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Digital education hubs in medical higher education: Ukraine and the EU perspectives

Centros de educación digital en educación médica superior: Perspectivas de Ucrania y la UE

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Abstract

The digital hub for the medical university is the embodiment of a synergetic model of the educational system. It is an educational and methodical arsenal forms the content of the digital hubs. It is also an organizational model that focuses on the use of information and communication technologies. The purpose of this scientific research is to examine two fundamental elements of the digital hub in medical education: logistics and teaching. The methodology of comparative analysis that is used is closely related to the synergetic principles of the modern scientific paradigm. This way we can see different levels of effectiveness of digital educational hubs in Ukraine and Europe in the training of future medical professionals. The reason is significantly higher rates of integrative

Resumen

El hub digital de la universidad médica es la encarnación de un modelo sinérgico del sistema educativo. Es un arsenal educativo y metódico que forma el contenido de los hubs digitales. También es un modelo organizativo centrado en el uso de las tecnologías de la información y la comunicación. El propósito de esta investigación científica es examinar dos elementos fundamentales del hub digital en la educación médica: la logística y la enseñanza. La metodología de análisis comparativo que se utiliza está estrechamente relacionada con los principios sinérgicos del paradigma científico moderno. De este modo, podemos observar diferentes niveles de eficacia de los centros educativos digitales de Ucrania y Europa en la formación de los futuros profesionales de la medicina. La razón es que los

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factors in European educational hubs, compared to Ukrainian counterparts. Thus, filing hubs make up the in-formation and digital space of Ukrainian higher medical education. European counterparts have already integrated the potential of the digital hub not only in the educational space but also in the clinical environment.

Keywords: digitalization of education, medical education, digital education hub, educational content.

Introduction

Prior to digitization, people were responsible for accumulation, organization, and integration of medical knowledge. This personal element has also allowed people to gain both theoretical knowledge and practical skills. The globalization has accelerated digitization and now digital education hubs accumulate educational content, organizational structural elements, and elements of integration of medical education into clinical work. As a result of the change, radical changes to education strategies are needed. Rather, it is about ways to optimize the use of human intellectual and organizational resources through digital technologies. Currently, the question arises about building a conceptual definition of digital transformation (Vial, 2019). The concept of the hub has long been effectively implemented in other areas of social activity. The need for synergetic coherence is relevant for all clusters of modern socio-cultural space. In medical education, the hub is implemented exclusively in the interaction of educational and clinical clusters. In addition, digitalization processes currently permeate virtually all elements of educational, therapeutic or organizational elements. As a result, higher medical education institutions have begun active work on the creation and filling of digital educational centers. The effectiveness of integrating digital educational hubs into the existing higher education infrastructure and their impact on educational processes remain pertinent questions. Establishing a successful implementation of hub concepts within the European educational landscape while addressing the challenges faced in the Ukrainian context could provide a synergistic approach to creating a new center of knowledge in the higher education information network.

The aim of this study is to examine the logistical and pedagogical aspects of digital educational hubs in medical higher education while focusing

hubs educativos europeos presentan índices significativamente más altos de factores integradores que sus homólogos ucranianos. Así pues, los centros de archivo constituyen el espacio digital y de formación de la educación médica superior ucraniana. Los homólogos europeos ya han integrado el potencial del hub digital no sólo en el espacio educativo, sino también en el entorno clínico.

Palabras clave: digitalización de la educación, educación médica, hub educativo digital, contenido educacional.

on their effectiveness in preparing future medical professionals in Ukraine and Europe. This investigation is guided by the synergetic principles of the contemporary scientific paradigm. In alignment with this objective, the following research questions have been formulated:

RQ₁: What are the underlying principles for designing digital hubs as knowledge centers, based on the concept of educational synergy?

RQ₂: Can digital educational hubs provide a solution for addressing the organizational and logistical challenges faced in medical higher education?

RQ₃: To what extent are participants in the educational process prepared and willing to adopt the technologies associated with digital educational hubs?

In order to address the research questions, this study adopts synergetics as its methodological paradigm, emphasizing the investigation of self-organization principles within complex systems, particularly in educational settings. This research methodology enables an in-depth analysis of digital educational hubs and their potential applications in medical education. Considering the transdisciplinary nature of medicine and the growing importance of information and communication technologies, the study highlights the utilization of digital scientific methods. These methods have become increasingly significant within the methodological framework of the current scientific and ideological paradigm, ensuring that the research findings are anchored in the latest advances in this field. Consequently, this research methodology facilitates the examination of how the incorporation of digital scientific methods can augment the methodological cluster of the contemporary scientific and ideological

paradigm, ultimately fostering the continued development of medical education.

Theoretical Framework or Literature Review

The issues arising with the use of digital educational hubs are covered in the scientific literature are split into two areas: organizational & logistical and information & training. The purpose and strategic aspects of the functioning of the digital educational hub in higher medical education institutions are found in the study de Villiers, et al., (2017). The features of the digital educational hub in the context of digitalization are of great historiographical importance (Brunetti et al., 2020). The practical elements of the implementation of information and communication centers were studied by Fritz (2018) in the online of libraries as bulk science hubs (Sassanelli et al., 2021). General characteristics and significance of the process of digitalization of the higher medical education system can be found in Tan, et al., (2021); Rampton, Mittelman & Goldhahn (2020); Chegade et al., (2020). The European experience of using the digital hub in the system of higher medical education is described in the research of (Kalpaka et al., 2020); Gulson & Sellar (2019). Korniichuk, et al., (2021) studied the use of digital hubs in Ukrainian higher education institutions; Tsekhmister, et al., (2021). Upon reviewing the literature sources, it becomes evident that in previous research process was extensively analyzed various aspects of digital educational hubs in higher medical education. These studies have provided valuable insights into the strategic and practical expediency of digitalization, and regional experiences in both Europe and Ukraine. However, there is still room for further investigation, particularly concerning the effectiveness of digital educational hubs in training future medical professionals and the readiness of participants to adopt the associated technologies. By addressing these gaps, the proposed research aims to contribute to a more comprehensive understanding of digital educational hubs in medical higher education.

Methodology

Synergetics is the most acceptable methodological paradigm for the study of digital space in higher medical education. It has a multi-vector nature and involves the use of different types of empirical and rationalist methods. The principles of self-organization of complex systems are relevant for the analysis of the digital educational hub and ways to use it in medical education. In the modern scientific picture of the

world, medicine is an area in which the ideas of transdisciplinary are actively implemented. Given that we consider information and communication technologies, much attention should be paid to the so-called digital scientific methods, which are beginning to occupy an important niche in the methodological cluster of the modern scientific and ideological paradigm.

Results and Discussion

RQ₁: What are the underlying principles for designing digital hubs as knowledge centers, based on the concept of educational synergy?

Digital education hubs decentralize learning. As a result, the process becomes more dynamic. Learning modes shift from administrative management to focusing on the student needs and experience.

Digital transformation is based on three key concepts: “culture and skills”; “infrastructure and technology”; “ecosystems” (Brunetti et al., 2020). When we talk about the concept of “culture and skills”, we mean the general processes of digitalization of the education sector. Information and communication technologies, which have flooded our present in all its manifestations, are becoming part of the socio-cultural space. For a future medical professional, the fundamental aspects of professionalism are the skills acquired during training. Digitization is becoming an integral and important part of the process of acquiring these skills.

Considering the concept of “infrastructure and technology”, we note the technological aspects that ensure the functioning of the digital hub. Software, content access channels, cybersecurity systems - all these are routine technological elements that ensure the operation of the digital hub.

Digital hubs used by medical universities are not only educational and strategic. With the help of a digital hub, an educational institution has a good opportunity to organize educational and information resources. First of all, it is about the work of libraries and scientific repositories of higher education institutions. In particular, for the successful formation of digital content centers, academic libraries combine the potential of their funds and archives (Fritz, 2018). The synergistic effect is achieved through joint activity. The academics drop their work into the repository, where it becomes accessible to other academics and students. As a result, additional

interaction is created at the level of: teacher-teacher, scientist-scientist, teacher-student.

The library system has also undergone significant changes in recent years and is gradually moving away from the use of paper copies of educational and scientific literature and physical visits to this institution. The digitalization of the library automatically turns it into a digital hub, which is relevant and popular among students. The role of the library remains as providing access to resources, now the student can access literature on their electronic device instantly. The digitation of the library as a hub ensures that students' educational needs are met.

In addition to digital hubs being created within universities, inter-university networks are becoming more common. In fact, a single network of digital information resources for medical universities is being created, which, accordingly, consists of a large number of participants. Such level of integration has previously been impossible before digitization.

The latest technologies of modern times allow us to use the digital hub not only as an information source, but also as a clinical space. Carrying out video support of surgical interventions actually transports the viewer to the operating room. Thanks to the digital hub, such content becomes educational, as it unites interested viewers and provides appropriate information support for such sessions.

Of course, personal assistance in a medical institution is the most effective teaching method. However, the COVID-19 pandemic has restricted personal contact. One of the ways to solve this problem was virtual practice. Under such conditions, the digital hub has become an important platform for the implementation of such educational and methodological innovations.

Modern production is irrevocably entering the era of digital technology. Under such conditions, the training of specialists in any field should be

provided using digital technologies. In today's dynamic world, it is impossible to allow situations where a doctor will have less technological equipment or information and communication support than an employee in any other field. Such guidelines pave the way for the final consolidation, application and adoption of the future reference model: business ecosystems-skills-technologies (Sassanelli et al., 2021). Modern researchers emphasize the need to harmonize the educational environment with the process of creation and functioning of knowledge. A key factor in this alignment is digitalisation, which is an effective tool in integrating the concept of knowledge into educational strategies. The model from the following key components is offered:

- worldview awareness of knowledge and highlighting its positive aspects;
- modern educational competencies designed to provide training for highly qualified specialists;
- justice, which is manifested in equality and access to knowledge;
- integration of the latest information and communication technologies into educational models;
- cooperation and interaction of all stakeholders in the education system (applicants, teachers, educational institutions, employers, civil society);
- the process of continuous self-improvement of all subjects of the educational process;
- focusing on strategic and concrete learning outcomes (Tan et al., 2021).

Guidelines for the harmonization of knowledge and education are fundamental to the effective functioning of the digital education hub. If we compare the classical model of education with the innovative one, we will get virtually identical results for the target component. At the same time, we have significant changes in the clusters of subjects of the education system and the educational and methodological arsenal of the educational process (see Table 1).

Table 1.
Sources of knowledge acquisition in educational strategies

Sources of knowledge	
Traditional model	Innovative model
Educational and methodological arsenal	Information and communication technologies
Educator's pedagogical mastery	Student's self-organization

Source: authors' own development

RQ₂: Can digital educational hubs provide a solution for addressing the organizational and logistical challenges faced in medical higher education?

Analyzing the innovative model of educational strategy, we can conclude that this format is most favorable for the use of digital hubs. The classic educational model, which is based on the personal skills of the teacher, actually eliminates the key purpose of the hub. When it comes to an innovative model based on the principles of self-organization, the hub is an ideal environment for learning and acquisition of necessary skills.

Digital educational hub is important for the formation of so-called soft-skills, which for the future doctor are the defining qualities for the level of his professionalism. In particular, along with analytical and critical thinking, digitalization promotes the development of creative thinking, as it often becomes a catalyst for innovative solutions. Online platforms, digital hubs, interactive video conferencing, distance educational and medical sessions, virtual modeling and technological learning are potential elements of the development of medical education (Thakur et al., 2021).

It is important to understand the practical significance of the functioning of educational digital hubs for medical universities. Reducing the gap between the professional opportunities of medical school graduates and the needs of patients is a priority of medical education. The introduction of interactive methods, in particular the case method, can help solve this problem (Korniichuk et al., 2021). The use of the case method is quite effective in the digital educational space, because the student in such conditions has not only access to the necessary information, but also has the opportunity to choose the most acceptable educational content.

Digital educational hubs for European medical universities have been operating for a long time. This allows some analytical research on their effectiveness in the context of the acquisition of professional skills by future medical professionals. Studies focus on the question of the benefits of the surge of artificial intelligence technologies for the health care system (Rampton et al., 2020). It is noted that new approaches in medical education that improve the digital literacy of physicians and allow better integration of patients' views form an effective format of medical education. Note that the digital hub is a

kind of embodiment of synergistic interaction of all actors in the health care system. Therefore, the use of such digital centers in the educational process for medical universities is relevant and in demand. In Ukraine, it is still quite difficult to draw such conclusions, as digital hubs at medical universities are in their infancy. There is currently a period of filling these e-learning centers with the necessary resources. Digital hubs are popular among students. Particularly in demand during the COVID-19 pandemic, when the training format involved the active use of distance and electronic means.

Ukraine is currently in the process of conducting research to assess virtual reality technology and online teaching systems. In particular, similar scientific investigations were carried out among medical students of the Bogomolets National Medical University. The results of the survey show that most students accepted and agreed to virtual reality technology and online teaching and recognized that these technologies are the best alternative to physical education. However, it should be noted that the surveys and further research were conducted solely on the basis of the basic model of the educational process. That is, digitalization still serves as an alternative, rather than an independent full-fledged educational format. The conclusion of such studies is that digital learning environments are extremely effective in terms of satisfaction of medical students and staff, achievements, and growth of technical learning skills (Tsekhmister et al., 2021). But the transition from the traditional model of educational space to innovative still has many obstacles at the moment.

RQ₃: To what extent are participants in the educational process prepared and willing to adopt the technologies associated with digital educational hubs?

In order to understand the relevance of the digital educational hub, we should turn to the opinion of those for whom it is created and functions. A survey was conducted among the students of the Sumy State University, Academic and Research Medical Institute. 300 respondents from the Departments of Public Health, Oncology, and Radiology took part in the study. They were interviewed on the relevance of using a digital hub in the institution of higher medical education. Here is a list of questions that were offered to respondents (see Table 2).

Table 2.
The digital learning hub through the eyes of medical students

Has your institution offered you the use of an innovative learning format using a digital hub?
Have you used the resources of the digital hub in the learning process?
Do you consider the innovative resources of the educational digital hub as an alternative to traditional forms of learning?
What educational digital hubs do you prefer (Ukrainian or foreign)?
Which learning cluster is more relevant for the digital educational hub (theoretical knowledge or practical skills)?

Source: authors 'own development

- 1) Among the questions of importance to our academic exploration are the following: the educational digital hub as an alternative to traditional forms of learning? (Fig. 1).
- 2) Do you consider the innovative resources of

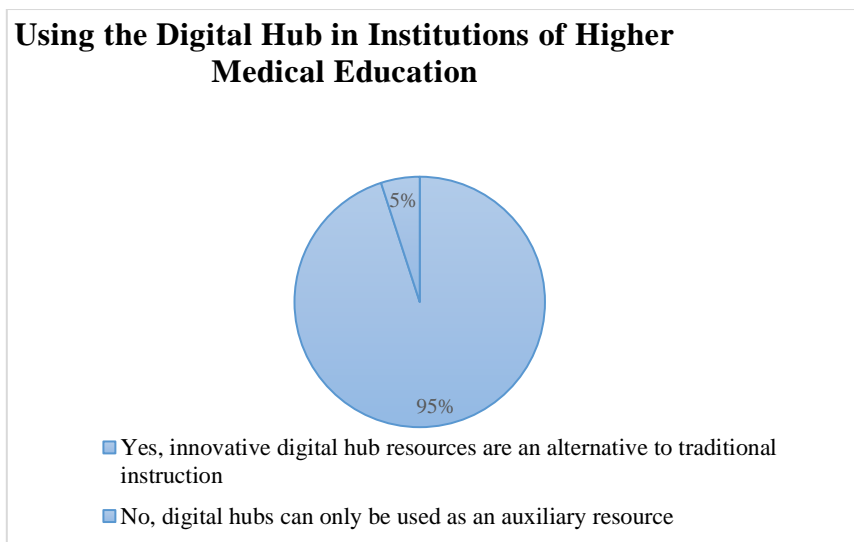


Figure 1. Use of the digital hub in institutions of higher medical education
Source: authors 'own development

We can state that the vast majority of students consider the digital hub as a full-fledged resource for knowledge and skills. Consequently, the presence of a digital hub is an important factor in the competitiveness of higher education (Fig. 2).

- 1) What educational digital hubs do you prefer (Ukrainian or foreign)?

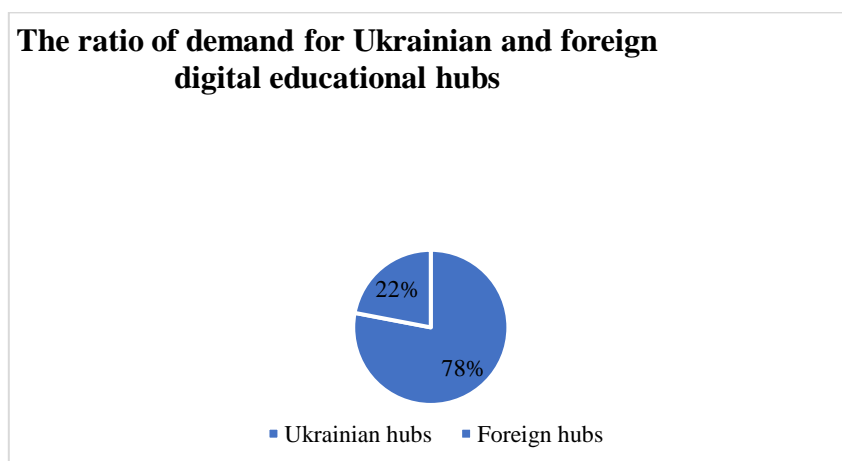


Figure 2. Ratio of demand for Ukrainian and foreign digital educational hubs.
Source: authors 'own development

The results indicate that Ukrainian medical students mainly focus on the use of domestic digital resources. One of the reasons for this ratio is the lack of proficiency in foreign languages and the inability to fully receive the information presented in foreign resources.

Among foreign platforms, the most popular among Ukrainian medical students were English-language educational spaces of leading European and American medical universities.

The use of digital hubs in the educational process requires a thorough methodological study. In particular, conceptual resources from the culture of typology and infrastructure research are used to provide a basis for analyzing the spatial relationships between educational data, discourses, policies and practices in new governance configurations (Gulson & Sellar, 2019). The importance of digitalization and the benefits it can bring to the EU's socio-economic landscape have also been analyzed in detail and emphasized in the light of the forthcoming financial period. The rapid transition to digital alternatives has helped to restore many important social and economic clusters: distance work, online education, e-commerce, administrative processes (Kalpaka et al., 2020). If we analyze these benefits in detail we see beneficial impacts of the education space. Moreover, advanced digital technologies are used for public health. It is expected that in the future (especially after the

experience of COVID-19) the spread of digital technologies will expand even more (Housni et al., 2021). Today's progressive health care system recognizes the growing importance of supporting patients in a variety of ways. One such component, along with the direct treatment process, is the concept of a web-based digital health center for integrated patient care (Chehade et al., 2020). Cooperation between doctors, patients, medical institutions forms a specific powerful digital hub, which aims to meet the needs of all actors. Thus, the idea of a digital hub is becoming a popular format in all clusters of the healthcare system. The digital revolution is opening up opportunities for institutions, organizations and companies across Europe, but for many, it is still difficult to get the most out of it. The countries of the European Union are still characterized by significant differences between regions in the use of ICT technologies (Lopes et al., 2019; Kucirkova & Littleton, 2017). This gap is even bigger in comparison with Ukrainian educational centers. The solution to this imbalance is the need to identify the strengths of a particular region and use them to create a network of digital education centers.

Prospects For Further Research

It is worth noting that many studies of the functioning of digital educational hubs are reduced to the analysis of three key components (see Fig. 3).



Figure 3. Clusters of research on the functioning of educational and digital hub

Information-communicative and organizational clusters deal with the problems of logistical aspects of filling and using digital content. When

it comes to the educational component, it is worth updating such research (see Fig. 4).

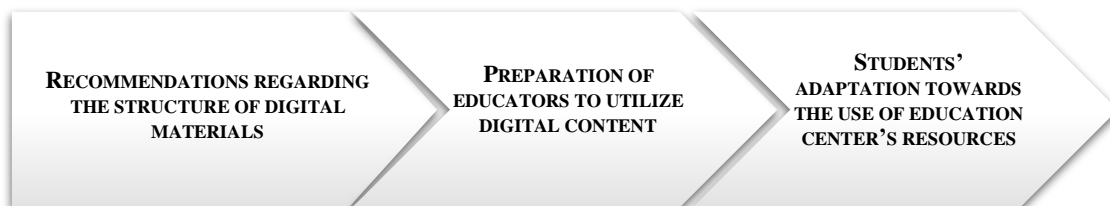


Figure 4. Educational component using digital content
Source: authors 'own development

The key problem of the digital hub in the system of higher medical education is the understanding of its strategic purpose and practical use. The

European higher education system has already gone through a transition period of uncertainty due to conflicts of interest between human

intellectual and organizational resources along with the digitalization processes. Signs of this transitional period are currently being observed in Ukrainian higher medical education. Based on the European experience of implementing the principles of digitalization in general and the use of digital educational hubs in particular, we can identify several suggestions that will serve as guidelines for Ukrainian institutions of higher medical education in the development of innovative strategies.

First of all, we note the synergetic principles that are relevant for the organization of digital educational hubs and their further operation in the field of medical education. With the theoretical component of medical education, everything is more or less clear and organized. Educational digital environments created at universities allow to fully provide informational content for the training of future physicians. Several clusters of digital hubs of theoretical nature have proven to be effective (see Fig. 5).

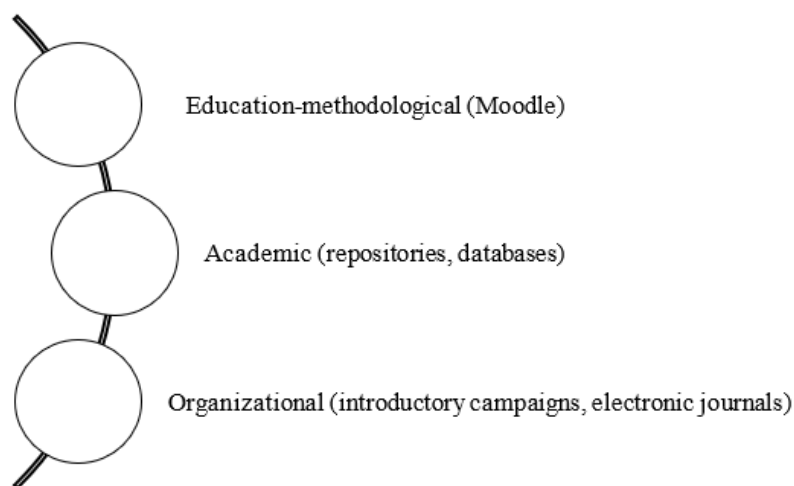


Figure 5. Digital hubs for acquiring theoretical knowledge in medical university
Source: authors 'own development

The importance of synergetic is that the future medical professional is not limited to theoretical knowledge and requires the acquisition of practical skills directly during training. In medical universities, the practice involves primarily gaining experience through direct learning in the clinical space. That is, the student, along with the mentor has the opportunity to analyze all stages of the process of diagnosis, treatment and rehabilitation. Therefore, the medical institution itself, where such an educational process is conducted, becomes a kind of organizational hub. However, here we see the difference between European and Ukrainian realities. If in Europe such concepts as university clinics are widely developed, in Ukraine they only exist in medical institutions. Hence the contradiction in the efficiency of the digital hub. In the university clinic, the digital educational hub covers both the educational and theoretical cluster of the educational institution and the medical element. When practical training takes place in medical institutions, the effectiveness of the digital educational hub is significantly reduced.

As an alternative, the possibilities of the simulation center are actively used in Ukrainian medical universities. The simulation center operates in the format of a kind of hub where models for providing medical services of various types are collected. The applicant has the opportunity to use the potential of the center to develop their own practical skills. This type of organization of practical training eliminates the contradictions associated with the conflict of pedagogical and artificial intelligence, as the mentor acts as a consultant, which organically fits into the format of the digital practice-oriented hub of medical education.

Secondly, it is important to clearly distinguish between organizational and logistical and educational and methodological functions of the digital educational hub. Quite often, digital educational hubs are organized by analogy with economic and business models. This approach is unjustified and is no longer used in Europe's leading medical institutions. The point is that a digital education hub could potentially cover several fundamental clusters of social activity specific to the medical education space. Educational and learning strategies accumulate

in the digital educational hub. Educational strategies provide the medical professional with organizational information. Learning strategies accumulate educational and methodological and practical tools for acquiring the necessary hard-skills, soft-skills and digital-skills. The combination of practical and theoretical components is especially relevant for digital hubs in medical education (Wu & Plakhtii, 2021).

Conclusion

The digital educational hub for higher medical education is currently not an ancillary or related element, but a basic center in which the necessary training and logistics potential is accumulated. In the European Union, there are currently processes of creating unified digital educational hubs that will be relevant for use by various educational institutions. In addition, European institutions of higher medical education have self-sufficient and powerful educational and digital hubs. In Ukraine, the stage of formation of digital educational hubs at medical universities is currently underway. At the same time, Ukrainian educational realities do not yet allow us to talk about a holistic digital hub, as there is a certain diversity of educational and methodological, scientific and organizational information centers.

The digital educational hub has two purposes for higher medical education institutions:

educational and strategic, which is the need to organize and effectively operate the digital space in the education system;

educational and practical, which is reduced to the use of the hub as a source of knowledge to develop student's medical skills and abilities.

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