COMMUNICATION AS A FACTOR OF TRANSPARENCY IN SOCIAL INTERACTION: THE ERA OF DIGITALIZATION

ISBN: 978-83-66760-42-4

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Andriy Krysovatyy, Lesia Buiak, Oksana Koval, Marcin Radziłowicz

Elk – 2026

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Monograph

Recommended by the Academic Council of the West Ukrainian National University
(Protocol No. 4 dated December 19, 2025)

Elk – 2026

Communication as a Factor of Transparency of Social Interaction: The Era of Digitalization. Monograph. Scientific Editors: Andriy Krysovatyy, Lesia Buiak, Oksana Koval, Marcin Radziłowicz. Ełk, 2026. Publishing House: University of Warmia and Mazury in Olsztyn, Ełk Campus Branch. 482 pages.

Reviewers:

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Cover design and DTP
Oksana Koval, Viktor Koval

ISBN: 978-83-66760-42-4

The monograph is published based on the research materials presented at the IV International Scientific and Practical Conference "Communication as a Factor of Transparency of Social Interaction: The Era of Digitalization", and within the framework of the implementation of the Ukrainian–American STEM project.

Publishing house:
Uniwersytet Warmińsko-Mazurski w Olsztynie
Filia w Ełku

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CHALLENGES, ADVANTAGES AND DISADVANTAGES OF DIGITALISATION OF EDUCATION IN UKRAINE

Introduction. In the 21st century, digitalisation has become a key factor in socio-economic development, affecting virtually all areas of life, including education. Digital technologies are not only changing teaching methods, but also shaping a new educational ecosystem focused on openness, inclusiveness and a competence-based approach[1]. The digitalisation of education is a complex transformational process that involves the introduction of information and communication technologies (ICT) into learning processes, management practices and educational services. Ukraine, which is undergoing large-scale reforms, is actively implementing digital education tools in line with the objectives of the European Higher Education Area (EHEA) and UNESCO recommendations.

Between 2020 and 2024, the development of digital education in Ukraine accelerated significantly due to the COVID-19 pandemic, full-scale war, and the forced transition of most educational institutions to remote or blended learning formats. These challenges simultaneously acted as catalysts for investment in infrastructure, the spread of digital devices, and the development of electronic educational resources. These events not only accelerated digital transformations but also revealed systemic gaps that require comprehensive solutions. However, along with the advantages, this has also given rise to a number of risks: unequal access, a shortage of skills among teachers, problems with content quality, and cyberattacks. It has also raised questions about the sustainability, accessibility, and security of educational infrastructure. At the same time, the digitisation of education is not only a technological but also a socio-cultural phenomenon that requires new approaches to pedagogical interaction, ensuring equal access to digital resources, and preparing educators to work in a digital environment. According to data from the Ministry of Education and Science of Ukraine (MES), as of 2024, more than 82% of educational institutions used elements of online education, while in 2019 this figure did not exceed 27%[2] .

The development of digital technologies opens up new opportunities for Ukrainian education

[1] UNESCO. *Reimagining our futures together: A new social contract for education.* Paris, 2021. URL: https://unesdoc.unesco.org/ark:/48223/pf0000379707.locale=en
[2] Ministry of Education and Science of Ukraine. *Report on the state of digital transformation in education, 2024.* Kyiv, 2024. URL: https://thedigital.gov.ua/news/regions/rezultati-tsifrovoi-transformatsii-v-regionakh-ukraini-za-2024-rik

to improve its quality, efficiency and international competitiveness. At the same time, the digitisation of education is not only a technological but also a socio-cultural phenomenon that requires new approaches to pedagogical interaction, ensuring equal access to digital resources and preparing educators to work in a digital environment.

This process is accompanied by a number of challenges: uneven access to digital resources between regions, insufficient technical infrastructure, and low levels of digital literacy among some teachers and students[3]. The digitisation of Ukrainian education remains uneven: according to the State Statistics Service, only **68% of rural schools** have stable access to high-speed internet, and the level of digital competence among teachers varies from region to region. In its report "Education at a Glance 2024", the OECD emphasises that in Ukraine there is a "strong correlation between the level of digital infrastructure development and the quality of educational outcomes".

In view of this, the relevance of the study lies in a comprehensive analysis of the current state of digitalisation of education in Ukraine, identifying its advantages, risks and directions for development until 2025.

In 2023-2025, digitalisation became one of the priority areas of Ukraine's state policy in the field of education, as confirmed by the implementation of such strategic documents as the Concept for the Development of Digital Competences (Ministry of Education and Science, 2021), the National Strategy for the Development of Education in Ukraine until 2031[4], and projects for the implementation of "Digital Education" within the framework of the "Action.Education" initiative.[5]

The aim of the study is to conduct a comprehensive analysis of the current state of digitalisation in education in Ukraine, identify its advantages and disadvantages, and develop recommendations for improving the effectiveness of digital transformation, taking into account international experience.

Presentation of the main material. Digitalisation of education in Ukraine: analytical dimension

The current state of digitalisation of education in Ukraine

The digitisation of education in Ukraine is one of the most dynamic components of the modernisation process of the national education system. Over the past five years, particularly after the COVID-19 pandemic, the pace of introducing information and communication technologies into

[3] State Statistics Service of Ukraine. Education in Ukraine: Statistical Compendium 2024. Kyiv: State Statistics Service, 2024. URL: https://iea.gov.ua/wp-content/uploads/2024/02/1-d-4_derzhavnikomunalnipryvatni_2023-2024.pdf
[4] *Strategy for the digital transformation of education and science in Ukraine for 2021–2027. Ministry of Education and Science of Ukraine, 2021.* URL: https://mon.gov.ua/news/kontseptsiya-tsifrovoi-transformatsii-osviti-i-nauki-mon-zaproshue-do-gromadskogo-obgovorennya
[5] Concept for the Development of Digital Competencies of Ukrainian Citizens, Ministry of Education and Science, 2021.

the educational process has significantly increased. According to the Ministry of Education and Science of Ukraine, as of 2024, more than 94% of general secondary education institutions have access to broadband Internet, and about 70% actively use electronic platforms for learning[1]. The most popular among them are Google Workspace for Education, Moodle, Microsoft Teams and their Ukrainian counterparts – Yedyna Shkola, Osvita.ua and Vseosvita.

The development of digital infrastructure is accompanied by the implementation of government initiatives aimed at improving the digital literacy of teaching staff. As of 2024, the "Action. Digital Education" programme has reached over 1.5 million citizens, of whom approximately 230,000 are teachers at various levels of education[6] . This indicator demonstrates a growing awareness of the role of digital competencies as one of the key factors in professional effectiveness. At the same time, according to an OECD survey (2024), only 58% of Ukrainian teachers rate their level of digital competence as sufficient for conducting online classes, which indicates significant disparities between institutional capabilities and individual skills.

According to the OECD Digital Education Outlook 2024 study, countries that systematically invest in the digitisation of education show a 7–10% increase in average educational attainment compared to control groups that have not implemented ICT tools.

At the same time, the digital transformation of education is impossible without the proper infrastructure – high-speed internet, modern computers, multimedia equipment, and digital platforms for communication. According to the Ministry of Education and Science of Ukraine (MES), as of 2024, more than 96% of schools have an internet connection, but only about 68% of them have stable broadband access.

The biggest problems are observed in rural communities, where the quality of the connection often does not allow for effective organisation of distance learning. In 2023–2025, with the support of UNICEF, the European Union and the World Bank, technical support programmes are being implemented, thanks to which educational institutions have received over 260,000 laptops and tablets for teachers and students.

At the same time, digital infrastructure should be viewed not only as a set of technical tools, but as an integrated system that includes cloud services, learning management systems (LMS), video conferencing platforms, and analytical tools for monitoring learning outcomes.

Advantages of digitising the educational process

The introduction of digital technologies into the educational process creates conditions for

[6] State Statistics Service of Ukraine. Education in Ukraine: Statistical Compendium 2024. Kyiv: Derzhstat, 2024. URL: https://iea.gov.ua/wp-content/uploads/2024/02/1-d-4_derzhavnikomunalnipryvatni_2023-2024.pdf

improving the accessibility of education, individualising learning, and expanding forms of educational interaction. Online resources allow multimedia materials, simulations, and interactive platforms to be integrated into learning, providing greater flexibility and engagement for pupils and students. A World Bank study (2024) confirms that institutions that actively use e-learning demonstrate 12-15% higher student success rates compared to traditional forms of learning.

Another advantage of digitalisation is the openness of the educational space. The ability to access courses created by leading universities around the world contributes to the integration of Ukrainian education into the global educational space. Ukrainian universities are increasingly collaborating with platforms such as Coursera, EdX, FutureLearn, and Udemy, which expands academic mobility and fosters a culture of lifelong learning.

In addition, digitisation creates favourable conditions for inclusive education. The use of speech recognition technologies, adaptive interfaces and remote platforms allows people with visual, hearing or musculoskeletal impairments to be involved in the educational process. Thus, the digital transformation of education has a powerful social and humanitarian effect, expanding the rights and opportunities of various population groups.

Challenges and limitations of digital transformation

Along with numerous advantages, digitalisation also creates new challenges. The most critical issue is the persistence of digital inequality between regions. According to the State Statistics Service, as of 2024, only 78% of educational institutions in rural areas have high-quality internet connections, while in cities this figure reaches 97%[7] . Such disparities create unequal starting opportunities for students and teachers and require targeted government policies to support remote schools.

Equally important is the issue of professional training for teachers to work in a digital environment. Teachers often face difficulties in organising distance learning, managing digital resources, and assessing students' online activity. A UNESCO report (2023) emphasises that effective digitalisation is impossible without pedagogical rethinking: digital tools should not simply complement traditional learning, but should become the basis for new methodologies focused on developing critical thinking and student autonomy[8] .

Technological risks also remain significant. Low levels of cybersecurity in some education systems, the lack of clear protocols for protecting personal data, and cases of cyberattacks on school

[7] Ministry of Education and Science of Ukraine. Report on the state of digitalisation of education in Ukraine in 2024. Kyiv: Ministry of Education and Science, 2025 [in Ukrainian]. URL: https://thedigital.gov.ua/news/regions/rezultati-tsifrovoi-transformatsii-v-regionakh-ukraini-za-2024-rik

[8] OECD. *Education Policy Outlook: Ukraine 2023.* Paris: OECD Publishing, 2023. URL: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/11/education-policy-outlook-2023_06f957b6/f5063653-en.pdf

servers and electronic journals demonstrate the need for a systematic approach to digital protection. In addition, the psychological consequences of intensive digitalisation – overload, teacher burnout, and reduced student concentration – are becoming the subject of research by educational psychologists.

Socio-economic and pedagogical consequences of digitalisation

The digital transformation of education affects not only the quality of learning, but also socio-economic processes. According to OECD estimates (2024), a 10% increase in the digital literacy of the population correlates with an increase in the country's GDP of approximately 0.8%. This indicates a direct link between investment in digital education and national economic competitiveness. In Ukraine, this link is particularly noticeable in the context of post-war recovery, with digital skills seen as a key condition for youth employment and the development of the IT sector.

The digitisation of education has not only a technological but also a social dimension. It affects the level of social equality, access to education for vulnerable groups, and the formation of a digital culture in society.

According to ITU (2024), more than 15% of students in rural areas of Ukraine do not have permanent access to a personal device for learning, and 12% do not have stable internet access[9] . This creates the risk of **a digital divide**, which can exacerbate educational inequality.

At the same time, digital technologies open up new opportunities for **inclusive education**. The use of adaptive programmes, text and voice interfaces, translators and virtual laboratories helps to involve children with special educational needs in full-fledged learning.

An additional problem is the emotional and psychological strain on teachers and students during prolonged distance learning. This requires the development of digital well-being programmes and mental health support for those involved in the learning process.

From a pedagogical point of view, digitalisation is changing the role of the teacher from a knowledge carrier to a learning facilitator ( ). The structure of the lesson itself is also changing, becoming more interactive, gamified, and focused on the development of soft skills. However, this process requires a profound rethinking of the traditional pedagogical paradigm, as technological innovations without methodological adaptation can reduce learning effectiveness.

Table 1 presents comparative data on the level of digital integration of educational institutions of various levels in 2020–2024.

[9] ITU. *Measuring Digital Development: ICT Facts and Figures 2024*. Geneva: International Telecommunication Union, 2024. URL: https://www.itu.int/en/ITU-D/Statistics/pages/facts/default.aspx

Table 1

Level of digital integration of educational institutions in Ukraine (2020–2024)

Year	Secondary education institutions using LMS (%)	Higher education institutions with electronic platforms (%)	Teachers with a high level of digital competence (%)
2020	35	62	24
2021	48	70	32
2022	61	79	41
2023	68	84	52
2024	74	89	63

Digitalisation has a number of advantages that determine the competitiveness of the education system:

Increased accessibility of education. Online courses, massive open online courses (MOOCs) and blended learning ensure inclusiveness.

Individualisation of learning. The use of learning analytics allows for the creation of personalised learning trajectories.

Innovation and interactivity. Digital laboratories, virtual and augmented reality, and simulators make it possible to model experiments without risk.

Effective education management. Electronic journals and automated performance monitoring systems reduce the workload on administrative staff.

The dynamics of indicators show steady growth, indicating the gradual integration of digital technologies at all levels of education. At the same time, the gap between secondary and higher education remains significant, requiring a balanced state policy.

Forecast for development until 2025 and directions for policy improvement

According to forecasts by the OECD Digital Education Outlook (2024) analytical centre, in 2025 the level of digitisation of Ukrainian education may exceed 85% in the general education sector and 95% in higher education. It is expected that almost all universities will switch to blended learning, combining face-to-face and distance learning modules. At the same time, the role of artificial intelligence in assessment, content personalisation and learning data analytics will grow.

Table 2 presents a forecast of Ukraine's education indicators for 2025 based on an extrapolation model using data from the State Statistics Service and the OECD.

Table 2

Forecast of Ukraine's education digitisation indicators for 2025

Indicator	2024 (actual)	2025 (forecast)
General education institutions with LMS (%)	7	86
Teachers with high digital competence (%)	63	75
Educational courses with AI elements (%)	18	33
Share of blended learning in higher education institutions (%)	57	6

The implementation of the predicted trends requires a number of governmental and institutional decisions. First and foremost, it is necessary to introduce a national system for monitoring the digital skills of teachers, which will allow for regular assessment of their progress. It is also important to develop a regulatory framework for the use of artificial intelligence in education, as this area is developing rapidly but remains largely unregulated by legislation. Ensuring cyber security and the ethical use of pupils' and students' personal data is another important aspect.

Thus, the digitisation of education in Ukraine has obvious strategic prospects, but requires coordinated state policy, backed by stable funding, scientific support and international cooperation. It is not only a tool for modernisation, but also the foundation for the formation of a new educational culture, at the centre of which is the individual as an active user, creator and critical thinker of the digital age.

Digital competences of teachers and students

One of the main challenges of digitalisation is the need to develop the digital skills of teaching staff. According to a study by the Ministry of Education and Science (2024), only 56% of Ukrainian teachers have sufficient digital literacy to use educational technologies effectively, while 22% require basic training[10] .

Table 3

Level of digital competencies of teachers in Ukraine, % (2024)

Competence level	Percentage of teachers (%)
High	2
Average	34
Basic	22
Low	22

[10]Ministry of Education and Science of Ukraine. Report on the state of digitalisation of education in Ukraine in 2024. Kyiv: Ministry of Education and Science, 2025[in Ukrainian].

Compared to 2019 data, there has been a 9% increase in the proportion of teachers with high digital skills, but regional disparities remain significant. In cities, the figure reaches 68%, while in rural areas it is only 39%[11] .

It should be noted that the digital competence of teachers has not only a technical but also a methodological dimension. The use of technology should not be limited to multimedia presentations – it should contribute to the development of critical thinking, collaboration skills and project-based learning.

At the same time, the development of students' digital skills shows more positive dynamics. According to OECD surveys (2023), about 74% of Ukrainian students use online platforms for self-study, and more than 60% use digital tools for team projects. This indicates that the Ukrainian education system is gradually approaching European standards of digital literacy.

Digitalisation of the educational process: forms and effectiveness

The digitisation of education is changing not only the tools, but also the very structure of the learning process. In the context of distance and blended learning, pedagogical interaction is taking on new forms, from interactive online platforms to virtual laboratories.

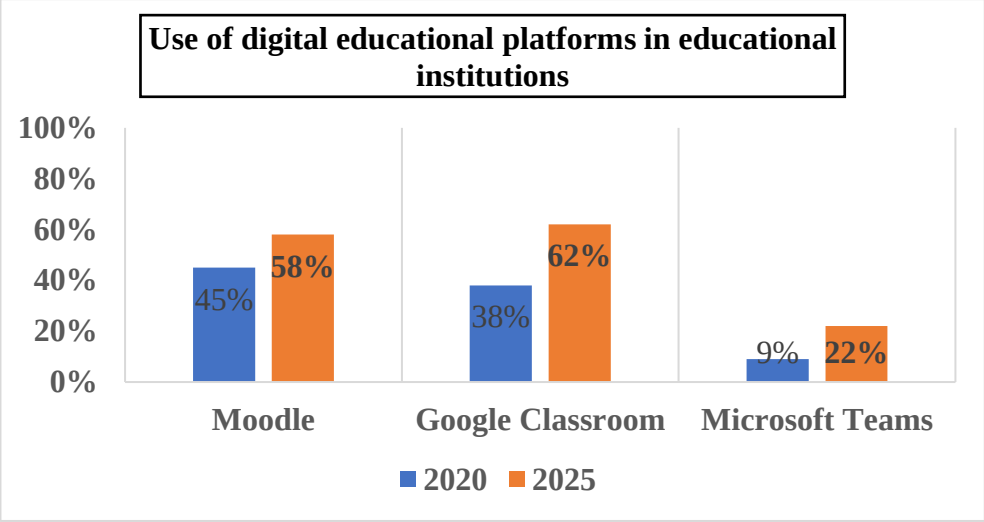

Fig. 1. Use of digital educational platforms in educational institutions (2020–2025, forecast)

The use of digital tools significantly increases the efficiency of learning organisation, but requires stable technical support and methodological assistance. According to UNESCO analysts (2023), digital platforms can reduce the time spent on administrative procedures in the learning process by up to 30%[12] .

[11] State Statistics Service of Ukraine. Education in Ukraine: Statistical Compendium 2024. Kyiv: State Statistics Service, 2024[in Ukrainian]. URL: https://iea.gov.ua/wp-content/uploads/2024/02/1-d-4_derzhavnikomunalnipryvatni_2023-2024.pdf

[12] ITU. *Measuring Digital Development: ICT Facts and Figures 2024.* Geneva: International Telecommunication Union, 2024. URL: https://www.itu.int/en/ITU-D/Statistics/pages/facts/default.aspx

Despite positive developments, there are risks of students becoming overwhelmed with information, losing motivation due to excessive distance learning, risks of personal data leakage, lacks of funding and technical support, risks of involving third-party sources during the student's tasks and problems with academic integrity during online testing.

The main digital education platforms in Ukraine include the All-Ukrainian Online School (video lessons, tests), Prometheus and Ed-Era (massive open online courses), iLearn (preparation for the External Independent Testing), as well as Google Classroom and Moodle (learning management systems for creating courses, assignments, tests, and communication). Additionally, services such as Padlet (for collaborative work with information) and LearningApps.org (for creating interactive exercises) are used. Their main purposes are presented in the table below:

As for the quality of digital content, the lack of uniform standards for electronic resources creates challenges for ensuring the quality of education.

A significant achievement in recent years has been the introduction of a number of national educational platforms:

- All-Ukrainian Online School (VSO) – provides access to video lessons, tests and materials for pupils in grades 5-11.
- Diia.Osvita – a national hub for digital literacy, aimed at teachers and citizens.
- e-Journal and e-School – tools for digital administration of the educational process.

Thanks to these resources, education has become more flexible and open. However, there is a problem **of digital content fragmentation**: the lack of uniform quality standards and unification of teaching materials leads to uneven levels of education between different regions and schools.

An additional challenge is **the protection of personal data** of participants in the educational process. The lack of clear mechanisms for storing and using educational analytics creates risks of information leakage, especially in foreign cloud services.

Ukraine has developed a number of regulatory documents governing the process of digital transformation in education. The key document is the project **"Digital Transformation of Education and Science for 2021–2025,"** which provides for the development of infrastructure, the creation of a unified educational digital ecosystem, and support for open educational resources.

The main directions of state policy on the digitalisation of education are:

- Infrastructure – connecting all institutions to high-speed internet and providing them with computers.
- Competencies – improving the digital literacy of teachers and students.
- Digital resources – developing the national platform "All-Ukrainian Online School".
- Security – protection of personal data and cybersecurity.

The implementation of these areas will create an integrated educational environment in which teaching materials, performance analytics and management will be interconnected.Digitalisation offers significant advantages for Ukrainian education. Firstly, it expands access to high-quality educational resources regardless of location. Secondly, it ensures the individualisation of the learning process through adaptive technologies and artificial intelligence. Thirdly, it contributes to improving the efficiency of educational institutions' management by enabling the analysis of large amounts of data on learning outcomes[13] .

The OECD's forecasts for 2026 indicate that digitalisation could increase the efficiency of the Ukrainian education system by 10–13% in the medium term, provided that adequate funding and staff training are in place.

Conclusions

The digitisation of education in Ukraine is a strategic direction for the country's development, combining technological, social and pedagogical aspects. The analysis showed that despite significant problems – uneven technical support, insufficient digital literacy among teachers, and the need to update curricula – progress is steady.

The digitisation of education in Ukraine shows positive dynamics in key indicators, but requires further improvement of infrastructure, teacher training and increased security of digital services. The forecast for 2025 indicates a gradual transition to a model of "digital sustainability", where digital tools become an integral part of the educational environment.

By 2025, it is predicted that over 90% of schools will be connected to high-speed internet, and the proportion of teachers with high levels of digital competence will exceed 30%. These trends indicate Ukraine's gradual integration into the European educational space and growing potential for innovation.

At the same time, digitalisation requires not only investment in technology, but also in people – in the development of pedagogical culture, motivation and the ability to work with digital tools. It is necessary to strengthen the scientific and methodological base, provide ongoing support to teachers and students, and improve the legislative regulation of digital content and data protection.

Therefore, digitisation is not an end in itself, but a means to improve the quality, accessibility and fairness of education in Ukraine. Its effectiveness will be determined not only by the level of technology, but above all by the level of human capital capable of using it creatively.

[13] Gurzhii A. M., Prokhorenko L. I. *Digitalisation as a factor in the innovative development of education.* Information Technologies and Learning Tools. 2024. Vol. 95, No. 3. Pp. 7–21 [in Ukrainian].

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Abstract

The article provides a comprehensive analysis of the processes of digitalisation of education in Ukraine in the context of socio-economic transformations, martial law and integration into the European educational space. It examines the current state of the digital infrastructure of the education system, the level of training of teaching staff, and the specifics of using digital platforms and educational content. The main advantages, challenges and shortcomings of digital transformation are identified, and the social consequences and problems of accessibility to education are analysed. Particular attention is paid to the international experience of EU countries in the field of digitalisation of education, as well as the possibilities for adapting best practices to the Ukrainian context.

An analytical section was conducted using statistics and examples of support programmes (UNICEF, Device Coalition, Ministry of Education and Science, World Bank). Based on statistical

data, official reports and research, conclusions were made regarding the prospects for the further development of digital education in Ukraine. State and international initiatives were analysed, and issues of digital inequality, staffing, content quality and security were examined. Particular attention was paid to the impact of the COVID-19 pandemic and the war on the digital infrastructure of education and prospects for development. Recommendations were made to enhance the effectiveness of digital solutions and reduce the risks of social and educational inequality.

Keywords: digitisation of education, digitilisation, distance learning, digital skills, digital literacy, information and communication technologies, education in wartime, digital transformation of data protection, digital security.

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