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## **Digital Resources and Technologies for Improvement of Educational Process in Ukraine**

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**Abstract:** The contemporary system of higher education necessitates the application of digital resources and technologies. The aim of the research is to manifest the impact of digitalization on the educational process and to outline their incorporation into teaching practices. The descriptive study was applied that is based on the participants' behaviors, or perceptions of digital resources and technologies used. The following methods were implemented: surveys; observations; content analysis; semi-structured interviews; and questionnaires. Over 60 recent scientific works were selected to evaluate the problem of using digital resources and technologies for improvement of educational process. The research was conducted among 43 instructors of educational institutions. The findings showed that instructors use digital resources and technologies extensively. On the basis of average calculated index, it was concluded that Google Docs, communication tools, smartphone apps, Learning Management systems, games, presentation software, online assessment, AI tools are most effective. Digital resources and technologies are characterized by a number of advantages oriented towards improvement of the educational process. It was found that digital tools are incorporated through a number of techniques and strategies: demonstration, collaborative learning, problem-based learning, project-based learning, and digital games. Instructors stated that they use interactive lecture, peer learning, and simulation-based learning less frequently. The choice of techniques and strategies depends on the course or lesson, educational objectives, students' needs, and possible challenges which instructors may face. The study outcomes can be used to elaborate funding decisions, curriculum development or teachers' professional development for formation of digital skills among academic and pedagogical staff.

**Keywords:** digitalization, educational process, higher education, techniques and strategies, tools.

## Introduction

Informatization is currently one of the basic trends of higher education and refers to the integration and use of information and communication technologies in various aspects of the education system. This trend has become increasingly important due to the rapid advancement of technology and its potential to enhance the educational process, research and development, and administrative processes at the institutions of higher education. In 2020, to address the challenges and opportunities of the increasing digitalization of education the Digital Education Action Plan for 2021-2027 was developed (European Education Area, 2020). It is a framework adopted by the European Commission to promote the use of digital technologies in education across the European Union. The plan aims to harness the potential of digital technologies to improve learning outcomes, enhance digital skills, and foster inclusion in education. In the current context of European integration and digital transformation, the educational policy of Ukraine is constantly developing considering the influence of international standards and recommendations (Ivanenko et al., 2023). European integration involves harmonizing policies and practices with those of the EU. This includes implementation digital policies related to education, such as the use of digital tools, online learning platforms, and digital skills development (Cabinet of Ministers of Ukraine, 2022).

According to Hetmańczyk (2023), digitalization is essential for training future specialists to meet the demands of the modern labor market as it equips them with digital skills and competencies necessary for professional activity. In today's digital age, most careers require high level of digital proficiency since it requires using software, analyzing data, or employing online platforms for communication and collaboration. When digital technologies are integrated into higher education, students gain practical skills and learn how to adapt to the rapidly evolving digital landscape (Söderlund

et al., 2023). Digitalization enhances learning experiences through interactive and multimedia-rich content, preparing students for the digitalized nature of modern workplaces (Haleem et al., 2022). In the modern world the issue of transition to digital learning is the most acute, especially after the COVID-19 pandemic has made significant adjustments and accelerated the use of digital resources and technologies within the educational process (Cone et al., 2022; Wollscheid et al., 2023). As a result, Ministries of Education and educational institutions were forced to rethink organizational structure of the educational environment and suggested replacing classroom learning with online education as a “defensive tool” (McCarthy et al., 2023). Also, online education can provide a safer alternative to attending traditional schools during natural disasters (Cakici & Aksoy, 2023) or armed conflicts (Tverdokhliebova & Yevtushenko, 2023), ensuring that students have access to education when physical classrooms are disrupted.

Obviously, implementation of digital resources and technologies has revolutionized higher education by enhancing accessibility (Prado et al., 2023) and efficiency (Haleem et al., 2022). Online platforms and digital tools provide flexible learning options, both synchronous and asynchronous learning (Fabríz et al., 2021), which can accommodate diverse student needs and schedules. The recent findings show that digital technologies facilitate communication between students and instructors, as well as among peers significantly, enabling collaborative learning (Jakoet-Salie & Ramalobe, 2023). Digital resources often include interactive elements such as quizzes, simulations, and multimedia content, making learning more engaging and effective for students (Alenezi et al., 2023). Van Schoors, Elen, Raes, Vanbecelaere, and Depaepe (2023) state that digitalization of educational environment contributes to the creation of digital personalized learning experiences resulted in implementation of individual learning paths focused on the specific resources that a student needs to take to progress through an educational program. Digital tools are able to improve assessment processes, making them more objective, provide instant feedback to students and instructors (Baa & Minj, 2023; Jurāne-Brēmane, 2023). Additionally, digital technologies simplify routine administrative tasks such as registration, grading, and course management (Petrov et al., 2022). It is worth indicating that digitalization has the considerable potentials to transform teaching methods in higher education. Shaikh (2023) declares about the development of digital pedagogy that refers to the use of digital resources and technologies to improve teaching and learning practices. It involves integrating technology into educational strategies and approaches to create positive educational environment. Digital pedagogy emphasizes the importance of active learning (Chernova et al., 2023), student-centered approaches (Otto et al., 2024), and the integration of technology into the curriculum (Brooks et al., 2023).

### *Research Problem*

The contemporary system of higher education objectively necessitates the application of digital resources and technologies (Timotheou et al., 2023). Online platforms are available for facilitating the delivery of educational content, conducting the sessions, and organizing the assessment (Haleem et al., 2022). From the didactic perspective digital technologies are powerful tools that teachers can apply to improve the teaching-learning processes, and transform students’ learning experiences (Okoye et al., 2023). Digital resources and technologies are used to improve the classroom atmosphere make the educational process more compelling (Santoveña-Casal & López, 2024), and create engaging learning opportunities (Alenezi et al., 2023). According to Uzorka, Namara, and Olaniyan (2023), traditional teaching methods may supplement digital learning environment and then create new chances for student-centered learning contribute to the production of students’ knowledge (Otto et al., 2024). At the same time, digital resources and technologies assist evaluation, peer assessment, and self-assessment (Jurāne-Brēmane, 2023). Also, they enhance autonomous learning activities and develop self-education skills, motivating to pursue knowledge independently (Terzieva et al., 2021). Furthermore, Haleem,

Javaid, Qadri, and Suman (2022) state that the institutions of higher education gain greater flexibility and curriculum customization due to digital tools. Also, digitalization of the educational process is closely connected with development of students' professional performance, such as creativity, critical thinking, problem-solving collaboration, and adaptability (Morze et al., 2022; Panchenko et al., 2020). And the use of digital resources and technologies is aimed to form technical skills among students and so prepare future specialists for a more unpredictable and changing future in which technology will play a critical role (Hetmańczyk, 2023; Sanetra & Małodobry, 2022).

In the Ukrainian context, digitalization of higher education has been influenced by various factors, including technological infrastructure, government policies, and socio-economic conditions (Sibruk et al., 2023; Tokar et al., 2022). At present Ukrainian institutions of higher education have made significant progress in adoption of digital technologies and developing digital educational environment based on the experience of the leading countries (Binytska et al., 2022). This is mainly a result of European integration which influences Ukrainian educational policies, leading to the development of strategies and initiatives to promote digitalization in education (Ivanenko et al., 2023). For example, the European Union's Digital Education Action Plan has inspired similar initiatives in Ukraine to promote digital skills development and the use of digital technologies in education (Kharazishvili et al., 2021; Shatalova, 2023). Accordingly, this suggests that the use of digital resources and technologies has significantly improved Ukrainian education by enhancing access to educational materials, enabling interactive and personalized learning experiences, and fostering collaboration among students and teachers. Additionally, online learning tools allow for more flexible and self-paced learning, create immersive educational environment, and help students better understand complex concepts. Therefore, digital resources and technologies have transformed the educational landscape in Ukraine, making education more engaging and effective.

#### *Research Focus*

The theoretical framework of the problem establishes clearly that the research oriented towards the analysis of using digital resources and technologies for improvement of educational process in Ukraine is of critical importance since European integration and digitalization have led to significant changes in Ukrainian institutions of higher education, promoting innovation, improvement of educational process, and providing its continuity. Moreover, digital resources and technologies are extensively used to create the increased opportunities for formation of professional competence among students and prepare them to work in the rapidly evolving digital environment successfully and adapt to new technologies and trends. Quite understandably, incorporation of digital resources and technologies into the teaching practices brings enhanced engagement, personalized learning, collaboration, and increasing of productivity of the participants of educational process. At the same time, there is a need to explain the selection of digital resources and technologies by instructors and to investigate the patterns of their implementation within the educational environment of the Ukrainian institutions of higher education.

#### *Research Aim and Research Questions*

The aim of the research is to manifest the impact of digital resources and technologies on the educational process and to outline the aspects of their incorporation into teaching practices in the Ukrainian institutions of higher education.

The research addresses the following research questions:

- 1) What digital resources and technologies are used within the educational environment of the Ukrainian institutions of higher education?
- 2) What is the efficiency of digital resources and technologies applied and how they affect the educational process?
- 3) What are the techniques and strategies for using digital resources and technologies to enhance teaching and learning at the Ukrainian institutions of higher education?

## **Literature Review**

The problem of digitalization has become the subject of scientific and educational discourse since numerous studies and academic papers have been published on the impact of digitalization on education, covering topics such as the effectiveness of online learning (Hedzyk et al., 2023), the role of digital technologies in improving students' outcomes (Vasianovych et al., 2023), and the challenges and opportunities of digitalization in education (Bader et al., 2022). Ukrainian scholars define digitalization in higher education as refers to the process of integrating digital technologies and tools into all aspects of education, including teaching, learning, administration, and communication (Rossikhin et al., 2020). The framework of educational digitalization is based on several components: technological infrastructure (Tokar et al., 2022), digital content and resources (Vorotnykova, 2019), and technologies supporting and enhancing effective teaching and learning practices (Chernova et al., 2023).

Digital transformation in Ukrainian higher education is driven by the need to modernize education, improve its quality and meet the demands of the digital age. Another important aspect of digitalization of higher education in Ukraine deals with the necessity to harmonize the educational standards and cultivate the European values successfully (Ivanenko et al., 2023; Sanetra & Małodobry, 2022) that are closely related to the creation of develop a more inclusive, innovative, interconnected and sustainable European Higher Education Area (Bondarenko et al., 2021). Today's Ukrainian realities have proven that digital technologies are a unique mechanism for modeling the educational environment, because they offer an opportunity for rapid exchange of experience and knowledge, adaptation of online learning, its integration with offline learning, or development of digital libraries (Martynenko, 2023). Also, the special attention is paid to the significance of development of digital educational environment during full-scaled Russian-Ukrainian war (Galynska & Bilous, 2022; Sibruk et al., 2023) since it helps ensure continuity of learning through digital resources and technologies and establish positive collaboration between the participants of educational process.

Some works are related to the improvements of higher education due to application of digital tools. For examples, Sikora, Skorobahatska, Lykhodieieva, Maksymenko, and Tsekhmister (2023), studying digitization of the educational process, found that using of digital resources and technologies contributes to increasing of inclusiveness of education, its individualization, implementation of interdisciplinary approaches in teaching, and enhancement of professional development of future specialists. Some studies emphasize that digital tools integrated into the curriculum support, stimulate, and motivate students to learn (Zhorova et al., 2022). Also, the findings show that the implementation of digital tools within the educational process effectively is subject to certain requirements. Firstly, digitalization requires introduction of a new didactical approach. The findings of Abysova, Kravchuk, and Hurniak (2023) demonstrate that didacts oriented towards digital resources and technologies is designed to solve the problems of the delivery of educational content through innovative teaching methods, issues of self-education as a means of increasing the effectiveness of educational, and assessment of knowledge and skills and the level of students' readiness for professional activities. besides, the experienced and competent use of digital technologies requires the formation of institutions

of higher education with profound digital infrastructure (Tytova & Mereniuk, 2022) and development of digital competence among the participants of educational process (Chernenko, 2021; Ovcharuk & Ivaniuk, 2021).

It is necessary to mention that a number of researches deal with examination of improvements of future specialists' training using digital resources and technologies. Strutynska, Torbin, Umryk, and Vernydub (2021) analyzed the training of future teachers using computer, multimedia and computer-based learning tools and equipment such as cloud technologies, virtual reality (VR) and augmented reality (AR) tools, gamification, robotics, tools for learning 3D technologies, and MOOCs. Some findings concentrate on the effectiveness of the implementation of digital technologies in the educational process of Ukrainian medical universities (Vasianovych et al., 2023). Baranovska, Simkova, Akilli, Tarnavska, and Glushanytsia (2023) outline the development of digital education environment for training future philologists. Besides, digital resources and technologies positively affect the training of future IT specialists (Yefimenko, 2023), engineers (Oliynyk et al., 2020), and managers (Panchenko et al., 2020). Currently, the special focus is devoted to digitalization of military officers' training in Ukraine (Chmyr & Bhinder, 2023; Poltorak et al., 2021).

Digital transformation in Ukrainian higher education is, consequently, improve access to education, and contributes to the improvement of students' preparation for the challenges of the digital professional landscape. However, it was found that there are challenges such as infrastructure limitations, necessity to introduce digital pedagogy, and the need for continuous training and support for academic and pedagogical staff. These findings support the idea that the system of higher education in Ukraine is aimed at modernization through using of digital resources and technologies. As a result, this requires comprehensive analysis of the impact of digital tools upon the educational process and enhancement of future specialists training at the Ukrainian institutions of higher education.

## **Research Methodology**

### *General Background*

To answer the research questions, the descriptive study was applied that is based on the participants' behaviors, or perceptions of digital resources and technologies used. The study characterizes the current state of digitalization at the Ukrainian institutions of higher education and offers practical recommendations for creation of digital educational environment through using digital resources and technologies. To conduct the study the following methods were used: surveys to collect data from a large number of participants and describe their opinions or behaviors; observing and recording behaviors within the educational environment to describe classroom dynamics, teaching practices, or student interactions when digital resources and technologies are introduced; content analysis to describe the patterns of using of digital resources and technologies through interpretations of the content of educational materials, curriculum documents, or regulatory acts; semi-structured interviews to describe the participants' experiences, opinions, or perceptions; questionnaires to collect data from a large number of participants. Questionnaires were administered in person, by mail, and online.

The experiment was organized in four research tiers. The first tier involves describing the types of digital resources and technologies used within the educational process. The focus is on providing a comprehensive overview of the digital resources and technologies available and their features. The second tier concentrates on the context in which digital resources and technologies are being implemented, including the educational environment, the target audience (students, teachers, administrators), and the objectives of the implementation (improving students' learning outcomes,

providing the continuity of education). The tier three examines efficiency of digital resources and technologies used and evaluates the potentials of the educational process where digital tools are implemented. Tier four identifies the challenges and opportunities associated with the implementation of digital technologies in education. This includes the technical, pedagogical, and organizational challenges. Also, the tier describes the techniques and strategies for using digital resources and technologies to enhance the educational process at the Ukrainian institutions of higher education. It is obvious that conducting descriptive study on the role of digital resources and technologies for improvement of the educational process across the research tiers, researchers developed a comprehensive understanding of the problem in the context of Ukrainian institutions of higher education and identify areas for further research and improvement.

*Sample / Participants / Group*

The research was conducted among 43 instructors of Ukrainian institutions of higher education. The participants' selection was based on their relevance (experience or expertise related to digitalization in education) and diversity (gender, educational background, scientific degree, as well as factors related to level of digital competence). According to the Code of Ethics and all instructors provided the informed consent to participate in the research, meaning they are informed about the nature of the research, their rights as participants, and any potential risks or benefits of participation. Also, the researchers took all necessary measures to protect participants' rights throughout the research process and safeguard individuals' personal information ensuring that it is not misused or disclosed without their consent. Table 1 shows the demographics of survey participants.

**Table 1**

*Demographics of survey participants*

Descriptor	Sub-descriptor	Quantity
<b>Gender</b>	male	16
	female	27
<b>Role</b>	instructors	35
	methodologist	5
	technology specialists/head of laboratory	3
<b>Scientific degree</b>	Master	11
	PhD	28
	Doctor of Science	4
<b>Field of specialization</b>	Philology	6
	Education	7
	Psychology	4
	Business and management	6
	Law	5
	Engineering	5
	Politics	2
	Environmental science	3
	Information technology	5

<b>Previous experience with digital resources and technologies in education</b> (some participants may be involved in two or more activities)	use of online learning platforms	42
	creation of digital content	31
	use of VR and AR tools	4
	using adaptive learning technologies	7
	using data analytics tools	6
	using digital assessment tools	12
	implementation of blended learning	21
	application of interactive whiteboards and smartboards in classrooms	24
using of mobile learning	39	

Source: based on the survey results.

### *Instrument and Procedures*

To analyze digital resources and technologies that are used within the educational environment of the Ukrainian institutions of higher education, a close-ended questionnaire was applied. It consisted of 24 questions that required participants to select from predefined answer choices. This questionnaire enabled to collect quantitative data that was further analyzed and compared. However, the questionnaire included an "other" option with a text box for participants to provide additional information if their answer is not listed. It is worth mentioning that before administering the questionnaire, it was pilot tested with a small group of participants to identify the potential issues with understandings of questions or answer choices.

To assess the efficiency of digital resources and technologies applied within the educational process, the Technology Acceptance Model (TAM) was applied (Scherer et al., 2019; Su & Li, 2021). It is a theoretical framework that enabled to explain participants' perceptions of digital resources and technologies according to five core components: (1) perceived usefulness assesses productivity of educational tasks when using digital resources and technologies and achievement of learning objectives; (2) perceived ease of use analyzes the interaction with digital resources or technology; (3) attitudes towards using describes feeling when using digital resources or technology; (4) behavioral intention to use presents the frequency of using digital resources or technology and considers intentions to use them in future within the educational process; and (5) actual use evaluates the effectiveness of digital resources and technologies in supporting teaching and learning objectives or administrative functions. The participants assessed each component in 5-point scale. Then the average score of responses to questions were calculated to draw general picture of the efficiency of digital resources and technologies used in Ukrainian institutions of higher education.

To reveal the techniques and strategies for using digital resources and technologies within the educational process, classroom observations were implemented. Observers focus on how teachers use digital resources and technologies during a lesson. This suggests observing what digital resources or technology are used according to structured checklist which included twelve different options. Observers assessed the frequency of using digital resources and technologies according to 5-point scale. Further, observations were supported by semi-structured interviews to describe the participants' experiences and perceptions.

## Data Analysis

Descriptive statistics was used to explain the efficiency of digital resources and technologies within the educational process. It summarized and described the characteristics of data collected from the surveys, questionnaires, and observations. These statistics presented the central tendency, variability, and distribution of the data. Also, the researchers were able to provide the summary of instructors' perceptions of the use of different digital resources and technologies while training future specialists at Ukrainian institutions of higher education as well as the techniques and strategies for using digital resources and technologies within the educational process.

### Research Results

*What digital resources and technologies are used within the educational environment of the Ukrainian institutions of higher education?*

The results of the questionnaire showed that instructors at the Ukrainian institutions of higher education use digital resources and technologies extensively. The responses demonstrated that most often they apply Google Docs to collaborate multiple users on a single document in real-time, to create a user-friendly interface, and to share documents with others and publish them to the web. Other items include educational videos, educational apps for smartphones and tablets, open educational resources, online courses, and online assessment quizzes. At the same time, the survey demonstrated that VR and AR applications, AI tools, learning analytics tools, and adaptive learning platforms are used less frequently within the educational process since they demand special digital skills and advanced training for instructors to create digital content. Table 2 shows the use of digital resources and technologies within the educational process of the institutions of higher education in Ukraine.

**Table 2**

*The use of digital resources and technologies*

Digital resources and technologies	Quantity				
	Always	Often	Sometimes	Rarely	Never
Educational apps for smartphones and tablets	9	13	14	5	2
Digital textbooks	5	10	18	6	4
Google Docs	12	20	1	0	0
Podcasts	2	8	22	7	4
Open educational resources	6	14	16	6	1
Educational videos	10	29	4	0	0
Interactive whiteboard resources	4	17	15	4	3
Online courses resources	6	15	18	3	1
Online assessment quizzes	5	20	14	4	0
Online subject-based tests	7	18	16	1	1

<b>Learning Management Systems</b>	1	14	18	7	3
<b>Educational software for certain disciplines</b>	7	12	22	2	0
<b>VR and AR applications</b>	2	8	15	10	8
<b>Educational games</b>	6	13	20	3	1
<b>Simulations</b>	4	13	17	6	3
<b>Video conferencing tools for virtual classrooms</b>	5	15	19	4	0
<b>Online course platforms</b>	2	9	18	9	5
<b>Adaptive learning platforms</b>	0	4	15	18	6
<b>Online tutoring services</b>	2	8	17	9	7
<b>Online academic journals and databases</b>	2	11	16	10	4
<b>Artificial intelligence (AI) tools</b>	0	3	20	15	5
<b>Learning analytics tools</b>	0	7	18	16	2
<b>Communication tools</b>	8	24	11	0	0
<b>Presentation software</b>	7	23	10	3	0

Source: based on the survey results.

*What is the efficiency of digital resources and technologies applied and how they affect the educational process?*

The efficiency of digital resources and technologies was assessed according to 5 TAM components: perceived usefulness, perceived ease of use, attitudes towards using, behavioral intention to use, and actual use. Average calculated index showed that Google Docs (25 points), communication tools (25 points), educational apps for smartphones and tablets (24 points), Learning Management systems (23 points), educational games (23 points), presentation software (23 points), online assessment quizzes (22 points), online academic journals and databases (22 points), AI tools (22 points) are the most effective. Also, the participants' responses enabled to reveal digital resources and technologies that are perceived as less effective. They include the following: open educational resources (18 points) and podcasts (12 points). The instructors explain that the quality, including accuracy, relevance, and currency, and accessibility can significantly impact their effectiveness. Table 3 shows the assessment of the use of digital resources and technologies within the educational process according to TAM components.

**Table 3***Assessment of the use of digital resources and technologies*

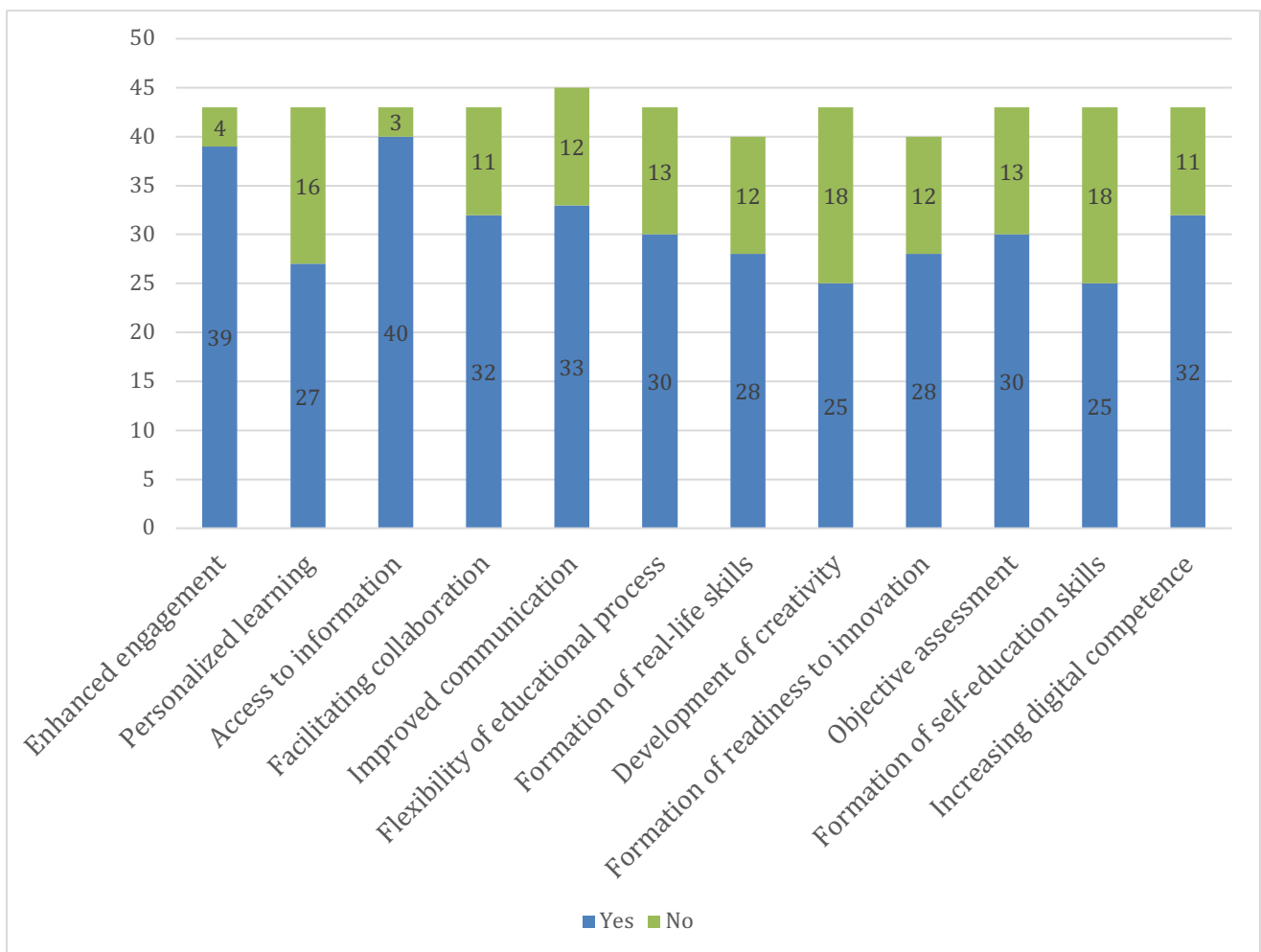
Digital resources and technologies	TAM components					TOTALLY
	Perceived usefulness	Perceived ease of use	Attitudes towards using	Behavioral intention to use	Actual use	
<b>Educational apps for smartphones and tablets</b>	4	5	5	5	5	24
<b>Digital textbooks</b>	4	3	4	4	3	16
<b>Google Docs</b>	5	5	5	5	5	25
<b>Podcasts</b>	3	2	3	2	2	12
<b>Open educational resources</b>	4	3	4	3	3	18
<b>Educational videos</b>	4	4	4	4	4	20
<b>Interactive whiteboard resources</b>	4	5	4	4	4	21
<b>Online courses resources</b>	4	3	4	4	4	19
<b>Online assessment quizzes</b>	4	4	4	5	5	22
<b>Online subject-based tests</b>	4	4	4	4	5	21
<b>Learning Management Systems</b>	5	4	4	5	5	23
<b>Educational software for certain disciplines</b>	4	4	4	5	5	22
<b>VR and AR applications</b>	4	3	5	4	4	20
<b>Educational games</b>	5	4	5	5	4	23
<b>Simulations</b>	4	5	5	5	5	24
<b>Video conferencing tools for virtual classrooms</b>	4	4	4	5	4	21
<b>Online course platforms</b>	4	4	4	4	4	20
<b>Adaptive learning platforms</b>	4	3	4	4	4	19
<b>Online tutoring services</b>	4	4	4	4	4	20

<b>Online academic journals and databases</b>	4	4	4	5	5	22
<b>Artificial intelligence (AI) tools</b>	5	5	4	4	4	22
<b>Learning analytics tools</b>	4	4	4	5	4	21
<b>Communication tools</b>	5	5	5	5	5	25
<b>Presentation software</b>	4	5	5	4	5	23

Source: based on the survey results

**Figure 1**

*Effects of the use of digital resources and technologies*



Source: based on the survey results

Additionally, instructors were interviewed about the effects of using digital resources and technologies within the educational process. The results showed that integration of digital tools into the curriculum brings a number of advantages and improves the educational process significantly. The survey participants answered that these benefits include the following: enhanced students' engagement, organization of personalized learning and building individual learning paths, access to education information through a variety of formats (video, multimedia, 3D visualization, etc.), facilitating

collaboration, improved communication, flexibility of the educational process, formation of real-life skills, development of creativity, formation of readiness to innovation, implementation of objective assessment, formation of self-education skills and preparation of students to lifelong learning, and increasing digital competence necessary for successful professional activity within digital environment. Figure 1 shows the analysis of effects of the use of digital resources and technologies within the educational process according to respondents.

*What are the techniques and strategies for using digital resources and technologies to enhance teaching and learning at the Ukrainian institutions of higher education?*

The analysis of techniques and strategies for incorporation of digital resources and technologies is important since it helps determine which ones are most effective and understanding their strengths and weaknesses when building the educational process. Besides, effective techniques and strategies contribute the evolving landscape of digital technologies and allow instructors to identify innovative approaches and best practices. The survey results show that demonstration, collaborative learning, problem-based learning, project-based learning, and digital games are most frequently used within the educational process. To compare, instructors stated that they use interactive lecture, peer learning, and simulation-based learning less frequently. Table 4 shows the analysis the techniques and strategies used when digital resources and technologies are incorporated into the educational process.

**Table 4**

*Techniques and strategies for incorporation of digital resources and technologies*

Techniques and strategies	Quantity				
	Always	Often	Sometimes	Rarely	Never
<b>Demonstration</b>	12	19	8	4	0
<b>Guided practice</b>	8	18	12	5	0
<b>Collaborative learning</b>	11	20	11	1	0
<b>Problem-based learning</b>	4	15	12	9	3
<b>Interactive lecture</b>	2	18	13	6	4
<b>Online discussion</b>	4	13	17	9	0
<b>Peer teaching</b>	0	8	23	8	6
<b>Project-based learning</b>	5	12	16	9	1
<b>Digital games</b>	1	14	18	7	3
<b>Simulation-based learning</b>	2	11	20	12	8
<b>Feedback</b>	2	15	17	6	3
<b>Assessment</b>	10	12	9	8	4

Source: based on the survey results.

At the same time, the survey focused on the investigation of advantages and disadvantages of techniques and strategies used to incorporate digital resources and technologies within the educational process. The respondents' answers prove that all the techniques and technologies are advantageous and may enhance using of digital resources and technologies. The choice of techniques and strategies depends on the course or lesson, educational objectives, students' needs, and possible challenges which instructors may face. Additionally, the choice of digital resources and technologies is intentional and

based on a careful consideration of instructors when their plan the educational process. Table 5 shows advantages and disadvantages of techniques and strategies for incorporation of digital resources and technologies.

**Table 5**

*Analysis of advantages and disadvantages of techniques and strategies for incorporation of digital resources and technologies*

Techniques and strategies	Advantages	Disadvantages
<b>Demonstration</b>	<ul style="list-style-type: none"> <li>1) clarity of educational material;</li> <li>2) enhanced engagement;</li> <li>3) accessible educational materials for students;</li> <li>4) effective in a large group.</li> </ul>	<ul style="list-style-type: none"> <li>1) mostly a passive learning activity;</li> <li>2) limited interaction;</li> <li>3) not effective for improvement of practical skills;</li> <li>4) decreased focus during a demonstration.</li> </ul>
<b>Guided practice</b>	<ul style="list-style-type: none"> <li>1) practical skills development;</li> <li>2) immediate feedback;</li> <li>3) use of engaging activities;</li> <li>4) learning is tailored to individual students' needs;</li> <li>5) encouragement of collaboration.</li> </ul>	<ul style="list-style-type: none"> <li>1) time-consuming;</li> <li>2) limitations of students' ability to explore and experiment;</li> <li>3) dependence on the teacher;</li> <li>4) difficult to implement in larger groups of students.</li> </ul>
<b>Collaborative learning</b>	<ul style="list-style-type: none"> <li>1) enhanced engagement;</li> <li>2) improved communication skills through online discussions, chats, and collaborative projects;</li> <li>3) enabling easy sharing of resources;</li> <li>4) formation of problem-solving skills;</li> <li>5) encouragement of social interactions.</li> </ul>	<ul style="list-style-type: none"> <li>1) technical problems, such as connectivity issues or software glitches;</li> <li>2) unequal participation;</li> <li>3) lack of individual accountability;</li> <li>4) distractions lead to a loss of focus and reduced productivity.</li> </ul>
<b>Problem-based learning</b>	<ul style="list-style-type: none"> <li>1) formation of practical skills;</li> <li>2) development of critical thinking;</li> <li>3) promotion of collaboration among students;</li> <li>4) development of information literacy;</li> <li>5) improvement of technical skills;</li> <li>6) development of creativity.</li> </ul>	<ul style="list-style-type: none"> <li>1) time-consuming;</li> <li>2) assessment challenges;</li> <li>3) possible technical problems;</li> <li>4) dependency on technology.</li> </ul>
<b>Interactive lecture</b>	<ul style="list-style-type: none"> <li>1) interactive and engaging content;</li> <li>2) immediate feedback;</li> <li>3) digital lectures can be recorded and shared online;</li> <li>4) multimedia integration.</li> </ul>	<ul style="list-style-type: none"> <li>1) Digital technologies can be distracting, leading to reduced focus and attention during the lecture;</li> <li>2) technical issues disrupt the flow of the lecture;</li> </ul>

		3) lack of personal interaction.
<b>Online discussion</b>	1) encouraged participation; 2) flexibility of educational process; 3) facilitating interactions among students from diverse backgrounds and locations.	1) lacking the nonverbal tools; 2) dependence on digital technologies; 3) text-based nature; 4) difficulty in building relationships.
<b>Peer teaching</b>	1) improved understanding; 2) enhanced engagement; 3) promotion of collaboration; 4) building communication skills; 5) enrichment of the learning process.	1) students may not have the same level of expertise or knowledge as the instructor; 2) lack of feedback; 3) Requiring additional time; 4) spread of misconceptions and confidence issues.
<b>Project-based learning</b>	1) enhanced engagement; 2) formation of practical skills; 3) development of creativity; 4) facilitating feedback.	1) dependence on digital technologies; 2) time-consuming; 3) assessment challenges.
<b>Digital games</b>	1) increased students' engagement and motivation; 2) development of a variety of skills, including problem-solving, critical thinking, and collaboration; 3) adaptation to individual students' learning styles and abilities; 4) immediate feedback; 5) cost-effectiveness.	1) addiction to games; 2) limited content that does not cover all aspects of a subject; 3) overemphasis on entertainment.
<b>Simulation-based learning</b>	1) formation of realistic educational environment; 2) providing a safe environment to experiment; 3) active participation in the education process; 4) development of a variety of skills; 5) immediate feedback; 6) effective for remote learning.	1) high-quality simulations are costly; 2) prone to technical issues; 3) having a limited scope.
<b>Feedback</b>	1) timely feedback; 2) customized feedback; 3) use of multimedia elements.	1) lack of personalization; 2) dependence on digital technologies; 3) misinterpretation; 4) lack of emotional connection.

<b>Assessment</b>	<ul style="list-style-type: none"> <li>1) providing flexibility for students to complete assessments at their own pace and convenience;</li> <li>2) immediate feedback;</li> <li>3) automated scoring;</li> <li>4) enhanced security measures.</li> </ul>	<ul style="list-style-type: none"> <li>1) prone to technical issues;</li> <li>2) may still be susceptible to cheating;</li> <li>3) lack of personalization.</li> </ul>
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*Source:* based on the survey results.

Therefore, it is important to note that digital resources and technologies contribute to improvement of the educational process significantly. Considering a number of digital tools available in education, it is necessary to select the most efficient ones on the basis of their functions, educational objectives, and students' needs. More importantly, the information on challenges of digital resources and technologies must be regarded to optimize the educational process at the institutions of higher education.

## Discussion

The research oriented towards the assessment of the impact of digital resources and technologies on the educational process is especially important since they improve the educational process through creation of interactive and engaging learning experiences (Haleem et al., 2022), facilitation of collaboration and communication among students and instructors (Morze et al., 2022; Panchenko et al., 2020), and personalize learning experiences (Van Schoors et al., 2023). At the same time, incorporation of digital resources and technologies into the curriculum contribute to the formation of professional competence offering various tools and platforms for practical skills development (Vasianovych et al., 2023, Yefimenko, 2023; Oliynyk et al., 2020). Additionally, digital resources and technologies are used to simulate real-life scenarios and challenges, providing professionals with opportunities to develop problem-solving and critical thinking skills in a safe and controlled environment (Alenezi et al., 2023).

The survey results showed that digital resources and technologies are extensively used within the educational process at the Ukrainian institutions of higher education. It was found that Google Docs, educational videos, educational apps for smartphones and tablets, open educational resources, online courses, and online assessment quizzes are most frequently used. Recent findings on the problems of using digital tools in higher education prove this idea and show that Learning Management Systems platforms (such as Moodle, Blackboard, and Canvas) (Rüdolf & Daniela, 2021), online libraries, digital textbooks (Alenezi et al., 2023), virtual conferences, and simulation-based software (Juera, 2024) are widely used for delivering online content, organizing course materials, and facilitating communication between students and instructors.

Currently, more scholars focus on studying VR applications and AI tools in higher education (Chmyr & Bhinder, 2023; Predescu et al., 2023). These technologies immerse students in the virtual educational environment that simulate real-life scenarios, allowing them to explore concepts and practice skills in a simulated setting. This is particularly beneficial for subjects that require practical learning, such as science and engineering. Also, AI tools contribute to personalization of students' learning experiences, analyze educational data and recommend personalized educational materials. A number of findings prove that VR and AI-based technologies have the potential to transform the system of higher education by making learning more engaging, interactive, and target-oriented. According to the participants' answers, VR and AR applications, AI tools, learning analytics tools, and adaptive

learning platforms are used less frequently at the Ukrainian institutions of higher education. Instructors think that these tools demand special digital skills and advanced training to create digital content.

The special attention is paid towards the incorporation of digital resources and technologies into the curriculum to enhance the educational process. According to Brooks, Møller, and Schurer (2023), digital tools help develop curriculum materials, organize assessments, and demonstrate educational resources during interactive lectures. Mintii (2023) considers that combining of traditional face-to-face instruction with online learning activities, such as flipped classrooms, allows for flexibility in learning and increasing students' engagement and motivation. The survey on the implementation of digital resources and technologies shows that demonstration, collaborative learning, problem-based learning, project-based learning, and digital games are effective within the educational process and assist to improve the professional training of future specialists. Other techniques and strategies used for incorporation of digital resources and technologies include: interactive lecture, peer learning, and simulation-based learning.

Studying the advantages of using digital resources and technologies, it was found that they contribute to collaboration and communication among students, preparing students for future careers that will require digital literacy skills, and streamline administrative tasks for instructors. The survey showed that digital resources and technologies bring some advantages within the educational process and their choice depends on the educational objectives and institution's digital infrastructure. This coincides with the recent findings of Alenezi, Wardat, and Akou (2023) which demonstrate benefits of digitalization in higher education. At the same time, the analysis of challenges of digital resources and technologies is important for organization of efficient educational process and avoid possible errors while teaching and learning.

Therefore, the educational process is heavily dependent on using of digital resources and technologies. In today's digital age, digital tools have become integral to the educational process, transforming how students learn, instructors teach, and educational materials are delivered. The survey of using digital resources and technologies for improvement of educational process in Ukraine demonstrates that Ukrainian institutions of higher education extensively integrate digital tools and improve their digital infrastructure despite of the existing challenge. For instance, the Ministry of Education and Science has implemented digital literacy programs for students and instructors to ensure they are proficient in using digital resources and technologies within the educational process (Ovcharuk & Ivaniuk, 2021; Stoika, 2023). Besides, the government is investing in digital tools for the educational institutions, including online platforms, educational apps, and digital textbooks (Binytska et al., (2022)). The special efforts are made towards development of digital pedagogy and implementation of teaching strategies to use digital resources and technologies effectively (Tverdokhliebova & Yevtushenko, 2023). According to participants' answers, digital pedagogy has the potential to transform the educational environment and approximate it to international standards. Also, the instructors state that digital resources and technologies are very important during emergencies to maintain the continuity of educational process.

## **Conclusions and Implications**

Digitalization is essential for training future specialists to meet the demands of the modern labor market as it equips them with digital skills and competencies necessary for professional activity. It enhances learning experiences through interactive and multimedia-rich content, preparing students for the digitalized nature of modern workplaces. Implementation of digital resources and technologies has

revolutionized higher education by enhancing accessibility and efficiency. Online platforms and digital tools provide flexible learning options, which can accommodate diverse student needs and schedules. The recent findings show that digital technologies facilitate communication between students and instructors, enabling collaborative learning. Digital tools are able to improve assessment processes, making them more objective, provide instant feedback to students and instructors. Additionally, digital technologies simplify routine administrative tasks.

In the Ukrainian context, digitalization of higher education has been influenced by various factors, including technological infrastructure, government policies, and socio-economic conditions. At present Ukrainian institutions of higher education have made significant progress in adoption of digital technologies and developing digital educational environment based on the experience of the leading countries. It was found that digital transformation in Ukrainian higher education is driven by the need to modernize education, improve its quality and meet the demands of the digital age. Another important aspect of digitalization of higher education in Ukraine deals with the necessity to harmonize the educational standards and cultivate the European values successfully that are closely related to the creation of develop a more inclusive, innovative, interconnected and sustainable

The findings showed that instructors at the Ukrainian institutions of higher education use digital resources and technologies extensively. The responses demonstrated that most often they apply Google Docs to collaborate multiple users on a single document in real-time, to create a user-friendly interface, and to share documents with others and publish them to the web. Other items include educational videos, educational apps for smartphones and tablets, open educational resources, online courses, and online assessment quizzes. At the same time, the survey demonstrated that VR and AR applications, AI tools, learning analytics tools, and adaptive learning platforms are used less frequently within the educational process since they demand special digital skills and advanced training for instructors to create digital content.

Besides, average calculated index showed that Google Docs, communication tools, educational apps for smartphones and tablets, Learning Management systems, educational games, presentation software, online assessment quizzes, online academic journals and databases, AI tools are considered to be the most effective. Also, the participants' responses enabled to reveal open educational resources and podcasts as less effective. The instructors explain that the quality, including accuracy, relevance, and currency, and accessibility can significantly impact their effectiveness.

Instructors answered that digital resources and technologies are characterized by a number of advantages oriented towards improvement of educational process. They include the following: enhanced students' engagement, organization of personalized learning and building individual learning paths, access to education information through a variety of formats, facilitating collaboration, improved communication, flexibility of the educational process, formation of real-life skills, development of creativity, formation of readiness to innovation, implementation of objective assessment, formation of self-education skills and preparation of students to lifelong learning, and increasing digital competence necessary for successful professional activity within digital environment.

It was found that digital resources and technologies are incorporated within the educational process through a number of techniques and strategies which determine which tool is most effective and understand its strengths and weaknesses. The survey results show that demonstration, collaborative learning, problem-based learning, project-based learning, and digital games are most frequently used within the educational process. At the same time, instructors stated that they use interactive lecture, peer learning, and simulation-based learning less frequently. Obviously, the choice

of techniques and strategies depends on the course or lesson, educational objectives, students' needs, and possible challenges which instructors may face. Additionally, the choice of digital resources and technologies is intentional and based on a careful consideration of instructors when they plan the educational process.

The study outcomes can be used to elaborate funding decisions related to the integration of digital resources and technologies at the institutions of higher education while preparing the documents for the research grant. Also, the findings can influence the curriculum development and help instructors integrate digital technologies into their teaching practices. Importantly, the research results can contribute to teachers' professional development and become the basis for training programs oriented towards formation of digital skills among academic and pedagogical staff.

### *Suggestions for Future Research*

The future research related to the implementation of digital resources and technologies within the educational process at the Ukrainian institutions of higher education could focus on several key areas to enhance their effectiveness and impact on teaching and learning. Firstly, the research could explore the impact of digital technologies on students' engagement and learning outcomes. This could include investigating how the use of digital resources and technologies affects students' motivation, and participation. Secondly, the research could examine the role of professional development in supporting educators in integrating digital technologies into their teaching practices. This could involve the assessment of the effectiveness of training programs and outlining best practices for supporting instructors in developing their digital competence. And thirdly, the research could investigate the availability and accessibility of digital infrastructure of the Ukrainian institutions of higher education. This could include the analysis of availability of various technical aids like computers, multimedia projectors, interactive whiteboards, etc., internet connectivity, and educational software. The special attention must be paid towards the investigation of the barriers of using digital resources and technologies, in particular lack of special training, privacy and security concerns, technical issues, pedagogical challenges, and resistance to innovations. The study of the barriers of using digital resources and technologies requires a comprehensive approach that development of theoretical framework and model for creation of optimal educational environment by means of digital resources and technologies. Additionally, the future studies could explore the impact of digital resources and technologies on development of innovative pedagogical approaches, such as flipped classrooms and project-based learning, that may contribute to improvement of educational process significantly.

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The survey was conducted according to the Code of Ethics and all instructors provided the informed consent to participate in the research. Also, during the research all necessary measures were taken to protect participants' rights and safeguard their personal information ensuring that it is not misused or disclosed without their consent.

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None

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