

UNIFIED EDUCATIONAL INFORMATION SPACE: DILEMMAS OF
IMPLEMENTATION, WAYS OF OPTIMIZATION

*ESPAÇO UNIFICADO DE INFORMAÇÃO EDUCATIVA: DILEMAS DE
IMPLEMENTAÇÃO, FORMAS DE OTIMIZAÇÃO*

*ESPACIO UNIFICADO DE INFORMACIÓN EDUCATIVA: DILEMAS DE
APLICACIÓN, VÍAS DE OPTIMIZACIÓN*



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How to reference this paper:

DEVTEROV, I.; KUZHELNYI, A.; ZINYCH, P.; KUZHELNYI, S.; SANAKUIEV, M. Unified educational information space: Dilemmas of implementation, ways of optimization. **Revista on line de Política e Gestão Educacional**, Araraquara, v. 27, n. esp. 2, e023035, 2023. e-ISSN: 1519-9029. DOI: <https://doi.org/10.22633/rpge.v27iesp.2.18381>



| Submitted: 15/02/2023

| Revisions required: 21/04/2023

| Approved: 25/07/2023

| Published: 21/08/2023

Editor: Prof. Dr. Sebastião de Souza Lemes
Deputy Executive Editor: Prof. Dr. José Anderson Santos Cruz

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ABSTRACT: The purpose of the article is to study the main risks, dilemmas and ways to optimize the formation of a single informative space. The methodology of the article consists of analysis, synthesis, modeling, prognostic methods, which were used to implement the task. The results noted the formation of the Bologna system as an important element of the formation of a unified informational and educational environment. At the same time, it was emphasized that digitalization of education and the development of a single digital educational environment were not included in the fundamental principles of this organization. It has been proven that in the future it will be important to create unified digital educational institutions that will become accessible to a globalized society. It is determined what the information space is, its components, the main conditions of optimization solutions for its improvement and further evolution are characterized.

KEYWORDS: Information space. Digitization. Optimization solutions. Distance learning.

RESUMO: O objetivo do artigo é estudar os principais riscos, dilemas e formas de otimizar a formação de um único espaço informativo. A metodologia do artigo consiste em análise, síntese, modelagem e métodos prognósticos, que foram utilizados para implementar o estudo. Os resultados apontaram a formação do sistema de Bolonha como um elemento importante da formação de um ambiente informacional e educacional unificado. Ao mesmo tempo, foi enfatizado que a digitalização da educação e o desenvolvimento de um ambiente educacional digital único não estavam incluídos nos princípios fundamentais dessa organização. Está provado que, no futuro, será importante criar instituições de ensino digitais unificadas que se tornem acessíveis a uma sociedade globalizada. Determina-se o que é o espaço da informação, seus componentes, bem como são caracterizadas as principais condições de soluções de otimização para sua melhoria e posterior evolução.

PALAVRAS-CHAVE: Espaço de informação. Digitalização. Soluções de otimização. Ensino a distância.

RESUMEN: El objetivo del artículo es estudiar los principales riesgos, dilemas y formas de optimizar la formación de un espacio único de información. La metodología del artículo consta de métodos de análisis, síntesis, modelización y pronóstico, que se utilizaron para llevar a cabo el estudio. Los resultados apuntaron a la formación del sistema de Bolonia como elemento importante en la formación de un entorno informativo y educativo unificado. Al mismo tiempo, se hizo hincapié en que la digitalización de la educación y el desarrollo de un entorno educativo digital único no figuraban entre los principios fundamentales de esta organización. Se ha demostrado que en el futuro será importante crear instituciones educativas digitales unificadas que sean accesibles a una sociedad globalizada. Se determina qué es el espacio de la información, sus componentes, así como se caracterizan las principales condiciones de las soluciones de optimización para su mejora y posterior evolución.

PALABRAS CLAVE: Espacio de la información. Digitalización. Soluciones de optimización. Formación a distancia.

Introduction

Research Problem

Modern transformations in education are caused by tangible changes in the development of society as a whole. The formation of the information society has accelerated significantly as a result of the dynamic development of digital data transmission technologies. This pace cannot be compared to the possibilities of the 1980s and 1990s, as the volume and speed of information exchange have accelerated thousands of times, opening up new opportunities for both economic and cultural life. These changes have also become important for the educational sector, as the capabilities of the Internet have been known for a long time, but the newest opportunities for using digital resources are much greater (ROIEVA *et al.*, 2023). The COVID-19 pandemic and the resulting global quarantine restrictions have demonstrated the viability of distance learning, its tangible potential and opportunities for further improvement and development in general (LUND; AAGAARD, 2020).

In this regard, the issue of developing unified information and educational spaces that fully meet the current challenges of a globalized society, the needs of students and teaching staff, employers, etc. has become urgent (RAK-MŁYNARSKA, 2022). In theory, the proposed system should provide universal access to digitized educational courses, disciplines and training, a common database and databases, technological tools for their convenient use, information and telecommunication system mechanisms and relevant information transfer networks that would function on the basis of common principles and according to common rules of information interaction between educational and academic institutions (PAWEŁOSZEK; KUMAR; SOLANKI, 2022). At the same time, even in modern European countries and the United States, the formation of such a single space is currently at the initial stages of development.

The unified information and educational space is a new integrated environment of educational and information technologies. This term is relatively new in pedagogical science. Currently, there are different approaches to its interpretation. Based on the content analysis of modern scientific sources, it has been established that the information and educational space is a pedagogical system that promotes the integration of various innovative information and educational technologies, resources, data transmission systems, management, organizational, hardware, methodological systems (pedagogical methods, forms, organization and conduct of training) (DOMANETSKA; KRASOVSKA, 2016; YAKOVIS, 2016).

In the old days, there was a tradition of creating a single educational space when higher education institutions established close international ties. It was prestigious and fashionable to get an education not in one but in several recognized European universities. Curious students turned into perpetual students, traveling from country to country in search of new knowledge. For example, people from Ukraine could study for several years at the Kyiv-Mohyla Academy, then at the Sorbonne or Prague universities, get a diploma in Bologna, stay there to teach, or return to their homeland. Among the famous traveling scholars from Ukraine was Yurii Drohobych-Kotermak, who was a professor and rector at the University of Bologna and a teacher of the famous early modern Polish scientist Nicolaus Copernicus.

Research Aim

Therefore, the purpose of the article is to analyze the main risks, dilemmas and ways to optimize the formation of a single information space at the current stage of transformation in the educational sector.

Methodology

General Background

The proposed article is based on the use of theoretical and practical methods of scientific pedagogical cognition. In particular, analysis and synthesis were used to write the paper, which allowed us to formulate and study individual elements of a complex system of functioning of the information educational space on the example of European countries (DHAWAN, 2020). The content analysis of the modern scientific literature has highlighted some little-studied elements, highlighted the relevance of e-learning environments in the education and training of students against the background of the globalization of the modern information society and the need to take into account the integration of digital technologies into the education sector. Based on the use of the prognostic method, the author characterizes the probable vectors of taking into account the practice of distance education for the functioning of a single information environment, identifying the importance of electronic educational resources and platforms in the system of student training. Such methodology was used by Tsekhmister (2022). The study also proposes the use of individual elements of the modeling method (DHAWAN, 2020), on the basis of which an attempt is made to trace the model of further evolution of the single information space and possible vectors of its evolution.

Results

Ukraine has a significant historical experience of active participation in the European educational space. First and foremost, we are talking about integration processes in science and education, which are formed in two elements: the formation of a community of the most influential European universities under the auspices of the Magna Carta organization and the integration of national education and science systems into a single European educational and information space, which implies the establishment of common requirements, criteria and standards in practice. The main goal of this process is to consolidate the efforts of the scientific and pedagogical community and the governments of the EU member states to increase the competitiveness of this sector against the background of growing labor market demands for graduates of higher education institutions.

The formation of a single educational space was based on several principles. Each of them played an important role in the educational process and universalization of education in general. These principles and their brief description are best demonstrated in the table below (See Table 1).

Table 1 – Principles of forming a single educational space

	Principles	Example
1	Introduction of three cycles in the higher education system	Initially, in 1999, it was proposed to study in two cycles. Later, the Berlin Communiqué recognized a three-cycle model of education as more effective: it was proposed to introduce doctoral studies as a separate, third cycle of education.
2	Credit system	ECTS, the European Credit Transfer and Accumulation System, was introduced. This provision is now recognized by all participants in the Bologna process at the university level.
3	Ensuring proper quality of education	Establishment of separate accreditation agencies that are independent of national government agencies or international organizations. For example, Ukraine has established the National Agency for Education Quality, which monitors the appropriate quality of higher education and does not accredit those study programs that do not meet quality criteria.
4	Mobility development	The goal is to ensure a high degree of common open system of movement of students, which will allow for an easy transition of students from one national educational system to another. The plan is to increase the share of mobile students to 25% of all graduates in national educational programs (including those from non-EU countries). This also applies to the acquisition of the required level of language competencies. The commonality of diplomas and programs, political initiatives to financially support mobility activities, and the absence or easing of visa barriers provide

5	Promoting graduate employment	<p>opportunities for the development of the future of education.</p> <p>An important aspect of the Bologna Process is the focus of higher education institutions on training top-level specialists. All academic degrees and other qualifications obtained must be relevant to the European labor market. To achieve this goal, the professional recognition of qualifications was even simplified. Such unification will allow for more effective use of the Diploma Supplement, which was created and recommended for use by UNESCO. Employability will help build partnerships between higher education institutions, government agencies, and society at large.</p>
6	Lifelong learning	<p>The policy of broad-based development of lifelong learning should receive the greatest support. To achieve this, methods such as the formation of flexible educational trajectories, on-the-job training (directly at the workplace), recognition of all theoretical knowledge and professional skills, and competencies gained during such training are used.</p>
7	Social aspect	<p>There is talk of strengthening social ties and a reverse process of reducing inequalities in discrimination based on gender or nationality, ethnicity, etc. This policy is currently being implemented at the European level and is a general guideline for all countries seeking to become members of the European Union. Thanks to the above policy, representatives of all social and ethnic groups have more access to complete higher education.</p>
8	Internationalization of modern higher education	<p>Internationalization of higher education has several tangible advantages. In particular, researchers emphasize the creation of a system of higher education that is understandable to all members of the international community, which is a significant achievement of integration and globalization processes within the single European space, educational and scientific. The next aspect is strengthening the competitiveness of higher education institutions, which is achieved through support for international cooperation of universities, their participation in international projects or programs. The last aspect is to strengthen the internal capacity of higher education institutions through monitoring and public control over educational activities.</p>

Source: article authors' development

As can be seen from the above list, the digitalization of educational environments took place at the level of higher education institutions. At the same time, it was not a powerful component of the Bologna Process, which was formed and developed before the large-scale penetration of information technology into all spheres of public life (ÇEKEROL; ÖZTÜRK, 2012). In practice, since the beginning of the XXI century, the Internet has become a common norm for the functioning of educational activities, in which digital equivalents have been used alongside traditional sources and media (BOND *et al.*, 2018). As of the early 2020s, the level of digitalization has increased tenfold (KUBITSKYI *et al.*, 2022). Access to digital networks and servers far exceeds access to libraries or archives. The further level of digitalization of

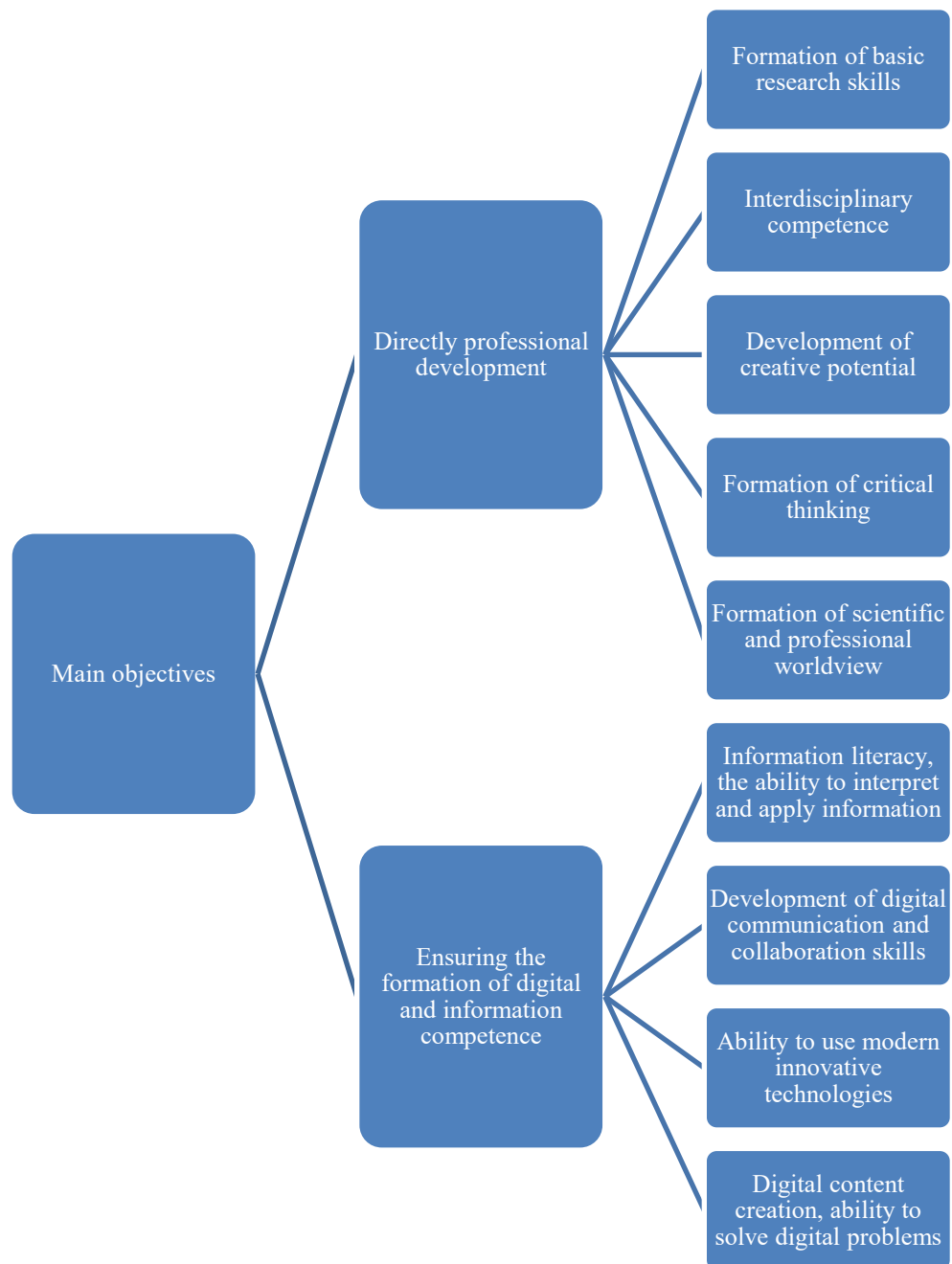
society will only increase, so this will raise an important issue of forming a single information educational environment within the current Bologna system (CAMPANINI, 2015).

The COVID-19 pandemic has demonstrated that distance learning is not inferior in quality to traditional forms of organizing the educational process. At the very least, motivated higher education students have even more ways to work on developing an appropriate level of knowledge and competencies on their own (DHAWAN, 2020). As a result, higher education institutions are faced with the question of whether it is advisable to return to pre-quarantine times with the full dominance of traditional education. This dilemma is also relevant for the Bologna system as a whole, as it opens up new aspects of the discussion on the feasibility of the national higher education system and the transition to a post-national type of work organization. Internships, study abroad, and academic exchanges are significantly accelerated and optimized thanks to digital technologies, meaning that there is no need to travel abroad (WILLIAMS *et al.*, 2023). The practice of studying at two higher education institutions at the same time has also become widespread. For example, in Ukraine, after the full-scale Russian invasion in 2022, a significant number of students continued their distance learning at their home universities, but also started their studies abroad, thanks to open opportunities (provided by charitable).

Another dilemma is the integration of non-formal education into the general educational process. Until now, part of the education credits can be obtained in non-formal educational institutions (trainings, courses, etc.). This additionally creates individual learning trajectories for students, but sometimes there are problems with this (STOIKA, 2022; SAFONOV; USYK; BAZHENKOV, 2022). The dilemma lies in the fact that digital opportunities provide access to a significant number of courses that students would like to include in their curriculum. However, in practice, the choices are limited - the system was designed for the physical presence of students during classes. At the same time, modern online learning makes it possible to acquire knowledge asynchronously, or even at night (if the courses or non-formal education institution operate on another continent). All this creates new challenges for existing digital learning environments (HRYNCHYSHYN, 2021). Therefore, reviewing the impact of digitalization on the transformation of the Bologna Process is a very relevant task for future research. It is obvious that globalization will lead to new manifestations of a single information space within entire educational systems. Accordingly, the formation of a single information and educational environment based on innovative technologies is aimed at meeting all the important needs of users in information, service and educational platforms, resources, developing the

information and digital competence of all participants in the educational process (QI *et al.*, 2016). Since the information and educational space is an integrated category, its main goals are to achieve professional, interdisciplinary competencies, develop information competence, culture of digital communication, form a critical, modern scientific and professional worldview, develop creative potential, digital literacy, awareness of modern innovative technologies, etc. (See Figure 1).

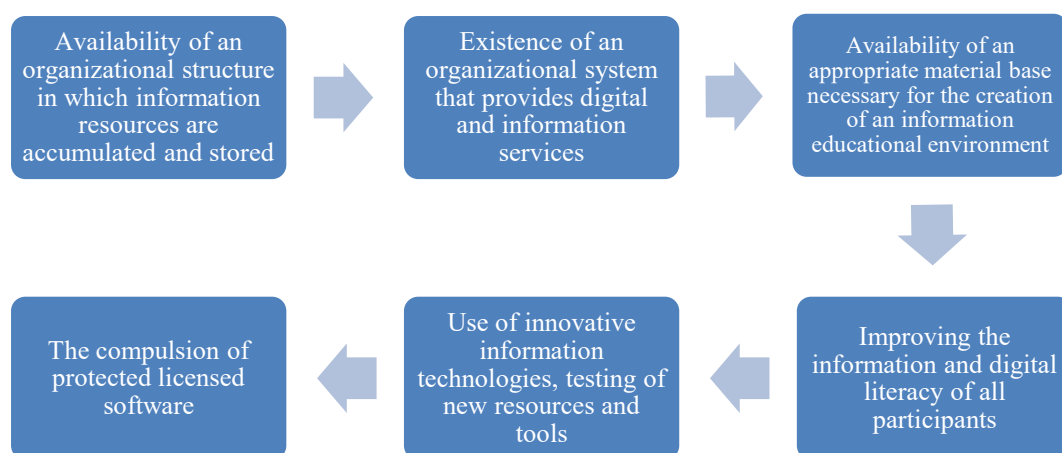
Figure 1 –The main goals of forming a single information and educational space



Source: Article authors' development

Thus, the information and educational space is an integrated system that promotes the development of relevant competencies and shapes the professional development of students. First of all, it means a special organizational system that facilitates the accumulation and storage of information resources. At the same time, an important condition for optimizing a single educational space based on information and digital resources is the availability of an appropriate material base that is important for its formation. On the other hand, an important condition for optimizing a single educational environment is the widespread use of information technology and the improvement of the information and digital competence of all its participants (See Figure 2).

Figure 2 –Basic conditions for optimization solutions in the system of a single information and educational space



Source: Article authors' development

However, such an environment consists of a number of complex structural elements that ensure its proper functioning: virtual representations of departments, electronic media libraries, libraries, a portal, system resources, services, cloud resources, assessment and quality control platforms (See Table 2).

Table 2 – Constructive components of a single information and educational environment

Virtual representative offices of the departments	These include information bases and educational and programmatic complexes that affect the functioning of typical educational services.
Electronic media library, library	Facilitate the accumulation and dissemination of training information through corporate networks. They have special documentation and security systems. Provide distribution of educational books, textbooks, manuals, scientific collections, journals, reference books, etc.
Portal	It is a software and hardware complex that facilitates the functioning of a personalized and digital interface. It supports communication between participants in the educational process. It promotes the dissemination, use and integration of up-to-date applications and digital resources into the learning space. The portal consists of a virtual representation of the departments, a digital media library, curricula, a set of special educational resources, scientific teaching materials, special messengers for certain disciplines, an information center, etc.
System resources. Maintenance services	They are responsible for the software and hardware that facilitates the development of support for learning resources. The main task of system resources is to form digital support. Services facilitate the functioning of organizational and technical tools that develop the digital learning environment.
Special learning resources for participants in the educational process. Tools for monitoring student learning and assessment	Promote the dissemination and use of special subject developments, teaching materials, and service tools that are constantly available to all participants in the training. Systems that provide assessment of the quality of the knowledge gained are also an important part of the integrated information learning space.
Special cloud services	The hardware and software system helps to connect the key elements of the learning space. The most common cloud technologies used in the educational process are: Dropbox, SkyDrive, Google Drive, SugarSync, etc. Modern researchers emphasize the ease of use of such cloud services.

Source: Article authors' development

However, the process of establishing a single information space is problematic. First of all, it is an integrated system that is difficult to develop and maintain. In particular, the technological component of a single information and educational space includes such systems of tools that contribute to the effective organization of learning with all the activities of using educational information, including special tools for its rapid search, processing and storage (NAMAZIANDOST *et al.*, 2020). A separate element of the technological part is an extensive system of media that facilitates the organization of learning (CHANKSELIANI; QORABOYEV; GIMRANOVA, 2020). At the same time, a separate part is a special system that ensures the commissioning, maintenance, and improvement of technical means used to

work with teaching materials. Therefore, the formation of a single information space is a complex process that should ensure the appropriate full satisfaction of multi-level educational information needs and services (MURASHCHENKO, 2019; YARMOLIUK, 2021). This dilemma is further complicated by the fact that in the system of a single information educational space, the information process at each educational level is not supported by a uniform and harmonious transformation of key system-forming and system-supporting factors. It is said that the hierarchical structure of the components of a single educational space determines the fact that the amount of educational information consumed by a subject and its reproduction is not equivalent and, accordingly, depends on the level at which a particular subject is studying.

Discussion

Modern scholars have not paid much attention to the theoretical aspects of developing a single information and educational space. Nevertheless, some modern scholars have professionally studied certain manifestations of the formation of the information and educational environment. These works form the methodological basis of this study. In particular, Çekerol and Öztürk (2021) traced the key aspects of the implementation of the Bologna integration process on the example of individual universities. Campanini (2015) and Kehm (2010) characterized the possible optimization aspects of the development of the modern Bologna educational system.

At the same time, Koukopoulos and Koukopoulos (2019) characterized the main integrative educational theories of the formation of a digital learning environment. Some aspects of the formation of the information and educational environment were characterized by Domanetska and Krasovska (2016). The study by Makoveichuk (2019) developed information technology for the construction and use of visual information and digital systems of augmented reality. Murashchenko (2019) substantiated the main possible ways of forming a single educational space of postgraduate education institutions through the prism of integration of educational, professional, research and cultural activities of the teacher as an important part of teacher training for integrated learning.

Murashchenko (2019) identifies several main components of the organization of a modern single educational space:

1. Scientific and targeted component (defines the purpose and basic methodological principles of organizing the learning space)

2. Content and information component (defines the key scientific foundations for the formation of the content of the organization of the educational environment)
3. Operational and activity component (characterized by the integrative principle of systematicity and research aspects of the organization of training: integration of methods, technologies, forms, models of education that are in accordance with different educational paradigms).
4. Communicative component (responsible for the dialectical interaction of all subjects of learning) (MURASHCHENKO, 2019).

RAK-MŁYNARSKA (2022) characterized the main trends in the formation of the modern educational environment. The author believes that digitalization solutions for the formation of such a system will play a leading role in the future. This problem is emphasized by many other scholars (KOSTENKO *et al.*, 2023; HORDIICHUK *et al.*, 2022).

Therefore, when forming a system of a single information and educational space of an educational institution, one should be guided by the following parameters. First of all, it should be taken into account that the actual work with its use depends on the material and technical base of the educational institution. Also, it is appropriate to pay attention to improving the digital and information capabilities of the educational institution. Therefore, to solve the main dilemmas associated with the informatization of the educational process, it is necessary to ensure the high quality of the information environment. Accordingly, the information educational environment can be considered high-quality only if certain conditions are met.

Accordingly, we can identify several ways to improve the single information space.

- Improving the scientific, pedagogical and technological foundations for the implementation of technical and software tools of information and communication technologies;
- Creating conditions for comfortable management of information flows from any distance;
- Effective organization of communication processes (for example, between the regional center and the administration of educational institutions; between the teacher training institute and the participants of the educational process; between separate groups of teachers, etc.);
- Formation of a professional information and digital scientific and methodological base for training teachers, methodologists, heads of scientific and educational institutions to work in a single information and educational space;

- Improvement of technical means of structuring and processing information for creating training complexes based on multimedia applications;
- Substantiation and development of methodological foundations for the use of network technologies in the process of studying interdisciplinary or professionally oriented subjects on the basis of a single information educational space;
- Formation of information and digital competence of students through the introduction of courses focused on the development of the following skills into the educational program;
- Improving the digital competence of teachers through advanced training courses, mandatory internships, participation in special webinars aimed at familiarizing them with modern digital learning resources, etc..

Tsekhmister (2022) explores the problem of improving digital skills and emphasizes that in the future, digital and distance education trends will only increase. This will require the development of appropriate skills for the teachers of the future. Although Sanetra-Pólgrabi (2023) focused on the peculiarities of organizing distance learning, it also demonstrated the importance of digital literacy for modern teachers and students. According to Abd-Rabo and Hashaikeh (2021), the trends of digitalization of education will only increase in the future. The development of such processes is also emphasized in Lund and Aagaard (2020). The features of the formation of professional digital literacy are characterized in the study by Almås, Bueie and Aagaard (2021). The effectiveness of using modern educational information technologies is demonstrated in Jena, Gupta and Mishra (2021).

Other modern scholars also emphasize the issue of optimizing the scientific, pedagogical and technological foundations for the implementation of hardware and software of information technology, the formation of favorable conditions for the effective management of information flows from any distance (DOMANETSKA; KRASOVSKA, 2016). For example, the study by Saienko, Kurysh and Siliutina (2022) also describes the importance of digital literacy for the organization of a modern learning space. Among other optimization solutions, this study focuses on improving technical means of information processing to create training complexes based on multimedia applications. It should be noted that modern research proves the effectiveness of using multimedia tools in the organization of the educational process. In particular, Sun (2022) proves that the use of modern multimedia tools contributes to solving many organizational and methodological issues. Other researchers, such as Şova and Popa

(2020), also emphasized that multimedia technologies have an impact on improving the organization of the learning space.

Therefore, the single information space, which is associated with the trends of education globalization, is a certain unified form of content and methods of education, which are ensured by the unity and integrity of the main documentary administrative, methodological, technological educational processes. Wider introduction of innovative technologies in the educational process, as well as unification of teaching and methodological technological tools and digital assessment of the quality of education are necessary components of further improvement of the unified information learning space.

Conclusions

Thus, the formation of a unified educational information space is a problematic system for the development of innovative education. A significant achievement on the way to its formation was the creation of the Bologna system, which to some extent unified the trendy way of improving personality-oriented integration models of higher education. However, it is inserted that the main disadvantage of the Bologna system is the failure to take into account the rapid development of digital technologies.

Accordingly, the modern innovative model of a single educational information space should be based on the trends of digitalization solutions, development of information and digital technologies. The process of forming a unified information and educational environment based on innovative technologies should be aimed at meeting all the important needs of users in information, service and educational platforms, developing information and digital competence. It is shown, that the main goals of the modern innovative information and educational space should be aimed at achieving professional, interdisciplinary competencies, forming information competence, critical thinking, modern scientific and professional worldview, digital literacy and information competence, etc.

On the way to forming an optimization model of a single information learning space, there are several important problems associated with the complexity of ensuring the appropriate full satisfaction of multilevel educational information needs and services. The main ways to optimize a single information space are related to the improvement of scientific, pedagogical and technological tools for the implementation and use of hardware and software of information and communication technologies, the formation of comfortable conditions for high-quality and effective management of information flows, professional organization of communication

processes, development of digital competence in all participants of the educational process. The proposed results are an initial step for the future improvement of the single educational space, which will obviously require further scientific substantiation.

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CRediT Author Statement

Acknowledgements: Not applicable.

Funding: Not applicable.

Conflicts of interest: There are no conflicts of interest.

Ethical approval: Yes.

Data and material availability: Yes

Authors' contributions: all authors participated in writing the article - 100%.

Processing and editing: Editora Ibero-Americana de Educação.
Proofreading, formatting, normalization and translation.

