FUTURITY
Education

DOI: https://doi.org/10.57125/FED/2022.10.11.26

How to cite: Bader, S., Oleksiienko, A., & Mereniuk, K. (2022). Digitalization of future education: Analysis of risks on the way and selection of mechanisms to overcome barriers (Ukrainian experience). *Futurity Education, 2*(2), 23-35. https://doi.org/10.57125/FED/2022.10.11.26

Digitalization of Future Education: Analysis of Risks on the Way and Selection of Mechanisms to Overcome Barriers (Ukrainian Experience)

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Received: April 1, 2022 | **Accepted:** May 10, 2022 | **Published:** June 25, 2022

Abstract: The modern development of the information society has actualized transformations in the system of obtaining education, which, after the quarantine restrictions caused by the COVID-19 pandemic, have become an important trend in the development of the learning system. One of these trends has been digitalization, which in the future may change the essence of knowledge acquisition. The purpose of the article is to analyze the risks of the digitalization of education in the future, to identify ways to overcome these barriers. To write the paper and to disclose its purpose, the following methods were used: analysis, synthesis, method of comparativistic approach, system analysis, SWOT-analysis. Also, attention was paid to empirical methods of research. The results determined that the qualitative use of digital teaching methods requires changes in the paradigm of teaching, updating approaches to the formation of methods, active recourse to the tools of platforms Google Meet, Zoom, and Microsoft Teams. It was determined that the platforms are not without disadvantages in use, but their effective use contributes to digitalization. Among the difficulties are identified a lack of experience in digital learning, the inability to fully use all the tools of online platforms (usually because of paid access to many resources), the lack of stable basic access to the Internet. The conclusions recommend mechanisms to overcome difficulties in the digitalization of education, in particular the need to form national educational platforms.

Keywords: digital education, online platforms, distance learning, prospects, and problems of development.

Introduction

The global transformations of society caused by the development and acceleration of scientific and technological progress have led to the emergence of the latest social, economic and technological paradigms. The new processes are based on global trends in digital infrastructure, which is capable of guaranteeing the automation of operations for collecting, receiving and transmitting, storing, processing, and analyzing large volumes of digital information. Accessibility, ease of use, speed of results, and other positive aspects of digital technologies have a defining influence on all aspects of modern life, including education. The trend of digitalization of the educational process in Ukraine is also extremely relevant. For example, the strategy for the development of higher education in Ukraine for 2021-2031 years determines the processes of digitization of the educational sector is an extremely important challenge, which will have positive consequences. Appeal to digital technologies became extremely relevant during the pandemic COVID-19, as distance learning allowed to continue the educational process while minimizing the personal physical contact between education applicants, teachers, which was an important factor in the gradual stopping of the galloping spread. and reducing the number of new cases. The introduction of quarantine measures actualized the spread and active use of digital technologies, which have become indispensable companion to the conduct of classes at various educational levels, including higher education. It is true that the digitalization of education, although it has become a notable social phenomenon, still needs additional research, since not all aspects of this phenomenon are exhaustively covered.

Research Problem

It is impossible to imagine a modern university without the involvement of digital technology in the educational process. The availability of digital infrastructure, access to specialized databases, the availability of the necessary software and support, the use of cloud services have become commonplace for the vast majority of universities. In the Ukrainian reality, on the example of the project of the Concept of digital transformation of education and science, which was to operate until 2026, it is noticeable that the formation of a unified digital environment was intended to provide access to communication and information exchange to all comers. Digital technologies were supposed to help reduce bureaucratic procedures and simplify management processes in education. However, it should also be realized that such initiatives have a greater chance of success if the main trends and challenges of digitalization are effectively explored, as this issue is not only technically organizational, but also social and administrative categories. The problems of the implementation and execution of previous strategies for implementing digitalization were also based, among other things, on the neglect of contemporary social processes. This topic is important for understanding the role of technology in learning. Contemporary authors have paid much attention to the definition of digitalization of education and its components. For example, AlDahdouh (2021) described the role of information technology in transforming education. At the same time, Bouton et al. (2021) analyzed the importance of social media for the formation of modern students. Kuzminskaya et al. (2019) investigated the state of digital competence in teachers in Ukraine. Edmunds et al. (2020) investigated the effectiveness of online courses and described their impact on virtue formation. Fromm et al. (2021) described the vast possibilities of virtual reality to provide an experiential education cycle. McGrew (2021) outlined the role of distance education during the Covid-19 pandemic. Duran (2021) also analyzed the features of e-education implementation during the coronavirus, outlining the disadvantages and advantages. Yoon et al. (2021) analyzed key aspects of videoconferencing education implementation. Rudd et al. (2021) investigated the level of academic resilience based on an analysis of different forms of learning. Meanwhile, Esteban et al. (2018) outlined key changes affecting academic virtue. Gauthie and Husain (2021) compared the security capabilities of Google Meet, Zoom, and Microsoft Teams. However, little explored and debated are the aspects of further implementation of digitalization of education, identifying the key points of reforming already digitized learning. Also unexplored is the definition of the main threats, barriers to the implementation of the digitalized education system, the coverage of the main mechanisms to address them.

Research Focus

The study aims to determine the role and place of digital technology in the learning process. Consideration of this issue is important in terms of identifying further perspectives and difficulties encountered in the further implementation of digitalization in education.

Research Aim and Research Questions

The purpose of this article is to analyze the ways and mechanisms to overcome the barriers to the digitalization of education in the future. Accordingly, the fulfillment of this goal is associated with the consideration of the following questions:

1.Outlining the positive aspects of the implementation of digitalization in education

2.Identifying the barriers to the implementation of digitalization in education

3.Comparative analysis of the strengths and weaknesses of digital learning platforms

4.Highlighting the main ways to improve the digitalization of education, characterizing the key problems in the digitalization of education and science.

Research Methodology

General Background

The methodology of the study consists of pedagogical theoretical methods of research, based on which the theoretical part of the work is reflected. Empirical methods were also used to implement certain goals and to carry out relevant tasks.

The study took place in several stages. In the first one the literature review was made; the debatable and unexplored problems were outlined. The second stage outlined the general state of digitalization of education, analyzed the key areas of digitalization of the educational sector. The third stage made a SWOT-analysis of modern distance platforms, identified the advantages, disadvantages, threats to the digitalization of education and based on the barriers to its implementation. The fourth stage outlines the key methods and their risks in overcoming the tested barriers. The last stage draws its own conclusions and recommendations for the implementation of digitalization in education.

Data analysis

To implement the defined goal, analysis and synthesis were used. In particular, based on the analysis an analysis of the risks on the way of development of the future digitalization of education in Ukraine was made, the key ways of overcoming the difficulties of its implementation were identified. In addition, the principles of system analysis were applied to determine the functionality of the platforms Google Meet, Zoom, and Microsoft Teams. In the system analysis, the system was decomposed into separate structural elements and the study of how these elements interacted to achieve the key goal - the productive organization of the training session, the formation of relevant competencies in students, professional and social skills was implemented.

Using the principles of concretization, key terms related to the digitalization of education and science were considered. Also, based on the systematic method of research, the modern digital platforms used in education are systematized. Using a comparativistic analysis, individual learning platforms and resources are compared. Based on the axiomatic method of research, certain stable generalizations are highlighted, which allowed to cover the problem of the digitalization of education in more detail.

Separately, the paper used the SWOT-analysis, which was used:

1.To identify the advantages and disadvantages of digitalization of education

2.For comparativistic analysis of distance learning platforms

Based on SWOT-analysis, it is possible to assess differently separate objects of research, having found out the external and internal factors influencing the efficiency of their activity (opportunities and threats, strengths and weaknesses). In general, the use of this method influenced the systematization of research results, comparison of the obtained results.

Materials

The main materials of the study were

1. Laws of Ukraine: "On Education" of 05.09. 2017 (Pro osvitu, 2017), "On Stimulation of Economic Development in Ukraine" of 15.07.2021 (Pro stymuliuvannia, 2021).
2. Strategies for developing higher education in Ukraine for 2021-2031 (Ministry of Education and Science of Ukraine, 2022).
3. The concept of digital transformation of education and science in Ukraine (Ministry of Education and Science of Ukraine, 2021).

The above-mentioned normative acts represent a comprehensive strategic perception of the digital transformation in the field of education and meet the key aspects of the implementation by the executive authorities of the provisions of state policy on digital development.

The results are summarized and correlated with:

1. State Register of Print Media and News Agencies as Subjects of Information Activity of the Ministry of Justice of Ukraine.
2. Science databases Scopus, Web of Science, CrossRef, ISSN International Center, ORCID, EBSCO Publishing, Index Copernicus International, Directory of Open Access Journals, etc.
3. The main portals of the National Library of Ukraine named after V.I. Vernadskyi.
4. Websites of professional periodicals of Ukraine.

Research Results

In the sphere of services, digitalization makes it possible to implement activities from any corner of the world, to organize various video conferences based on the Internet. The key areas of digitalization of the educational sector are: the formation of educational resources and platforms, the creation and implementation of modern innovative multimedia and computer methods, teaching methods, the introduction of special equipment to form a digital educational environment, the creation of permanent access to the Internet for students in classrooms in educational institutions, the development and implementation of distance learning using various information and communication technologies.

Table 1

Key Areas of Digitalization of Education

Directions for digitalization of education
Creation of training resources and platforms to support interactive and multimedia content
Formation and implementation of innovative multimedia and computer-based ways and methods of teaching

Introduction of special material and technical base for the formation of a digital learning environment
Development and introduction of distance learning
The application of various information and communication technologies at all levels of education

Source: authors' development.

At the same time, the main methodological principle of teaching is communicativeness, which has a practical orientation (Andros, 2022). This principle includes motivation, individuality, trusting cooperation between students and teachers, connectivity, informativeness, heuristic, functionality, etc. Consequently, we believe, in the system of quality education (as well as based on the distance form) the communication of students and teacher, which should be on a psychological and pedagogical basis, is important. At the same time, the proper use of innovative digital technologies and learning models contributes to the formation of individualized learning for each participant, taking into account individual-psychological aspects (Edmunds et al., 2020). It also influences the formation of relevant and demanded competencies of the XXI century: digital, communicative, intercultural competence, critical thinking, soft skills, etc.

It is obvious that modern education requires radical changes in the system of organizing the learning environment. These processes are associated not only with the digitalization of society but also with the spread of the COVID-19 pandemic and the large-scale Russian-Ukrainian war. Nevertheless, the competent use of digital tools, resources, and platforms requires creating and providing educational institutions with a quality product (Fromm et al., 2021). This will affect the student's ability to access a variety of teaching materials, the latest research findings, international academic libraries, etc. (Laufer et al., 2021). The most common modern educational digital platforms are Google Meet, Zoom and Microsoft Teams, the analysis of their advantages and disadvantages will affect the formation of general recommendations to improve digitalization in general (See Table 2).

Table 2

SWOT – Analysis of the Advantages and Disadvantages of Using Microsoft Teams, Zoom, Google platforms Meet

Microsoft Teams	
Advantages	**Disadvantages**
Availability of Office365 package provided free to educational institutions on a corporate basis	Supports all browsers except FireFox
A convenient integrated system for Microsoft resources (Word, Excel, Outlook, OneNote, PowerPoint, and others.	Complicated interface to use
Shared mode demonstration for participants	Microsoft Closed Loop Conferencing
Relative security due to Microsoft security policy	
Maximum number of participants - 300	
Zoom	
Advantages	**Disadvantages**
Relatively simple interface	In the free version, there is a time limit
Even the free version has many features available.	In the free version, there is a maximum of 100 people.

Transferring the role of the organizer to other participants	You cannot automatically track the presence of participants in the conference
Individual chat	In general chat, messages are highlighted only after a person is connected to the conference
Google Meet	
Advantages	**Disadvantages**
Corporate package	There is a time limit - up to 1 hour.
Integration with Google services	In the free version, the maximum number of participants - 100 people
Digital whiteboard - completely separate application	The poor sound quality in some cases
Relative security due to Google's security policy	If the conference takes place in virtual rooms, it is impossible to record
Simple interface	No individual chat

Source: article authors' development.

Consequently, SWOT analysis confirmed that the analyzed platforms are relatively easy to use and have a good interface for learning. However, all platforms also have weighty opportunities to improve the educational process (Gauthier & Husain, 2021). We believe that their nomadic disadvantages are the time limitation of the duration of the conference, the limitation of the number of participants. A separate challenge is the security factor, which in Zoom gives way to Google Meet and Microsoft Teams (See Table 3).

Table 3

Safety Threats of the Most Common Distance Education Platforms

Microsoft Teams	The recording of the conference may become available to all participants. This will lead to a violation of personal rights
Zoom	Zoom bombing phenomenon - connection of strangers
	Insecurity of security tools
	High probability of hacker attacks
	Availability of general chat
Google Meet	The platform is not available on Huawei devices
	Access to the digital whiteboard is public (via direct link)

Source: article authors' development.

In addition, based on the use of digital resources, students can form and virtual laboratories, interactive game resources, implement a variety of project works, participate in scientific online conferences, virtual excursions, observe online broadcasts of various training events (Laufer et al., 2021). Despite this, the use of digitalization of learning has significant drawbacks that require immediate solutions, especially in the Ukrainian education system.

Table 4

Advantages and Disadvantages of Digitalization of Education

The benefits of digitalization of education	The disadvantages of digitalization of education
Publicity and visibility. Access to information from anywhere in the world	Constant access to the Internet
Wider target audience, communication with students from different countries	Replacing typical communication with computer-based communication, which can lead to socialization problems
Motivated learning through interactivity, flexibility, and diversity of information	Requirement of self-discipline and motivation to learn
An opportunity not only to communicate or comment but also to create content independently	Limitation of methodological character
Wide range of educational service platforms	Limitation of corporate access to some learning platforms
High speed of information, convenient information retrieval	Deficiency of verbal communication
Algorithmization facilitates learning	Algorithmization does not contain an educational element in most cases
Learning autonomy	Teacher takes more time to prepare for ICT-based lessons than for traditional ones

Source: article authors' development.

Despite this, there are potential threats to the total implementation of the traditional (not existing now unreformed) digitalized system of distance education. First of all, a significant negative is the undermining of the prestige of the traditional system of education, limiting the use of some digital resources, etc. (See Table 3).

Table 5

Threats to the Digitalization of Education

Threats to the digitalization of education (unreformed digitalization)
Shortage of qualified and competitive specialists in the traditional form of education
Limitation of the use of some digital resources and platforms created in other states
Undermining of the prestige of the traditional form of education
Lack of permanent high-speed Internet
Need for self-discipline

Source: article authors' development.

Despite this, the key barriers to the implementation of digitalization of education are the lack of awareness of teachers, their lack of motivation in the application of innovative teaching methods and technologies primarily due to the lack of knowledge and competencies due to subjective and personal factors (Kuzminska et al., 2019). Currently, some barriers inhibit the professional development of

educators in the process of mastering digital technologies. Such barriers relate to individual human metastructures (Andros, 2022). Their study will allow us to understand the non-linearity of professional teacher preparation for activity in a digitalized learning environment. Didactic barriers are due to the fact that modern technologies are applied so far within traditional didactic systems (Rossikhina et al., 2019). Consequently, pre-digital methods and forms of organizing educational processes cannot fully realize all the potential of digital technology.

There are also barriers to pedagogical consciousness and social experience (Andros, 2022). We are talking about psychological attitudes, values, stereotypes, which entail an unconscious choice of certain methods that prevent the implementation of innovative, however effective, mastering of digital technologies in education (Mozgalli et al., 2019). In addition, in the digital space, the pedagogical reality is significantly complicated. The teacher must not only master modern professional roles but also be able to work with today's "digital generation". The phenomenon of the "digital divide" exists not only among different educators but also between educators and co-educators (Andros, 2022). Such misunderstandings in educational discourse are another significant obstacle to the digitalization of education.

Of separate importance are also administrative barriers, in particular outdated regulatory frameworks that have not been adapted to the full-scale use of digital education. Also, a significant obstacle to the implementation of full digitalization is a subjective factor. It is about self-motivation in learning, which some students may lack systems (Rossikhina et al., 2019). A barrier to the spread of digital education is also paid access to many educational platforms.

On the other hand, the growing popularity of digital technologies in learning has contributed to the emergence of a large number of educational online resources. The quality of their educational services can be questionable since there is no control over their activities. A separate barrier is the security factor because many modern platforms do not have protection from hacker attacks (See Table 6).

Table 6

Barriers to the Digitalization of Education

The main barriers to the digitalization of education
Teachers are not motivated to use innovative teaching methods and technologies, primarily for a lack of knowledge and competence
Factors that inhibit teachers' professionalism while mastering digital technologies
The use of digital technology within traditional didactic systems
"Digital divide" among educators, between teachers and students
Outdated regulatory framework
Subjective factors, in particular, the lack of self-motivation in learning
A large number of educational resources which are difficult to understand. Also, some of them may not provide quality educational services
Paid access to many educational platforms
Safe obstacles
. Requirement in the formation of national educational portals

Source: article authors' development.

Discussion

When analyzing the risks of digitalization of the educational process, we should analyze not only the capabilities of modern technology but also the human factor - the capabilities and knowledge of teachers. Human-centered learning should be the main principle of the development of the educational process, even despite the digitalization of learning. That is, the development of learning technologies should be subordinated to pedagogical needs and not exist for the sake of self-development, commercialization, or other factors (Andros, 2022). Software, online platforms should remain auxiliary tools, but the main role in learning will be played by the teacher, who will direct the best technological solutions in the right direction of learning.

This trend has been well recognized in the European Union member states, as well as in the United States, Japan, and Canada. Appropriate methods have been developed to introduce the necessary standards for teachers' work related primarily to mastering information and communication competence. Thanks to this, teaching and research staff at all educational levels undergo compulsory training, knowledge monitoring, and final certification. For the implementation of such programs, virtual educational communities have been created and supported, receiving comprehensive scientific support in the use of learning platforms and information hubs (cloud-oriented resources) (Rossikhina et al., 2019). Additional emphasis on obtaining information and communication competence will allow educators to fully utilize the power of digital learning environments, effectively conduct distance learning, and explain to higher education applicants the basics of using modern technologies (their advantages and disadvantages).

According to Kuzminska et al. (2019), the need for additional training also becomes relevant for the teachers themselves, as a teacher who independently understands the functioning of learning systems, has a sufficient level of information and communication competence, is able to be an effective professional. Therefore, the need for personal professionalism turns into an urgent requirement for modern teachers and is extremely important for modern education in general.

The conclusions of Andros (2022) that the necessity of self-improvement for teachers becomes extremely necessary because personal knowledge must develop with the development of technology are weighty.

In Ukraine, many pedagogical and scientific-pedagogical employees use cloud technologies and online services for training, control activities, development of electronic courses, etc. Modern formats of distance learning for students require careful preparation and working with large audiences remotely. Therefore, the use of the latest digital technology does not cancel, but on the contrary, re-emphasizes the need for professional-pedagogical and scientific-pedagogical staff who will have modern skills, abilities, and work habits.

These proposals for the establishment of an additional educational component in training and the need for self-development of teachers will actually allow for overcoming several of the established barriers to the development of digital education in general. True, the efforts of teachers should have state support. In particular, the outdated regulatory framework governing the educational process has long been in need of updating. The COVID-19 pandemic, if it had a positive side, was only in that it demonstrated the possibilities of distance learning, which needed a kind of “legalization” from the state authorities. Laws of Ukraine “On Education”, the Development Strategy of Higher Education of Ukraine

for 2021–2031, the Concept of Digital Transformation of Education and Science of Ukraine, and other documents established important markers that finally decided the question of the feasibility of digital technology in the future (Ministry of Education and Science of Ukraine, 2021, 2022).

State support is also important for the security factor - the example of Ukraine, which was subjected to Russian military aggression, is also quite telling. Increased attention to information competence, the creation of individual academic disciplines, and educational (educational-scientific) programs were aimed at increasing the level of information hygiene of the population. Such activities have also had an impact on the digitalization of education because trained users will not fall into the simple traps of enemy propaganda or the deception of attackers. This process will still require further research because many educational portals remain poorly protected. The formation of unified educational services will overcome this danger, although their creation will take some time.

As this study has shown, modern digital educational platforms have a wide range of threats. Therefore, it is important to reform (or establish new) distance education platforms. Also, a significant innovation would be the creation of new national educational portals, the use of which would allow online learning, access to educational databases.

Conclusions and Implications

So, the analysis of the risks on the way to the digitalization of education in the future allowed us to identify ways to overcome these barriers. In the context of the transition to distance education caused by the COVID-19 pandemic, it became clear: the use of digital tools, resources, and platforms allows a quality learning process. Several educational digital platforms - Google Meet, Zoom, and Microsoft Teams - were commonly used in the process of the new kind of education. Each of them has its disadvantages but also has advantages - based on the SWOT analysis it was determined that the Microsoft Teams platform has the least number of disadvantages. As long as the company-owner provides free access to use the service, it can be considered the best option for organizing digital learning. The most tangible obstacles to the continuation of digital learning are the problems associated with insufficient motivation and training of teachers, lack of knowledge and competence, which are due to both personal and objective reasons. Among the recommendations to overcome this situation should be considered the development and implementation of updated standards for teachers, including compulsory information and communication competence. It will allow to maintain of motivation and the professional level of pedagogical and scientific-pedagogical employees on appropriate indicators. In addition, it is proposed to address the updating of the regulatory framework, setting updated markers for the use of digital technology in the future. Thanks to state support it is possible to overcome the security challenge. In particular, the example of Ukraine demonstrates the positive experience of improving the state of information competence of teachers and the information hygiene of society as a whole. Specific implementation methodologies, however, will need to be studied in more detail in the future. In addition, for the purpose of large-scale digitalization of education in view of the security risks of popular distance platforms, it is important to create new national educational portals. In the future, the use will contribute to the effective organization of online learning, access to educational databases, hence the unification of digital education.

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