесу; цифровізація створює технологічне середовище для реалізації навчання; соціальна інклюзія гарантує рівний доступ до освіти незалежно від місця перебування чи безпекових умов. Практичний досвід Донецького національного медичного університету підтверджує ефективність запропонованої моделі та її потенціал для застосування в інших закладах вищої медичної освіти України.

Ключові слова: гібридне навчання; медична освіта; академічна автономія; цифровізація освіти; соціальна інклюзія; дистанційне навчання; освітній процес; воєнний стан.

Introduction. Modern medical education operates under crisis conditions that require ensuring the continuity of the educational process. Under these circumstances, hybrid learning has evolved from a pedagogical innovation into an essential mechanism for organizing education. Unlike most countries, where its implementation was a gradual component of the digital transformation of education (Delenko & Sholovii, 2023), the development of hybrid learning in Ukraine has been driven by the need to adapt to prolonged crisis conditions (Lutsenko et al., 2026; Hurevych et al., 2023).

The COVID-19 pandemic initiated a large-scale transition to distance learning technologies, whereas the full-scale war necessitated a fundamental reconsideration of approaches to organizing the educational process (Hurevych et al., 2023; Sobchenko, 2021; Vorona et al., 2024). Security risks, disruptions in energy supply, the forced displacement of students and academic staff, and unequal access to digital infrastructure have highlighted the need for flexible learning models capable of ensuring the continuity of medical education (Vorona et al., 2024).

These challenges are particularly significant in medical education, where the training of future physicians is impossible without the development of clinical competencies (Safdieh et al., 2026; Hanberher et al., 2025). Integrating theoretical instruction, practical training, clinical placements, and digital technologies requires the identification of an optimal model for organizing the educational process (Burmeister et al., 2025; Shvets & Shapoval, 2024; Perederii et al., 2025; Hurevych et al., 2023).

Current research primarily evaluates the effectiveness of hybrid learning from the perspective of digital technologies. However, academic autonomy of higher education institutions, which enables flexible managerial and educational decision-making, and social inclusion, which ensures equitable access to education regardless of students' location or security constraints, are equally important (Vesova

et al., 2025). The interaction of these components is likely to determine the effectiveness of hybrid learning, warranting further investigation.

Despite the growing body of research addressing individual aspects of hybrid education (Price & Winchester, 2025; Kamaruzaman et al., 2026), the relationship between academic autonomy, digitalization, and social inclusion within a unified conceptual framework remains insufficiently explored, particularly in the context of medical education.

The experience of Donetsk National Medical University provides an illustrative example of how a higher education institution can operate under prolonged crisis conditions. The university's relocation in 2014, followed by the COVID-19 pandemic and the full-scale war, prompted the development of a flexible educational model that integrates digital technologies, adaptive educational planning, and the preservation of the practical component of medical training.

Accordingly, there arises a need for a comprehensive analysis of hybrid learning as a systemic phenomenon, determined by the interaction of academic autonomy, digitalization, and social inclusion, while taking into account the unique characteristics of medical education.

The aim of the article was to analyze the functioning of hybrid learning in medical education and to develop a conceptual model describing the interaction between academic autonomy, digitalization, and social inclusion under contemporary crisis conditions.

Methods. The study was conducted at Donetsk National Medical University during the 2024–2025 academic year. A cross-sectional study design based on an anonymous questionnaire survey was employed. The study included 53 sixth-year medical students enrolled in the specialty 222 “Medicine”, all of whom had been studying under a hybrid learning model (combining face-to-face and distance learning) for at least one

academic semester. Participants were recruited using a convenience sampling approach.

Data were collected using a structured questionnaire developed specifically for the study based on a review of the relevant literature. The questionnaire consisted of 24 closed-ended items organized into four thematic domains: access to digital infrastructure, organization of the educational process, assessment and academic engagement and students' socio-geographical characteristics. All items were assessed using a five-point Likert scale. The questionnaire was designed to assess students' perceptions of hybrid learning across the predefined thematic domains.

Participation in the survey was voluntary and anonymous. Informed consent was obtained from all participants before data collection.

Descriptive statistical methods were used for data analysis. Continuous variables are presented as mean $\pm$ standard deviation ($M \pm SD$), whereas categorical variables are reported as absolute frequencies (n) and percentages (%). Statistical analyses were performed using Microsoft Excel 2021 (Microsoft Corp., Redmond, WA, USA).

Results and Discussion. The study included 53 sixth-year students enrolled in the specialty 222 "Medicine", including 33 (62.3 %) from Medical Faculty No. 1 and 20 (37.7 %) from Medical Faculty No. 2. The mean age of the respondents was 23.6 ± 3.0 years. Regarding the mode of study, 24 (45.3 %) students were learning using distance learning technologies, whereas 29 (54.7 %) attended face-to-face classes. More than half of the respondents (56.6 %) considered the traditional face-to-face format to be the most effective, while 33.9 % preferred hybrid learning and only 9.4 % favored fully distance education.

The survey findings demonstrated that digitalization is a necessary but insufficient prerequisite for the effective implementation of hybrid learning. Nearly half of the respondents (47.2 %) evaluated its impact on learning outcomes as positive, while an additional 30.2 % considered it partially positive. The most important advantages of the digital component identified by the students were the flexibility of the educational process (83.0 %) and the opportunity to continue learning during forced displacement (75.5 %). Video lectures and digital educational resources were regarded as the most effective methods of content delivery by 56.6 % of respondents. Only 15.1 % of students reported persistent difficulties with Internet access, indicating an overall adequate level of digital accessibility despite the existence of vulnerable groups. At the same time, the findings showed that digital technologies alone do not guarantee the effectiveness of hybrid learning. For 60.4 % of respondents, the learning format had a direct impact on motivation

and academic engagement, while a further 22.6 % reported a partial influence. These findings highlight the importance of effective organization of the educational process and the university's capacity to adapt teaching methods, practical training, and assessment procedures to rapidly changing conditions.

A total of 22.6 % of respondents expressed the need to increase the amount of clinical training, whereas 30.2 % emphasized the importance of expanding the use of clinical case discussions and case-based learning. At the same time, 73.6 % of students rated simulation center training as effective or highly effective, confirming the considerable potential of simulation-based education as an integral component of practical training within a hybrid learning environment.

Socio-geographical conditions were identified as another important factor influencing the effectiveness of the hybrid learning model. The opportunity to continue education during forced displacement was positively assessed by 75.5 % of respondents. At the same time, the security situation, forced relocation, unstable Internet connectivity, and limited access to clinical training sites significantly affected students' ability to participate fully in the educational process. Under these circumstances, the distance learning component functioned not as an alternative but as an essential prerequisite for ensuring the continuity of medical education.

The obtained findings indicate that the effectiveness of hybrid learning is determined not by individual digital solutions but by the balanced interaction of organizational, technological, and social factors. Based on the integration of the empirical findings of the present study, a critical analysis of contemporary scientific literature, and the institutional experience of Donetsk National Medical University, a conceptual model of hybrid learning was developed. The proposed model comprises three interrelated components: academic autonomy, digitalization, and social inclusion. In the proposed model (Figure 1), academic autonomy ensures the organizational flexibility of higher education institutions by enabling the timely adaptation of educational programs, teaching formats, assessment methods, and practical training to crisis conditions. Digitalization provides the technological environment required for implementing hybrid learning, supporting communication, access to educational resources, and the continuity of the educational process. Social inclusion guarantees equitable access to education regardless of students' place of residence, security conditions, or other social constraints.

A fundamental feature of the proposed model is that none of its components can ensure the effectiveness of hybrid learning in isolation.

Academic autonomy without an adequate digital infrastructure limits the institution's ability to adapt the educational process promptly. Likewise, digitalization without inclusive mechanisms exacerbates educational inequality, whereas social inclusion without organizational flexibility cannot ensure the quality of professional training. Only the balanced interaction of these three components ensures the resilience of the medical education system and its capacity to function effectively under prolonged crisis conditions.

The practical implementation of the proposed model is reflected in the organization of the educational process at Donetsk National Medical University, whose experience served as the foundation for developing the model. Its implementation is based on the interaction of academic autonomy, digitalization, and social inclusion in the context of prolonged crisis challenges. The university's multi-campus structure, unequal access of students to clinical training sites, and the necessity of ensuring continuity of education have led to the implementation of a flexible educational model that integrates academic autonomy, digital technologies, and inclusive educational practices.

Academic autonomy enables the adaptation of teaching formats according to the specific characteristics of educational components: face-to-face practical training remains a priority for clinical disciplines, whereas theoretical courses make broader use of distance and asynchronous learning formats. Digital technologies support these approaches by facilitating communication, providing access to learning materials, enabling electronic assessment, and ensuring interaction among participants in the educational process. At the same time, inclusive approaches are aimed at maintaining access to education for students regardless of their place of residence or security conditions.

Thus, the practical experience of Donetsk National Medical University confirms the feasibility of implementing the proposed conceptual model under prolonged crisis challenges and demonstrates its potential for application in other institutions of higher medical education.

Conclusions. The conducted study demonstrated that hybrid learning in contemporary medical education is not a temporary alternative to the traditional organization of the educational process, but rather an effective model capable of ensuring the continuity of professional training for future physicians under crisis conditions.

It was established that the effectiveness of hybrid learning is determined by the balanced interaction of three key components: academic

autonomy, digitalization, and social inclusion (Code, 2025; Ramírez-Correa et al., 2025; Kamaruzaman et al., 2026). Academic autonomy provides flexibility in managerial and educational decisions, digitalization creates the technological foundation for the implementation of the educational process, and social inclusion guarantees accessibility of learning regardless of students' location or security constraints.

The findings confirm that digital technologies significantly expand the possibilities of organizing the educational process, yet they cannot fully replace in-person clinical training. At the same time, the extensive use of simulation technologies serves as an effective means of partially compensating for the limitations of practical training (Vesova et al., 2025). Based on the study results, a conceptual model of hybrid learning has been proposed, which is grounded in the interaction of academic autonomy, digitalization, and social inclusion. The proposed model may serve as a theoretical foundation for improving the organization of the educational process in institutions of higher medical education and for enhancing its resilience under prolonged crisis challenges.

Further research should be directed towards the empirical validation of the proposed conceptual model, the determination of the significance of its individual components, and the assessment of their impact on learning outcomes and the development of clinical competencies among medical students.

Funding. The authors declare that they received no funding for conducting this research or for writing this article.

Conflict of Interest. The authors declare that they have no actual or potential conflicts of interest.

Author Contributions. Viacheslav Husiev – conceptualization; methodology; investigation; data curation; formal analysis; writing-original draft; visualization; project administration. Daria Khapchenkova – validation; writing-review & editing.

Information on the use of artificial intelligence. When preparing the manuscript, AI tools were used exclusively to assist with editing, improving writing style, structuring the text, and translating individual fragments into English. Artificial intelligence was not employed to generate scientific data, analyze data, interpret the results, or formulate scholarly conclusions. All research findings, their analysis, interpretation, and the final editing of the manuscript were carried out by the authors, who bear full responsibility for the article's content.

Authors approved the final version of the manuscript.

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Дата першого надходження статті до видання: 05.07.2026
 Дата прийняття статті до друку після рецензування: 30.07.2026
 Дата публікації (оприлюднення) статті: 02.10.2026



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