# Chapter I. THEORETICAL AND PEDAGOGICAL PROBLEMS OF MODERN EDUCATION

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## ПЕРСПЕКТИВИ ТА ПРОБЛЕМИ ЦИФРОВІЗАЦІЇ ОСВІТИ: ДОСВІД ПРОВІДНИХ КРАЇН СВІТУ

**Анотація**. Метою статті є вивчення досвіду провідних країн світу щодо переваг та проблем цифровізації освіти. Узагальнено, що на сучасному етапі розвитку педагогічної науки в науковців не має єдиного підходу до терміна цифровізації в освіті. Водночас усі дослідники зазначають, що поки альтернативи використанню цифрових технологій

у навчанні немає. Визначено основні напрями цифровізації освітнього процесу: використання імерсивних, хмарних, мобільних та інтернет-технологій навчання, дистанційної освіти, масових відкритих онлайн-курсів, гейміфікацію освітнього процесу, розвиток цифрових бібліотек і кампусів закладів освіти тощо. Узагальнено, що цифровізація освіти має очікувані як переваги, так і проблеми. До переваг віднесено: цифрове навчання стимулює органи зору та слух, тому освітній матеріал сприймається легше для розуміння; інтерактивне навчання підвищує якість освіти; цифрові пристрої стали доступними для широкого кола населення і відповідно цифрові навички є навичками XXI століття; відбувається підвищення ефективності роботи для викладачів та зменшується навантаження; реалізація ідеї «без паперового зошиту чи книги» для збереження екології та зменшення навантаження на учнів під час поїздки до школи; забезпечення надання освітніх послуг за умов локдауну, катаклізмів чи, до прикладу, під час військових конфліктів (як в Україні). До проблем віднесено: відсутність повноцінних екосистем цифрової освіти; матеріально-технічні проблеми в здійсненні навчання, зокрема вільний доступ до інтернету, забезпечення необхідними ґаджетами; незважаючи на високу якість дистанційної освіти в провідних країнах світу, учні все ж втрачають в очікуваному прогресі; через недостатній рівень сформованих цифрових компетентностей збільшене навантаження викладачів; не всім учасникам освітнього процесу навчання, яке відбувається лише дистанційно, є до вподоби; у всій різноманітності цифрової освіти не можна забувати про базовий носій знань – «папір та ручку»; збереження принципу індивідуальності в освітньому процесі; обслуговування мережевого середовища. Проаналізувавши досвід цифровізації в провідних країнах світу, визначено ключові зміни, які простежуються сьогодні в освіті в цьому напрямі.

**Ключові слова**: цифровізація освіти, дистанційне навчання, провідні країни світу, цифрова трансформація.

# PROSPECTS AND PROBLEMS OF DIGITIZATION OF EDUCATION: EXPERIENCE OF THE LEADING COUNTRIES OF THE WORLD

**Abstract**. The purpose of the article is to study the experience of the leading countries of the world regarding the advantages and problems of digitization of education. It is summarized that at the current stage of the development of pedagogical science, scientists do not have a single approach to the term digitalization in education. At the same time, all researchers note that there is still no alternative to the use of digital technologies in education. The article identifies the main directions of digitalization of the educational process: the use of immersive, cloud, mobile and Internet learning technologies, distance education, mass open online courses, gamification of the educational process, development of digital libraries and campuses of educational institutions, etc. In general, the digitalization of education has both expected advantages and problems. Advantages include: digital learning stimulates the organs of sight and hearing. Therefore, the educational material is easier to understand; interactive learning increases the quality of education; digital devices have become available to a wide range of people and accordingly digital skills are the skills of the 21st century; there is an increase in work efficiency for teachers and a decrease in workload; implementation of the idea “without paper notebook or book” to preserve the environment and reduce the burden on students during the trip to school;ensuring the provision of educational services in conditions of lockdown, cataclysms or, for example, during military conflicts (as in Ukraine). The problems include:lack of full-fledged ecosystems of digital education. Material and technical problems in training, in particular, free access to the Internet, provision of the necessary gadgets; despite the high quality of distance education in the leading countries of the world, students still lose in the expected progress; due to the lack of formed digital competences, the workload of teachers has increased; not all participants of the educational process like the fact that learning takes place only remotely; in all the diversity of digital education, one cannot forget about the basic carrier of knowledge – “paper and pen”; preservation of the principle of individuality in the educational process. Network environment maintenance. Having analyzed the experience of digitalization in the leading countries of the world, the key changes that can be traced today in education in this direction have been determined.

**Keywords**: digitalization of education, distance learning, leading countries of the world, digital transformation.

## INTRODUCTION

**The problem formulation.** At the current stage of the development of civilization, the modernization of the content of education in the digital sphere takes place in such a way that it corresponds to the dynamics and needs of the 21st century. Digitization in education in the 21st century today is not a luxury or an innovation, but a standard. The COVID-19 pandemic showed modern society that the education industry was not ready for the transition to digital technologies. The issues related to the pandemic and conflicts of recent years have shown the growing importance of the role of digital transformation in the field of education. Lockdown not only forced to talk about digital transformation, but also to develop new educational directions for the preservation and development of education. The topicality of our research is also confirmed by the fact that the events of recent years have demonstrated the importance of digital transformation for every participant in the educational process, educational institutions, society and states.

**Analysis of recent research and publications**. For comprehensive understanding of the concept of digitization of education in the conditions of the development of modern society, domestic and foreign scientists studied it in their scientific researches. The issue of digitization in educational activity was the subject of research by such scientists, in particular Bykov V., Horáčková Seidelová V., Kravchenko S., Leshchenko M., Smith Ch., (Tolochko S., Tolmakh M. and others (Bykov, V. & Leshchenko, M. (2016); Tolochko, S. V. (2019); Tolmach, M.; Horáčková Seidelová V. (2021).

**AIM AND TASKS RESEARCH.** The aim of the article is to study the experience of the leading countries of the world regarding the advantages and problems of digitization of education.

**RESEARCH METHODS.** To realize the aim of the work, a complex of methods was used, in particular, systematic approach and a dialectical method were applied. In the process of conducting scientific research, empirical methods

were used: analysis of the results of international scientific researches to determine the expected benefits and problems in the course of digitalization of education in the leading countries of the world.

**RESULTS OF THE RESEARCH**

The global pandemic of COVID-19 and the introduction of a strict lockdown (a decision to close educational institutions of all levels, which was adopted by the governments of individual countries on the basis of morbidity statistics related to the local development of the epidemic) at the beginning of 2020 in education took place in different ways in 200 countries of the world (Policy Brief: Education during COVID-19 and beyond) This made it necessary to very quickly introduce changes in the educational process and develop an innovative approach to learning – distance learning using radio, television or the Internet. As early as March 2020, many countries launched curricula and contingency programs for education systems (OECD. Education responses to covid-19: Embracing digital learning and online collaboration). We consider it expedient to study the experience of the leading countries of the world, which have significant achievements in this direction. For example, China, Italy and Great Britain have developed distance learning programs for teachers and school principals. In China, large-scale online classes have been introduced, and in the US, work and advisory groups have been created to support parents, teachers and students in difficult and new reality for them. Many countries have decided to close boarding schools both at the national level (China, Italy, Korea and Japan) and at the regional level (France, Germany, Portugal, Spain).

The closure of educational institutions and the transition to distance learning has had and will have negative consequences for education systems and learners worldwide. Since the lockdown caused by the outbreak of the COVID-19 pandemic in 2020, according to UNESCO, more than 1.5 billion education seekers have switched to online learning (The digital transformation of education: connecting schools, empowering learners. (2020). To make the learning process high-quality and uninterrupted for every student, national governments and educational institutions are developing digital transformation plans and implementing the necessary changes (Smith, Ch.(2022) What is the digitalization of education, and why do we need it?).

In November 2020, UNESCO, UNICEF and the World Bank published the results of a survey on the actions of the Ministries of Education of individual countries due to the closure of schools caused by COVID-19 (UNESCO. What have we learn?), which collected the responses of the Ministries of Education of 118 countries in May and June and 149 countries in June and October 2020. These results show how much the pandemic has damaged education systems. According to estimates from 108 countries, students missed about 47 days of schooling in the first half of the year. In response to this threat, almost all surveyed respondents noted that all countries introduced distance learning with the help of online platforms, television, and radio for high-income countries. According to the World Bank's classification, which is used in studies by UN agencies, high-income countries are those which national income in 2019 exceeded $12,556 per person. Among them: Australia, Canada, Qatar, the USA, New Zealand, Japan, Chile, Singapore, as well as most European EU member states. (World Bank Country and Lending Groups.). Online learning has become the new norm (at least for most learners), and distance education days are seen as days spent in school. However, the rest of the countries (4/5 respondents) this group includes both low-income countries, for example, Afghanistan, Korea, Madagascar, Syria, Tajikistan, and most African countries: Bolivia, Cameroon, Egypt, India, Kenya, Moldova, Mongolia, Nepal, Pakistan, Tunisia, Ukraine, Vietnam; as well as middle-high income countries, such as: Argentina, Brazil, Venezuela, China, Colombia, Iran, Indonesia, Mexico, Peru, Thailand, Turkey (World Bank Country and Lending Groups) were unable to organize a full-fledged educational process in distance format for those seeking education.

It should be mentioned that the COVID-19 pandemic affected not only the education of the future, but also the labor market. This influence does not mean a change in the direction of the current predictions of changes, but rather acceleration of them. What seemed like a vision of the future has become a reality today or in the coming years due to the pandemic. We are primarily talking about automation and digitalization trends. They are visible in the first post-COVID-19 labor market projections presented by the World Economic Forum in the report The Future of Jobs 2020. The report concerns employers' plans for 2020-2025. The Future of Jobs 2020 is the third edition of the research (the previous ones were published in 2016 and 2018). The report summarizes the results of quantitative (survey) and qualitative (in-depth interviews) researches conducted among business leaders: managing directors and HR directors – people who make decisions in the company regarding employment and personnel development. The data refer to companies from 15 economic sectors in 26 countries (The Future of Jobs Report 2020). This data was collected in the first half of 2020. The results show that the type of technologies that companies plan to develop (cloud services, big databases, e-commerce, cryptography, cryptocurrencies, industrial robots, artificial intelligence) remains unchanged. On the other hand, predictions for job automation are accelerating. It is expected that in 2025 the division of labor between humans and machines will become equal. Employers (43%) also say they are reducing permanent staff and willing to outsource new tasks as a result of technology (34% of companies). Also, the difference between the number of jobs in new professions and the elimination of unnecessary ones is also slowly decreasing. It is estimated that by 2025, 85 million jobs will disappear and 97 million new jobs will be created. In the previous report, this figure was 75 million and 133 million, respectively. We still observe a shortage of digital skills among employees. The companies estimate that nearly half of workers will need at least 6 months of training due to skills shortages. However, the increasing number of employers (94%, compared to 2/3 of companies in the previous report) assume that employees acquire the missing digital skills themselves, and do not plan to provide internal training. The key competencies reported by employers for the next 5 years include: critical thinking, problem solving, self-control, ability to learn, flexibility, resistance to stress, and employees acquire missing skills on their own and do not plan to do internal training.

Most of all, the pandemic has changed the approach to digital tools and remote work. Over the past year, 84% of white-collar workers were forced to perform at least part of their duties outside the office. Employers have also

taken measures to increase the productivity of remote workers, which were not previously required. The pandemic has deepened existing inequality and worsened the situation of people employed in the lowest positions (low-skilled workers, youth and women).

It should be mentioned that the strengthening of digitalization in many areas of our life changes the requirements for the education system and the learning process. On the one hand, competent handling of digital media is the goal of the school educational process, and on the other hand, digital media is the basis for learning academic subjects.

At the current stage of the development of pedagogical science, there is no single approach to the term digitization in education. Just as there is no term for analog education, there is no digital education. Just as we are experiencing social changes that are transforming everything that was previously considered fixed. Therefore, digitalization is only a process of this transformation. However, since digitization is happening not only in education, but also in many areas, we talk about digitization when not only the object is digitized, but also the process itself.

Digitalization is changing our society at breakneck speed. In just a few years, the way we communicate and receive information has changed dramatically. The computer has replaced the book as the leading medium of mass information. This shift in key media poses serious challenges for the school: what skills do students need in the digital, informational world? How important is the knowledge learned in school when mobile devices always have the answers at hand? And why are media and informatics relevant topics for education today? Therefore, the modern school can react: neither with general rejection, nor with naive euphoria, but only with conscious pragmatism. Modern society needs urgent changes (Ein Blogbeitrag der anderen Art).

Today, the term “digitalization in education” is understood as the creation of digital educational content. Synonyms for the concept of “digitalization” are “digital transformation”, “digital education” (Kravchenko S. Digitization as a trend in the development of school education in the USA).

Digitization of education is not only the purchase of the interactive whiteboard for the offices of educational institutions and the provision of tablets for use by teachers, but also the replacement of forms and methods of work of teachers and education of students. Modern digital technologies should serve people and save time, money and energy. Also, they can be effectively used where it is really necessary, in particular in the education system (Horáčková Seidelová V. (2021) Digitalizace školství nejsou jen tablet).

The main directions of digitalization of the educational process include: the use of immersive learning technologies (augmented, virtual and mixed reality), cloud technologies, mobile and Internet technologies, distance education, mass open online courses, gamification of the educational process, development of digital libraries and campuses of educational institutions, etc. (Dukhanina, N. M., Lesyk G. V. Digitization of the educational process: problems and prospects p.407).

However, even considering the results of these researches, there is still no alternative to the use of digital technologies in education. And not only because of security issues. Digitization of education is a trend that allows to study according to the individual trajectory, that is, as efficiently and conveniently as possible – at any time and in any place.

It is appropriate, in our opinion, to give an example that by 2020 and the introduction of distance learning, only every third student used a computer or smartphone every day to study or deepen their knowledge, while the vast majority of respondents studied traditionally – taking notes by hand in a notebook, and they used electronic equipment mainly for entertainment (Cyfryzacja edukacji – przyszłość edukacji w hybrydowej rzeczywistości (2021). Modern realities of distance or blended learning have significantly changed this trend and at the same time irrevocably changed our attitude to the use of digital technologies and various devices for learning. Today we have to take into account the realities of technological progress in the field of education, but scientists and educators need to find solutions that maintain the balance between the digital world and the real world.

It should be recognized that distance learning is associated with greater involvement into the process of acquiring knowledge by students, teachers, and often parents.

Digitization of education around the world occurs due to the following advantages:

- Digital learning stimulates the organs of sight and hearing. Therefore, the educational material is easier to understand.
- Interactive learning increases the quality of education.
- Digital devices have become available to a wide range of people and accordingly digital skills are the skills of the 21st century.
- There is an increase in work efficiency for teachers and a decrease in workload.
- Implementation of the idea “without paper notebook or book” to preserve the environment and reduce the burden on students during the trip to school and ensuring the provision of educational services in conditions of lockdown, cataclysms or, for example, during military conflicts (as in Ukraine) (教育のデジタル化とは?導入する5つのメリットと今後の課題).

Let us consider each of these advantages in more detail.

1) Digital learning stimulates the organs of sight and hearing. Therefore, the educational material is easier to understand.

As education goes digital, we will learn with the help of gadgets. Modern gadgets have more vivid symbols and schematic diagrams than blackboards and textbooks, and you can learn by looking at detailed diagrams and photos. You can also move the diagram yourself and watch the video.

The use of technological advantages in the educational process is based on the use of gadgets, such as computers, tablets, smartphones, printers or scanners, which provide for the effective exchange of necessary information in the student-teacher or student-student relationship.

When a person receives information, it is easier to receive visual, auditory and verbal information. Learning that stimulates sight and hearing through the tablet terminal has a sense of realism and it is easy to learn.

In addition, text magnification and read-aloud functions make learning easier for students with learning disabilities or visual impairments.

Gone are the days when students had to sit quietly at their desks. Educational technologies excel in making learning collaborative and interactive. Augmented, virtual and mixed reality are examples of transformative technologies that enhance teachers' lecturing while creating admiring lessons that are interesting for students (Digital transformation trends in education).

2) Interactive learning increases the quality of education.

When talking about usual education, classroom lectures delivered one-sidedly by teachers were common thing. However, in classroom lectures, there is no other way to check understanding than taking tests, and it is not easy to understand the level of knowledge of each student.

Digitization of education allows to conduct interactive classes and use active, student-oriented learning. Since the learners can write and send directly to the electronic terminal, the teacher can understand the level of knowledge of all the students using one terminal.

In addition, in the interactive classroom, both the teacher and the student are senders. There are more opportunities to ask students' opinions so that students can increase their own learning awareness.

3) Digital devices have become available to a wide range of people and accordingly digital skills are the skills of the 21st century.

Nowadays, there are many inconveniences if you cannot use digital devices such as tablets and computers. In society, regardless of the sphere, many companies continue to digitize. Once you get used to digital devices, you will be able to live a stress-free life.

In addition, the benefits that can be expected are not limited to familiarity with the work. If you know how to use digital devices well, you will be able to process information smoothly.

The amount of information that can be obtained from the Internet is always huge. Skills are required to obtain and process the necessary information. Information processing skills do not come suddenly, so it is important to learn them as early as possible.

4) There is an increase in work efficiency for teachers and a decrease in workload.

It is also expected that the digitization of education will affect the reduction of the workload on teachers: it eliminates unnecessary paper routines and the automation of checking students' works. For example, work that was previously done on paper can be done on a gadget, which will save the teacher from problems with checking. The use of gadgets eliminates the need to work on the blackboard during the lesson, as it will be easier for teachers to share educational materials in the electronic format.

Besides, if thanks to automated verification it is possible to reduce the workload on teachers, they will have more time to spend with students. Active communication with students makes it easier to notice their problems and increases the possibility of their early resolution.

Teachers who are overwhelmed with paperwork will find it easier to look around if they find some freedom to act.

5) Implementation of the idea "without paper notebook or book" to preserve the environment and reduce the burden on students.

Thanks to the use of distance learning, the burden on students is reduced during the trip to educational institutions and the provision of educational services in conditions of lockdown or, for example, military conflicts (as in Ukraine).

Textbooks, notebooks and printouts distributed at school are paper media. Even though each one is light, the set is heavy and can be a burden during the trip to school. In fact, many children complain of shoulder problems due to the heavy weight of notebooks, textbooks and stationery.

Abandoning the "paper notebook" thanks to digitalization can reduce the problem of lost or forgotten items and the "burden" during trips to school.

In addition, digitization of education is said to have a positive impact on the environment. Eliminating the need for stationery such as paper and pencils, chalk and pens will help save resources.

Now, when environmental problems are becoming serious, it can be said that it is necessary to promote digitization of education for the sake of the environment more quickly (教育のデジタル化とは?導入する5つのメリットと今後の課).

Education of the future and the challenges of digitalization mean that we have a number of new opportunities, and with them the development of innovative educational services that have, in addition to positive, in a certain way a negative impact on the quality of life. Therefore, in our opinion, it is appropriate to cite such examples.

However, the lack of full-fledged ecosystems of digital education somewhat reduces the potential of digital technologies. For example, the Mc Kinsey company conducted a research in 2021: more than 2,500 teachers from different 8 leading countries in the world (Australia, Germany, Canada, China, Great Britain, France, USA, Japan). During which teachers were asked to rate the effectiveness of distance learning on a scale from 1 to 10. The average score was 5. Australian teachers rated the effectiveness of distance learning the highest — 6.6 points, it is interesting that Japanese teachers, on the contrary, gave distance education 3.3 points (Online learning gets failing grades from teachers across the globe (2021).

Interesting are the results of a research conducted in the Netherlands by the Center for Demographic Sciences at the University of Oxford, which showed that despite the high quality of distance education in the Netherlands, primary school students lost 20% of their expected progress.

Requirements and expectations regarding the forms of conducting classes are still growing, at the same time there is a need for teachers to adapt to the use of new digital tools, so teachers feel more and more pressure and burden. In the course of our research, we considered the results of a Clickmeeting survey conducted in the Republic of Poland, according to which slightly more than 50% of respondents said that they do not like remote learning. However, in all the variety of immersive educational technologies (virtual, mixed or augmented reality technologies), video formats, games and online interaction between the teacher and the student, one cannot forget about the basic carrier of knowledge – "paper and pen". Using them allows us to develop basic skills that we cannot improve only in virtual reality.

In today's digital world, the adoption of digitization has both advantages and some problems, in particular, for example, today 3.6 billion people still do not have access to the Internet. Those without access tend to be the most vulnerable: people with disabilities, marginalized groups, also women, children and young people from socioeconomically disadvantaged backgrounds or living in areas or countries experiencing conflict or war. The lack of access to the Internet reduces opportunities for learning and development, which affects the digital lag and the gap in the quality of education. This problem is actualized in the Strategy of the United Nations Organization for the period until 2030, where it is stated that safe access to the Internet should be provided to everyone, especially children and young people, and the formation of digital skills is associated with the improvement in the quality of life. Therefore, the Strategy emphasizes the need to develop digital competencies and reduce inequality in education (The digital transformation of education: connecting schools, empowering learners. (2020), p.5).

As it was mentioned above, the digitalization of education has both expected advantages and problems. In particular, we can include the following problems:

- *Lack of full-fledged ecosystems of digital education. Material and technical problems in training, in particular, free access to the Internet, provision of the necessary gadgets.*
- *Despite the high quality of distance education in the leading countries of the world, students still lose in the expected progress.*
- *Due to the lack of formed digital competences, the workload of teachers has increased.*
- *Not all participants of the educational process like the fact that learning takes place only remotely.*
- *In all the diversity of digital education, one cannot forget about the basic carrier of knowledge – "paper and pen".*
- *Preservation of the principle of individuality in the educational process. Network environment maintenance.*

So, after analyzing the experience of digitalization in the leading countries of the world, we can identify the following key changes that can be traced today in education in this direction:

- educational institutions, especially institutions of higher education, should not only ensure the educational process, but also become a platform for creating innovations, which is impossible without merging with science and practice;
- unification of resources of educational institutions, state and public organizations and business for implementation of joint projects, creation of scientific and educational online platforms;
- it became possible to build personalized educational trajectories;
- in connection with the pandemic, society began to use non-traditional education on a level with traditional education, which can be explained by the growth of competencies for innovation.

**CONCLUSIONS AND PROSPECTS OF FURTHER RESEARCH**

Today, in the leading countries of the world, digitalization is considered to be one of the leading factors of improving the education system. In addition to influencing the effectiveness of the educational process, digitalization provides a number of advantages, in particular, educational material is easier to understand; the quality of education increases; work efficiency for teachers increases and their workload reduces; implementation of the idea "without paper notebooks, books" to preserve ecology.

Our research confirmed the topicality of the problem of future education and the problem of digitalization and proved the need for further development of issues, in particular, the study of the peculiarities of digitalization of professional training of teachers in the leading countries of the world for the possibility of improving the quality of education.

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