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Digital Transformation in Education: Using Technologies for Enhancement of Efficiency of Teaching

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Abstract: Digital transformation has an important role as it revolutionizes teaching and learning, offering access, engagement, and personalized instruction. The aim of the research is to evaluate the role of digital transformation within the Ukrainian educational institutions and to reveal its potentials towards enhancement of teaching efficiency. To answer the research questions the mixed methodology approach was applied that offers in-depth examining the role of digital transformation in education. The methods included literature review, content analysis, interviews, and observations, t-test, statistical analysis, modeling, and thematic analysis. Over 40 recent scientific works were chosen to study the problem from the conceptual dimension and organize accurate empirical survey. The investigation involved 48 instructors and 93 bachelor students from four Ukrainian educational institutions. The results showed that integrating digital tools within the educational environment can enhance the teaching efficiency since digitalization enables accessibility to educational materials and personalized learning. The special attention was paid towards instructors and students' perceptions of digital transformations in education. The results found that digital educational process was described as dynamic, interactive, flexible, innovative, technology-enhanced, and motivating. The Ukrainian context create special conditions for digital transformations at the educational institutions. Also, the recommendations to implement digital transformations in education to enhance the efficiency of teaching based on instructors and students' responses were developed during the research. It was found that the implementation of digital transformations requires a comprehensive approach that addresses the conceptual, organizational, methodical, and content levels. The findings can be applied within the educational institutions to improve the efficiency of teaching through digital tools.

Keywords: digitalization, digital tools, educational environment, educational institutions, opportunities, prospective dimensions, recommendations, levels.

Introduction

The advent of computing has triggered a significant digital transformation revolutionizing economy and social life in the last 20 years. Digitalization facilitates the efficient storage, transmission, and manipulation of data, enabling unprecedented levels of connectivity (Luo, 2022), and innovation across industries (Rachinger et al., 2019). The experience of developed countries shows that digitalisation delivers a positive impact on economic development including the increase of labour productivity and fostering entrepreneurship. Additionally, digitalisation enables transparency and reduction of the shadow economy (Galindo-Martín et al., 2023; Ghazy et al., 2022). By digitizing information, organizations can streamline operations, reduce costs, and enhance decision-making capabilities (Martínez-Peláez et al., 2023). Moreover, digitalization drives technological advancements bringing competitive advantage (Radicic & Petković, 2023), improves healthcare (Stoumpos et al., 2023) and environmental sustainability (Charfeddine & Umlai, 2023). According to Mikhaylovskaya (2024), the existing digital tools offer the opportunities to strengthen democracy and creation of open society.

Digital transformation of the educational process is of paramount importance in contemporary technology-driven world. This is very important given that the quality education is one of the fundamental components of the United Nations' sustainable development 2030 agenda that is oriented towards creation of inclusive and equitable educational environment (Adenle et al., 2023). And digital technologies have considered as essential instruments to achieve this goal. In 2019, the global e-learning market surpasses $200 billion in value. The learning management systems (LMS) generated almost $18 billion the same year (Statista, 2019). Currently, digital technologies serving as the foundation for e-education delivery and transformation of traditional learning models have been widely adopted across

various sectors, including school education (Rice & Ortiz, 2021), higher education (Díaz-García et al., 2022), corporate training (Barile et al., 2023). Also, digitalization has affected professional development and lifelong learning by offering flexible, accessible, and personalized learning opportunities tailored to the needs of professionals across various industries (Garzón Artacho et al., 2020; Vekić-Kljaić & Mlinarević, 2022).

Digitalization, therefore, has profoundly transformed education by increasing accessibility, personalization, collaboration, interactivity, and global connectivity (Alenezi et al., 2023; Haleem et al., 2022). A number of scholars associate digitalization mainly with access to information and resources, and thereby it offers diverse formats for accessing information, including text, audio, video, images, and interactive multimedia (Timotheou et al., 2023). Besides, digital transformation enables personalized learning experiences tailored to individual students' needs, preferences, and learning styles (Schmid & Petko, 2019). Adaptive learning platforms, educational software, and LMS use algorithms to analyze student data, provide personalized recommendations, adaptive exercises, and targeted interventions, optimizing the learning process and catering to diverse learning needs (Tharalson et al., 2023). Digital tools facilitate collaboration and communication among students and educators, create interactive and engaging learning experiences through multimedia content, simulations, VR, and gamified learning platforms (Gopinathan et al., 2022). In addition, digitalization enables flexible learning modalities such as online learning, blended learning (Rice & Ortiz, 2021), and flipped classrooms (Shikha & Baliya, 2023). The recent findings show that digitalization has significant implications for assessment practices in education (Haipinge et al., 2022; Jurāne-Brēmane, 2023) through automated and adaptive testing, immediate feedback, and assessment data analysis.

The COVID-19 pandemic has accelerated the shift towards digital education, with many educational institutions being forced to switch to remote and hybrid teaching models (Bustamante et al., 2022). Digital transformations were rapidly implemented to ensure continuity of learning despite social distancing measures (Gopinathan et al., 2022; Vekić-Kljaić & Mlinarević, 2022). Educators experimented with innovative pedagogical approaches and learning experiences enabled by digital technologies. Virtual field trips, simulations, gamified lessons, collaborative projects, and experiential learning activities engaged students within the interactive learning environment enhancing the efficiency of teaching (Farzana, 2023). At present, the prospects for e-learning are highly promising, caused by various factors that indicate its continued growth and expansion in the coming years. According to Global e-learning strategic analysis report 2023 (Research and Markets, 2023), e-learning market to reach $686.9 billion by 2030 and Virtual Reality (VR) technologies will bring e-learning to a new level in the improvement of educational processes, providing the concrete and measurable results.

Therefore, digital transformation in education has an important role as it revolutionizes teaching and learning, offering great opportunities for access, engagement, and personalized instruction. Using a number of digital tools, the educational institutions can overcome the barriers of traditional teaching, creating technology-enhanced collaborative environment and incorporating flexible instructional models. Since digitalization enhances students' engagement and motivation within the interactive, multimedia-rich educational environment, it contributes to preparing students for the demands of the digital age, fostering their critical thinking, collaboration, and digital literacy skills. Then digital transformation may enhance the efficiency of teaching and make learning easier. This requires a more detailed analysis of the role of digitalization in education as well as its tools used to improve the educational process.

Research Problem

In the context of the research, digitalization means changes in many spheres, in education in particular, where teaching and learning practices are moving from face-to-face meetings to more distant and algorithm-based ways to operate (Armila et al., 2022). Digital technologies have brought significant changes in education and made education systems worldwide adopt applicable approaches and strategies for information and communication technologies (ICT) integration (Timotheou et al., 2023). The emergence of the decisive innovations such as smart devices, Artificial Intelligence (AI), simulations, VR, augmented reality (AR), blockchain, and interactive software applications have brought new opportunities for fostering teaching and learning (Lakshmi et al., 2023; Rueda Márquez de la Plata et al., 2023).

At the same time, a successful digital transformation in education requires that educational institutions develop a clear vision and establish strong leadership support to driving change or fostering a culture of innovation (Niță & Guțu, 2023). Besides, integrating digital technologies into the curriculum is necessary because students need to develop digital literacy skills, technological proficiency, and 21st-century competencies to carry out professional activities (Alenezi et al., 2023). The findings show it helps create flexible educational environment (Haleem et al., 2022) contributing to the development of students' knowledge curiosity, creativity, and active engagement, enhancing their learning experiences and outcomes. It is obvious that digitalization enables personalize instruction (Schmid & Petko, 2019), expands the access to diverse learning resources (Timotheou et al., 2023), promotes teamwork and communication (Farzana, 2023). Using digital technologies in education is essential for building innovative, inclusive, and impactful educational process that empowers students inside and outside of the classroom and creates independent, proactive learners (Chai et al., 2023) who are able to establish straightforward professional goals and maximize their learning potentials.

Research Focus

Digitalization of education becomes an imperative for reforming the education sector in Ukraine since it addresses longstanding challenges and brings new opportunities for educational advancement. Currently, a number of works of Ukrainian scholars and educators are devoted to implementation of digital tools within the educational process. The findings show digitalization expands access to quality education (Ivanenko et al., 2023) and enhances teaching and learning practices by fostering innovation, engagement, and personalized learning (Sikora et al., 2023). The educational institutions transferring to the innovative educational environment, where online learning or blended learning models are extensively applied (Osadcha et al., 2022), build e-platforms and integrate external applications into their systems promptly, particularly in the emergencies (Opanasenko & Novikova, 2022). Importantly, digital tools enrich instructional delivery, enabling teachers to design interactive, multimedia-rich lessons, personalized learning pathways, and collaborative learning activities (Toziuk et al., 2022). Therefore, it is necessary to outline the opportunities digital transformation bring within the educational process. Also, to uncover the problem of digital transformations in education, the factors influencing the use of digital tools should be described.

Research Aim and Research Questions

The aim of the research is to evaluate the role of digital transformation within the Ukrainian educational institutions and to reveal its potentials towards enhancement of efficiency of teaching.

Accordingly, the aim was guided by the following *research questions*:

RQ1: What opportunities do digital transformation bring within the educational process?

RQ2: What factors influence the use of digital tools in education in the Ukrainian context?

RQ3: What are the perspective directions for digital transformations to enhance the efficiency of teaching?

Research Methodology

General Background

To answer the research questions the mixed methodology approach was applied that offers in-depth examining the role of digital transformation in education. By combining quantitative and qualitative data collection and analysis methods, the researchers gained a comprehensive understanding of the complex phenomenon of digital transformation in education. Quantitative methods enabled to assess the impact of digital transformation on educational outcomes, while qualitative methods provided comprehensive analysis into the experiences and perceptions of the participants of educational process when using digital tools.

The methods included literature review (to understand the current theories, and concepts related to digital transformations in education); content analysis (to examine pedagogical practices and to describe the use of digital tools within the educational process); interviews (to explore individuals' experiences, perspectives, and practices related to digital transformations in education); and observations (to analyse classroom dynamics and interactions related to the integration of digital technologies in education). Other methods involved the following: t-test (to compare the results of two groups and to reach a single decision on the use of digital tools in the educational process); statistical analysis (to quantify the impacts of digital transformations on various educational outcomes); modeling (to explore the potential impacts of digitalization aimed at promoting digital transformations at the educational institutions); and thematic analysis (to study the diverse perspectives and practices related to digital transformations, identifying efficient patterns).

The combined used of methods allowed to investigate the contextual factors influencing the implementation of digital transformation initiatives in education to conduct a comprehensive evaluation of the research problem. The quantitative and qualitative methods enable the researchers to contribute to advancements in educational theory related to digital transformation the Ukrainian educational institutions.

Sample / Participants / Group

The investigation involved 48 instructors and 93 bachelor students from four institutions of higher education in Ukraine. They participated according to the Ethical Guidelines on the principles of obtaining informed consent, protecting confidentiality, and ensuring voluntary participation in research activities. The instructors represented different specializations such as Law (4), Information Technologies (10), Foreign languages (13), Economics and management (10), Mechanics (6), and Healthcare (5) (Figure 1).

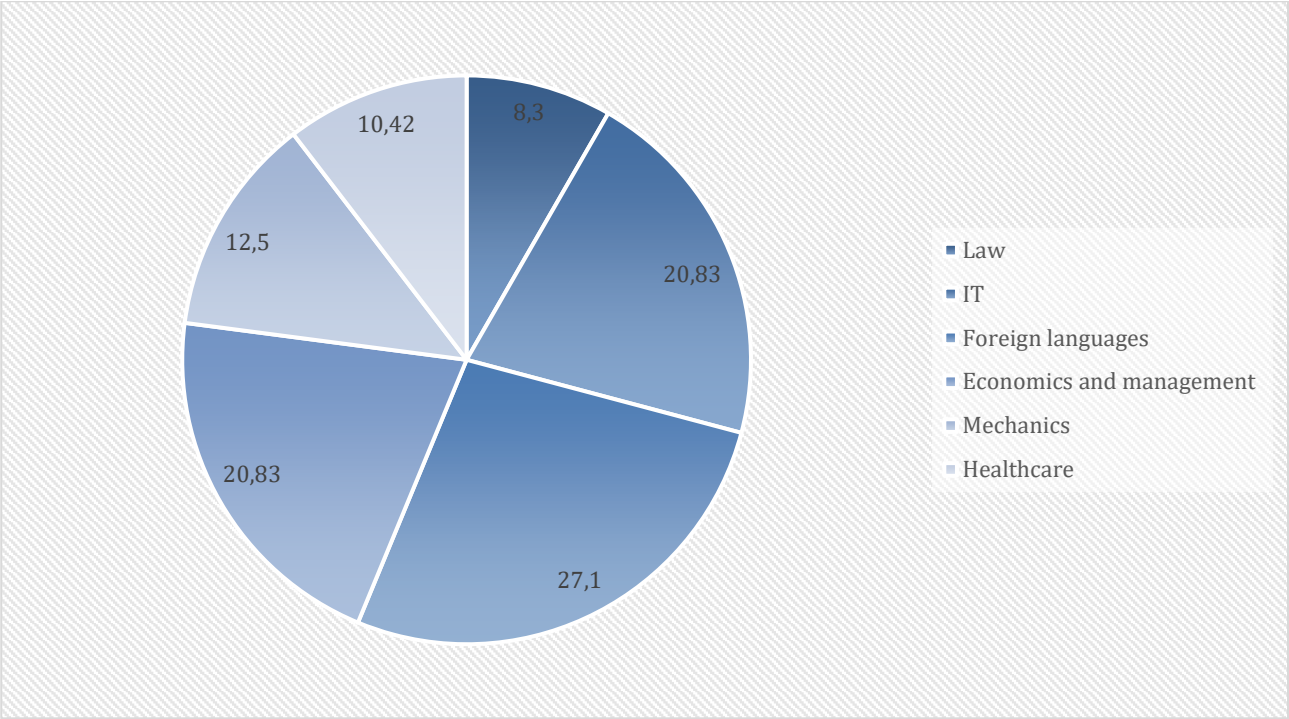

Figure 1. The distribution of instructors according to the specialization and departments.

Source: *authors' own development.*

93 bachelor students studied in different educational programs which included: "Theory and methodology of teaching of foreign language" (10), "Foreign literature and the English language" (9), "The Ukrainian and English languages: translation and editing" (7), "Software engineering" (6), "Technologies of Artificial Intelligence" (5), "Project management" (9), "Economics and economy policy" (11), "Accounting" (9), "Law" (12), "Automated and robotic mechanical systems" (7), "Construction and design of machines" (3), "Medicine" (4), "Medical psychology" (1). Figure 2 shows the distribution of students according to educational programs.

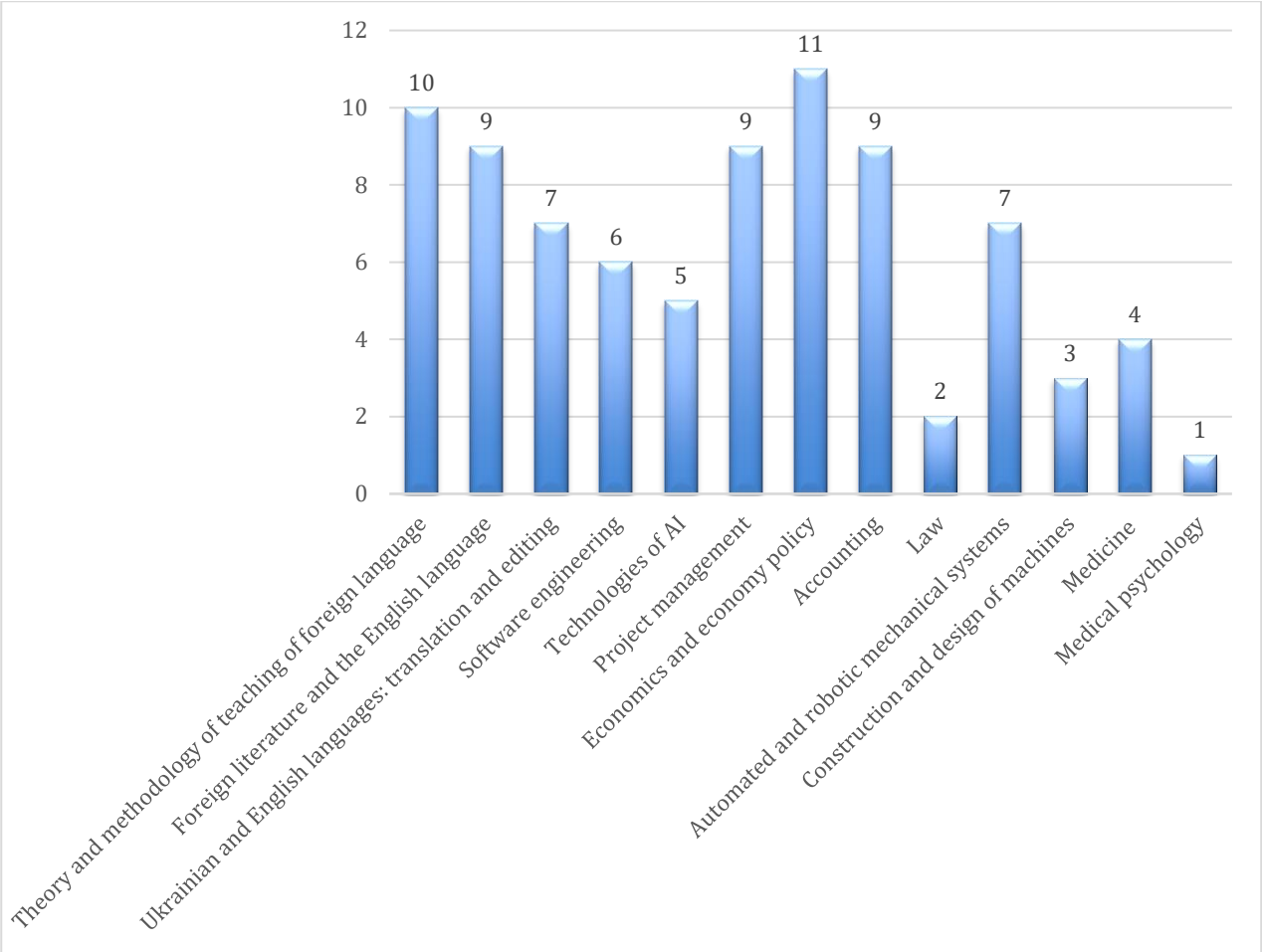

Figure 2. The distribution of students according to educational programs.

Source: *authors' own development.*

The inclusion of representative of different departments from instructors' side and students in different educational programs brings interdisciplinary perspectives on the research problem and enabled to contribute diverse perceptions and expertise developing a comprehensive understanding of the role of digital transformation in the educational context.

Instrument and Procedures

The analysis of the impacts of digital transformation in education was conducted in three phases between April-November, 2023. Figure 3 shows the research framework and the sequence of instruments used. Initially, the literature review, interview, content analysis, and observations were used to identify the research questions, to conduct a comprehensive review of relevant literature to analyse the existing theories and concepts, and to obtain the raw data through empirical instruments. Then, independent samples t-test and statistical analysis organized the raw data systematically for the following analysis and interpreted the data in relation to the research questions statistically. Also, these group of methods helped validate the interpretations resulted in presenting the outcomes on opportunities, challenges, and perspective of digital transformations at the Ukrainian educational institutions. The modelling was applied by the researchers to simulate educational interventions related to digital transformations and to evaluate the role of digital tools within the educational process accurately. Also, the thematic analysis was introduced to organize and structure the qualitative data.

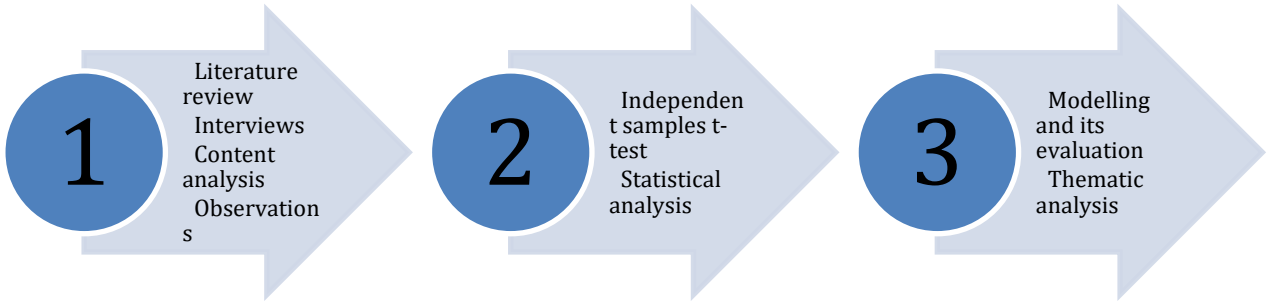

Figure 3. The research framework and the sequence of instruments used.

Source: *authors' own development.*

Data Analysis

The analysis of data in educational research on the role of digital transformations in education involved the qualitative and quantitative analysis. The qualitative data collected through interviews, observations and content analysis were analysed by means of thematic analysis where researchers were able to identify and interpret patterns on digital integration, educational practices, technological challenges, and the techniques oriented towards the increase of educational outcomes. The quantitative analysis involved independent samples t-test and statistical analysis to predict outcomes associated with digital interventions within the educational process. The evaluation of pedagogical model included the development of optimal educational environment to enhance the teaching practices through digital tools.

Results

RQ1: What opportunities do digital transformation bring within the educational process?

The results showed that digitalization brings new opportunities in education, revolutionizing traditional teaching and learning practices. The answers of instructors and students proved that integrating digital tools within the educational environment can enhance the efficiency of teaching since digitalization enables accessibility to educational materials, personalized learning. Also, digital transformations positively affect organization of interactive instruction and collaborative learning. Furthermore, it was found that digital tools facilitate implementation of innovative teaching technologies to support collaboration and communication among students and instructors. Introduction of new methods promotes students' active engagement, motivation, and attention. Additionally, digital tools inspire curiosity, creativity, and lifelong learning in students, improving the educational process. At the same time, a great number of instructors and students considered that digital transformations contribute to formation of necessary skills and help equip the participants of educational process with digital literacy, creativity, critical thinking. Comparing the answers of instructors and students it is possible to make a conclusion that they support the positive impact of digital transformations on the efficiency of teaching equally and consider digital tools to be integral components of the educational process at the Ukrainian educational institutions. Table 1 shows the opportunities of digital

transformations within the educational process at the Ukrainian educational institutions according to instructors and students.

Table 1. Opportunities of digital transformation within the educational process

Opportunity	Description	Number of participants (%)	
		Instructors	Students
Enhanced accessibility	making educational resources and materials accessible for using	76,5	81,2
Personalized learning	customization of teaching techniques to individual students' individual needs, preferences, and pace of learning	54,3	47,6
Interactive instruction	creation of engaging educational environment that stimulates students' interests and motivation	63,2	65,6
Collaborative learning	using of collaboration-based teaching methods to promote students' interactions, knowledge sharing, and teamwork	48,9	53,7
Creation of real-world context	integrate real-world scenarios to make learning more relevant and applicable for future profession	43,5	48,1
Lifelong learning	organization of continuous learning through digital platforms	32,8	65,4
Enhancement of efficiency of educational process	streamlining of administrative tasks, and introduction of automated processes, including assessment, content delivery, etc.	43,2	44,5
Cost saving	reduction the needs for physical materials and infrastructure	14,5	25,6
Innovative teaching technologies	support of innovative teaching technologies, such as flipped classrooms, blended learning, simulation-based learning, project-based learning, case study	48,7	43,9
Adaptive learning	personalization of instruction and providing targeted support to students	34,8	22,4
Increase of motivation	increase of students' engagement and motivation through gamification, multimedia resources, and interactive activities	68,5	69,1
Formation of necessary skills	equipment of students with digital literacy, creativity, critical thinking to prepare them to act in a rapidly evolving digital professional environment	54,6	73,7

Source: *authors' own development.*

At the same time the special attention was paid towards instructors and students' perception of digital transformations in education. Both categories of participants were asked about the description

of digital educational process. The results found that instructors describe it as dynamic (8), interactive (10), flexible (5), innovative (13), and technology-enhanced (12). The instructors insisted that digital tools bring constant change and innovation in the teaching practices, providing students with positive learning experiences. Additionally, digital transformations contribute to fostering active engagement among students in the classroom and, therefore, their learning outcomes increase significantly. Figure 4 shows the instructors' perceptions on digital transformation within the educational process affecting the efficiency of teaching.

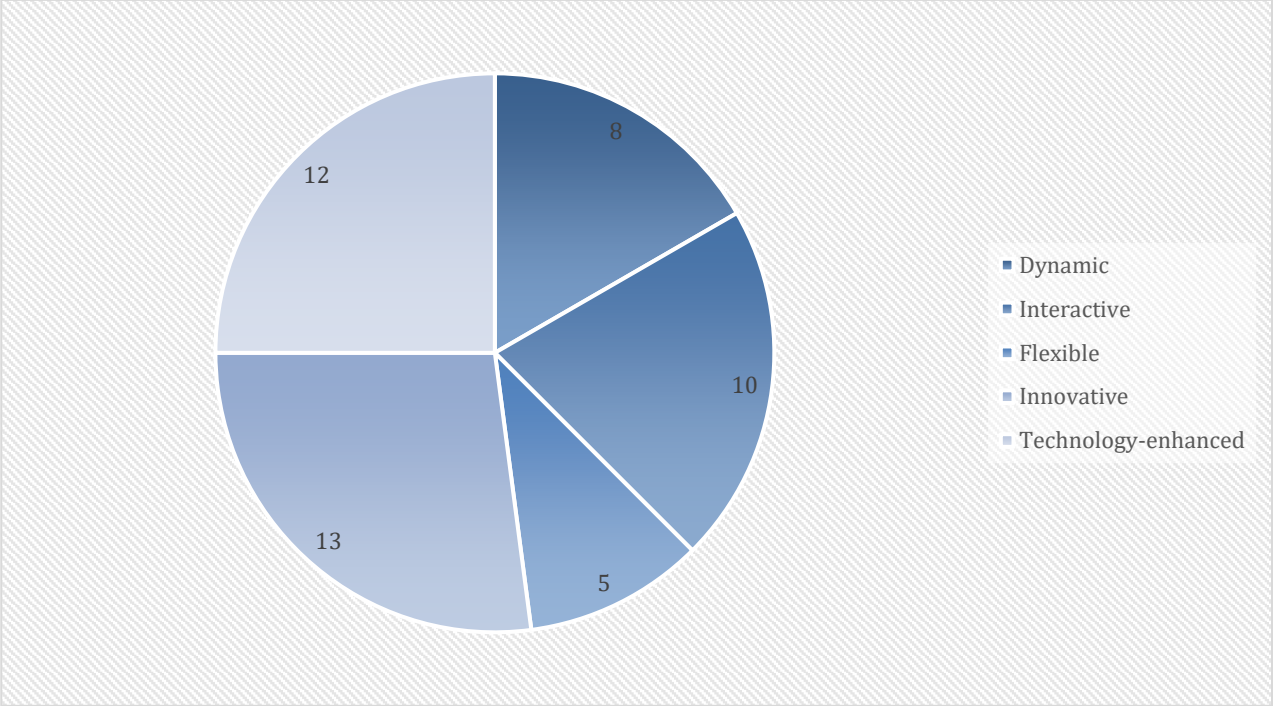

Figure 4. Instructors' perceptions on digital transformation within the educational process.

Source: *authors' own development.*

Students described the educational environment under the effect of digital transformations as interactive (13), engaging (14), collaborative (18), motivating (19), innovative (22), and creative (7). Based on their answers, the researchers came to the conclusion that students support the use of digital tools and consider digital transformation help improve the teaching practicing. As a result, the educational process offers more flexibility, accessibility to educational materials. Also, digital transformations enhance the efficiency of teaching focusing students' interest and motivation through gamification, multimedia content, simulation-based technologies, and interactive activities. Digital educational environments promote collaboration and teamwork among students, enabling them to work together on projects, share ideas, and solve problems correctly. Figure 5 shows the students' perceptions on digital transformation within the educational process affecting the efficiency of teaching inside and outside the classroom.

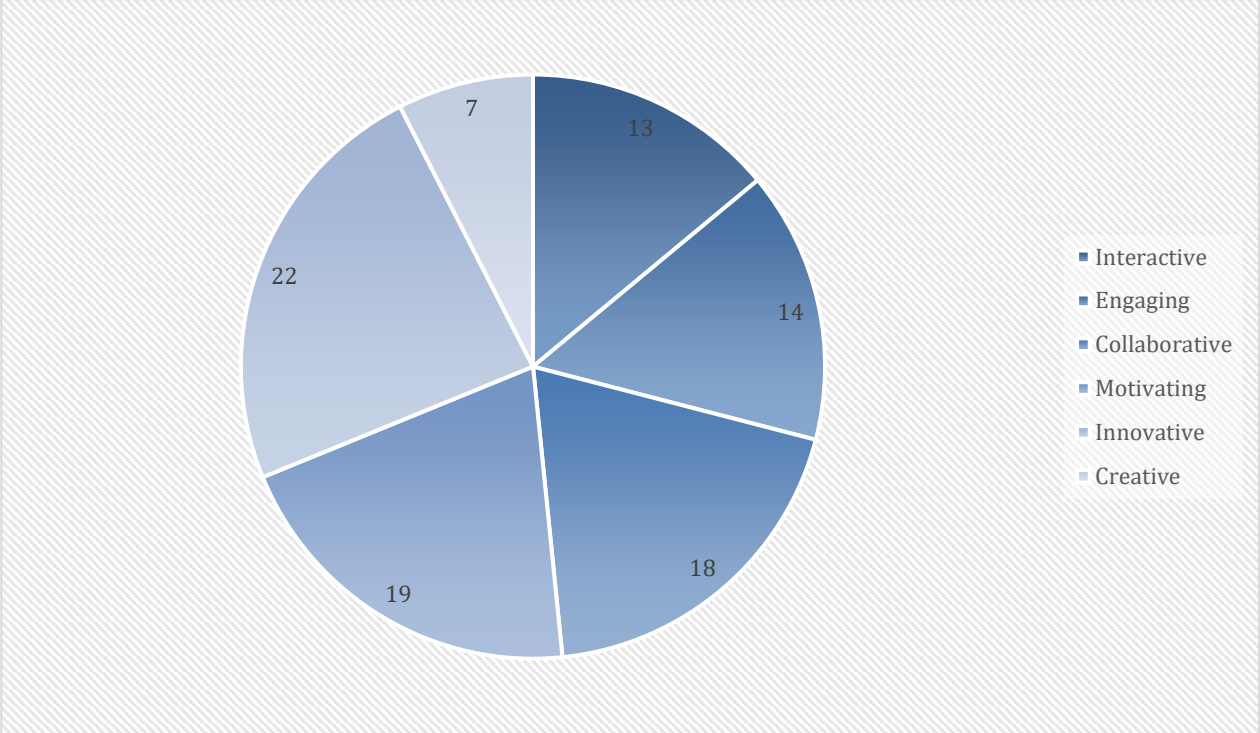

Figure 5. Students' perceptions on digital transformation within the educational process.

Source: *authors' own development.*

RQ2: What factors influence the use of digital tools in education in the Ukrainian context?

The Ukrainian context create special conditions for digital transformations at the educational institutions. The research results showed that instructors and students differentiate ten factors influencing the use of digital tools in education. Firstly, it is government policies and regulations oriented towards the support of digitalization in education, funding technology infrastructure and development of legal basis on the use of digital tools according with European laws. Over 32 % of instructors consider this factor a significant one. At the same time, only 17,8 % of students treat government policies as decisive for improvement of teaching practices. Secondly, 56,7 % of instructors and 78,4 % of students pay a great attention towards technological infrastructure of educational institutions. The participants stated that the availability and quality of technological infrastructure, including internet connectivity, hardware devices, and software applications, affect the use of digital tools in education.

Other factors include instructors' professional development and support. Both instructors and students determine training in using digital tools as a critical quality since it cultivates digital literacy, confidence in integrating technology into teaching, and, therefore, enhancement of teaching practices in the classroom. 32,6 % of instructors emphasized that integration of digital tools within curriculum promote students' engagement in the classroom. 44,9 % of students consider that digital tools make them more attentive and engaged. Additionally, students' access to digital devices, financial availability of educational institution and international collaboration in the sphere of digitalization positively affect digital transformations and help gain significant benefits in training future professionals. It was found that a great number of instructors (56,7 %) are worried about the data privacy while using digital tools. But comparatively smaller number of students (27,3 %) consider data privacy as an important factor

while using digital tools. Also, special attention was paid towards educational research in the sphere of digitalization and impact of digital transformations in education. 39,3 % of instructors agree that conducting the studies in this sphere with improve the educational process. Figure 6 presents the factors influencing the use of digital tools in education in the Ukrainian context. Considering all these factors can help develop strategies to effectively implement digital tools within the educational process and to enhance teaching practices.

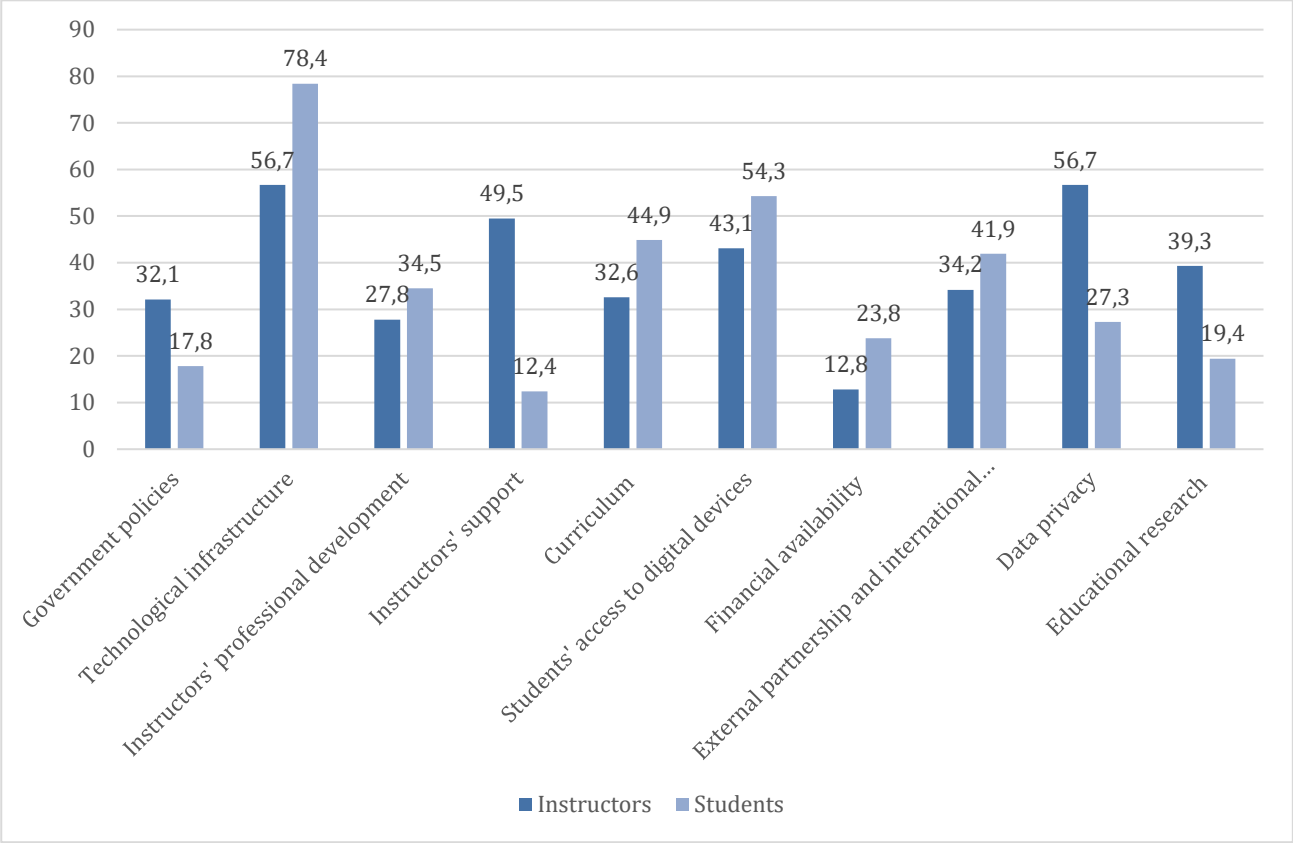

Figure 6. Factors influencing the use of digital tools in education in the Ukrainian context.

Source: *authors' own development.*

RQ3: What are the perspective directions for digital transformations to enhance the efficiency of teaching?

The analysis of perspectives regarding the use of digital tools in education is important since it provide comprehensive understanding of the problem, identify possible barriers and challenges associated with integration of digital tools within the educational process. Moreover, analyzing the perspectives fosters dialogue between the participants of the educational process and contributes to the development of effective teaching practices that maximize the potential of digital tools. To conduct in-depth analysis of the perspective directions for digital transformations, the answers of both instructors and students were considered. Thus, instructors' perspectives on using digital tools include enhanced teaching effectiveness (57,3 %), facilitated instructional delivery (42,7 %), personalized learning (21,5 %), extended access to educational materials and resources (45,6 %), promotion of active learning and students' engagement (41,9 %), and creation of diverse environment (32,8 %). Many instructors stated that digital tools are responsible for enhancing their teaching effectiveness and improving student

engagement, they facilitate instructional delivery by providing the access to a wide range of multimedia resources, interactive simulations, and educational software applications. Moreover, instructors participating in the survey recognized the potentials of digital transformations to personalize learning, streamline administrative tasks, automate a number of routine processes, create interesting content. Figure 7 shows the perspective directions for digital transformations to enhance the efficiency of teaching according to instructors.

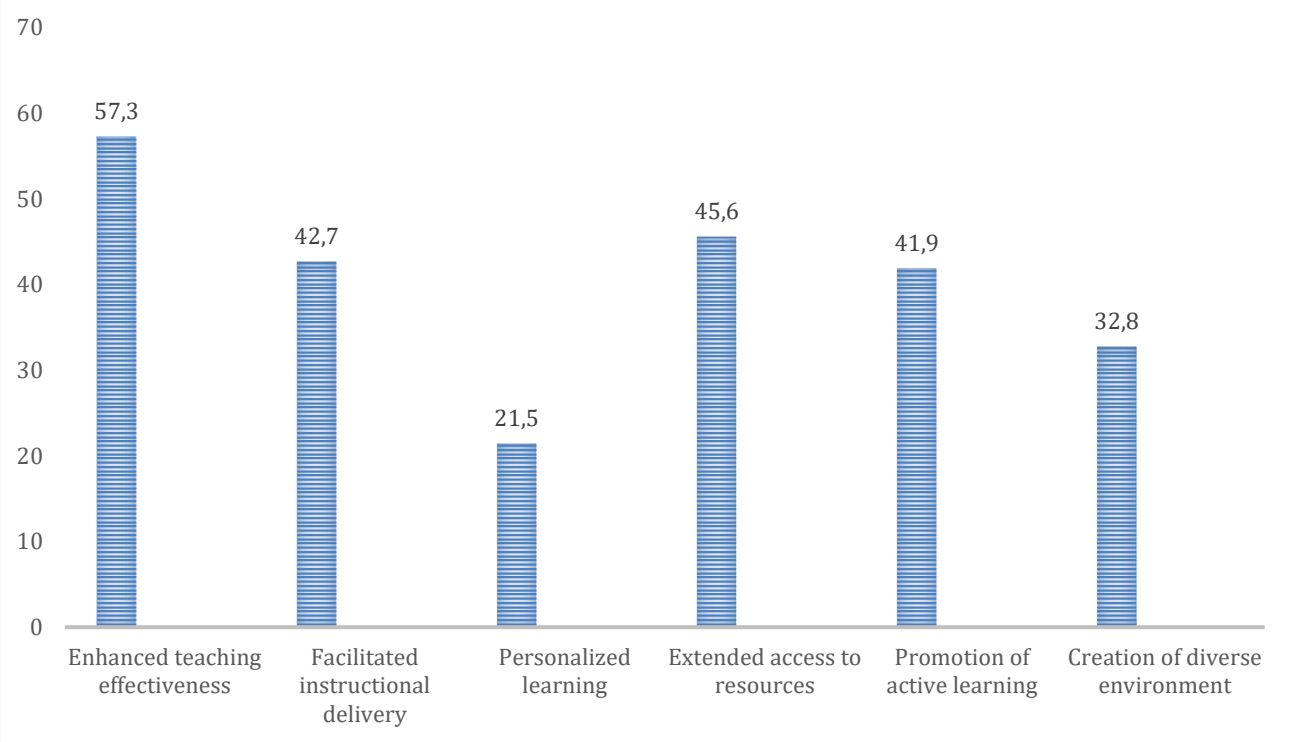

Figure 7. Perspective directions for digital transformations to enhance the efficiency of teaching according to instructors.

Source: *authors' own development.*

Students' perspectives on using digital tools in education include the following: increase of engagement and interest (53,9 %), flexibility (49,8 %), access to educational resources (64,9 %), building of individual learning trajectories (23,4 %), improved collaboration in the classroom (44,7 %), news skills development such as digital literacy, ICT competency, creativity, critical thinking, decision-making (46,1 %), facilitation of communication between students and instructors, providing immediate feedback (36,2 %), introduction of objective assessment through automated assessment platforms (26,3 %). Students admitted that the use of digital tools make the educational process more engaging and interesting, offer flexibility and convenience, allowing students to participate in learning activities and complete assignments at their own pace and schedule. Moreover, many students appreciate the personalized learning experiences facilitated by digital tools and consider that building of individual learning trajectories increase the efficiency of educational process significantly. Also, using digital tools in education helps students develop skills that are essential for future professional activity, professional development, and lifelong learning. Students recognize the importance of digital skills and technology proficiency for their future careers. Figure 8 shows the perspective directions for digital transformations to enhance the efficiency of teaching according to students' answers.

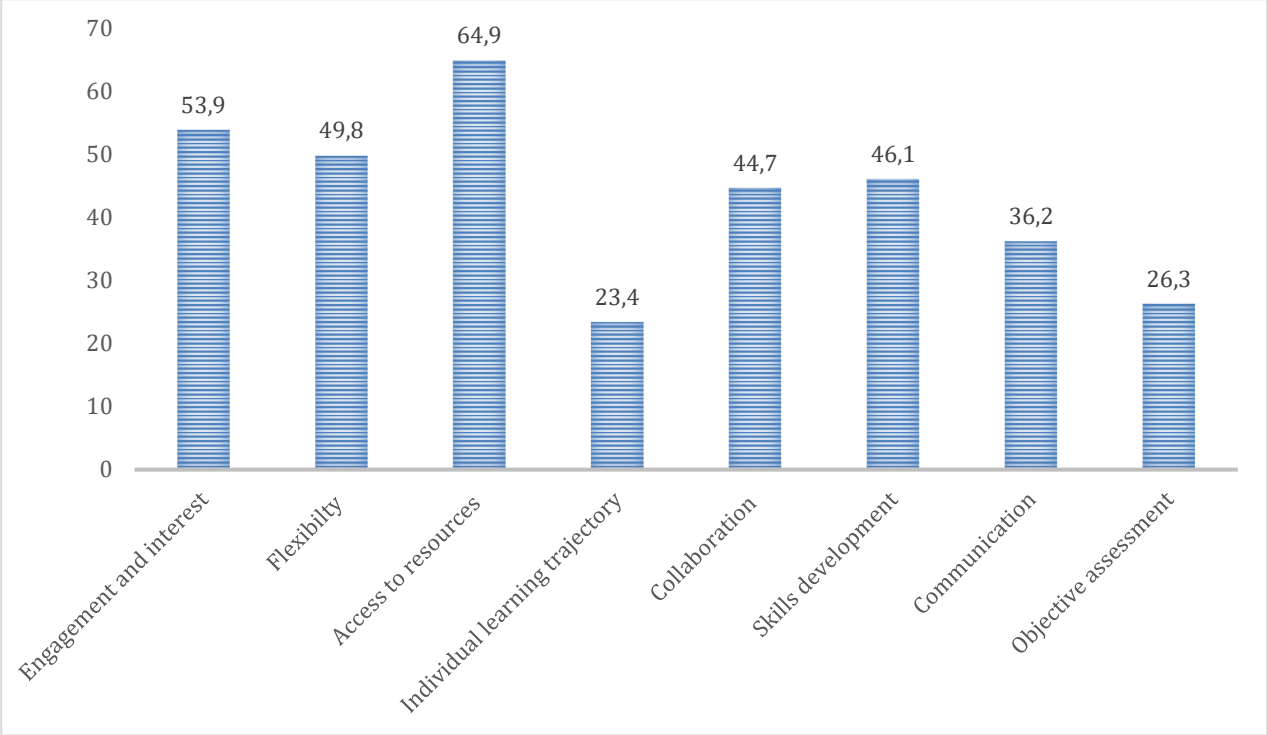

Figure 8. Perspective directions for digital transformations to enhance the efficiency of teaching according to students.

Source: *authors' own development.*

Improving the use of digital tools in education requires classroom feedback and positive interactions between instructors and students. The results of the research showed that the greatest number of instructors insisted on ensuring the accessibility of educational materials (60,3 %), integration of digital tools into the existing curriculum (57,2 %), promotion of critical thinking, problem-solving, and creativity among students (52,1 %), and encouragement of collaborative learning (48,9 %). At the same time, students state the following recommendations are the most significant: providing clear instruction before using digital exercises (63,2 %), choosing reliable and stable digital tools with minimal technical issues (63,1 %), using digital tools that promote active engagement, such as interactive quizzes, gamified learning activities, or multimedia presentations (58,4 %), and ensuring the accessibility of digital tools to all students (49,7 %). Table 2 shows the recommendations to implement digital transformations in education to enhance the efficiency of teaching based on instructors and students' responses.

Table 2. Recommendations to implement digital transformations in education to enhance the efficiency of teaching

Recommendations to implement digital transformations in education			
Recommendations according to teachers	**% of instructors**	**Recommendations according to students**	**% of students**
Conduct students' needs assessment	32,4	Ensure accessibility of digital tools to all students	49,7
Provide comprehensive training and professional development opportunities for instructors	27,8	Provide clear instructions	63,2

Foster a culture of innovation at the educational institution	29,3	Offer additional training and support through sessions and workshops	24,5
Collaborate with IT support staff	19,6	Encourage collaboration in the classroom through digital tools	41,3
Develop the guidelines for the effective use of digital tools	23,1	Ensure that students' privacy is respected when using digital tools	32,1
Create engaging and interactive educational environment	45,7	Offer flexible options for accessing and engaging with digital tools	33,9
Personalize students' learning experiences	44,3	Use digital tools that promote active engagement, such as interactive quizzes, gamified learning activities, or multimedia presentations	58,4
Encourage collaborative learning	48,9	Provide opportunities for students to give feedback on their experiences with digital tools	31,7
Provide feedback and assessment using digital tools	39,8	Use digital tools to facilitate communication between students and instructors, such as discussion forums, messaging platforms, or virtual office	35,3
Integrate digital tools into the existing curriculum	57,2	Allow for personalized learning experiences	25,8
Promote critical thinking, problem-solving, and creativity among students	52,1	Choose reliable and stable digital tools with minimal technical issues	63,1
Ensure accessibility of educational materials	60,3	Promote critical thinking skills	43,2
Monitor and evaluate the effectiveness of digital tools within the educational process	48,5	Encourage creativity	36,5
Build students' individual educational trajectories	28,1	Use digital tools to track students' progress and engagement	28,6
Encourage interdisciplinary collaboration	23,7	Promote self-directed learning	48,4
Be aware about emerging digital tools	20,4	Ensure that all students have equal access to digital tools and resources	45,9

Source: authors' own development.

Obviously, if these recommendations are implemented, the implementation of digital tools may facilitate creation of engaging, inclusive, and personalized educational environment as well as enhance the efficiency of teaching at the educational institution.

Discussion

The findings of scientific sources analysis and the survey conducted among the instructors and bachelor students from four institutions of higher education proved that the implementation of digital transformations in education enhances the efficiency of teaching through accessibility to educational materials, personalized learning. Also, digital transformations positively affect organization of interactive instruction and collaborative learning. At the same time integration of digital tools into the

curriculum of the educational institution is a complicated process and requires a comprehensive approach that addresses various levels of the educational process. Therefore, it was found that digital transformations are introduced at the conceptual (Solovei eta l., 2023), organizational (Egloffstein & Ifenthaler, 2021), methodical (Szűts et al., 2023), and content (Bader et al., 2022) levels.

Firstly, at the conceptual level, digital transformations are oriented towards the development of fundamental principles, philosophies, and pedagogical theories explaining the effective teaching practices (Solovei eta l., 2023). This level involves the outlining the role of digital technology as an instrument of pedagogical innovation as well (Lunevich, 2021; Santoveña-Casal & López, 2023). The analysis of factors influencing implementation of digital transformations and perspective direction of digitalization within the educational process according to respondents' responses proved that conceptual dimension facilitates correspondence of digital transformations with educational objectives aiming at further integration of digital tools into curriculum and instructional methods. Moreover, instructors stated that it is necessary to consider ethical considerations when implementing digital transformations which are elaborated at the conceptual level.

The research findings showed that the conceptual level is related to the following measures: (1) use of digital tools are corresponded with educational objectives and learning outcomes; (2) introduction of theoretical approaches to teaching, where digital tools facilitate students' active engagement and collaborative problem-solving; (3) designing of the digital educational environment that apply motivational strategies, such as gamification, interactivity, student-centered methods to enhance the efficiency of teaching; (4) fostering a culture of lifelong learning by using digital tools; (5) implementation of a culture of innovation; and (6) continuous evaluation of the impact of digital tools on teaching.

This proves that digital transformations in education bring both the potentials and the weaknesses of integrating technology into teaching and learning. The conceptual level suggests that technology can provide new opportunities and affordances for learning that were previously unavailable. However, there are some difficulties emphasizing the importance of how technology is designed, implemented, and integrated within the educational process. Therefore, a critical evaluation of digital transformations in education is oriented towards balancing the potential benefits of technology with a comprehensive understanding of the social, cultural, and pedagogical factors that shape the modern educational environment.

At the organizational level, digital transformations are implemented through a comprehensive and coordinated approach that involves the attempts of educational leaders, administrators, IT professionals, instructional designers, and support staff to work collaboratively and develop strategic plans that support the integration of digital tools into teaching practices (Egloffstein & Ifenthaler, 2021). Organizational structures must include investing in technological infrastructure, providing professional development opportunities for instructors, and fostering a culture of innovation and continuous improvement (Horobet et al., 2022; Vekić-Kljaić & Mlinarević, 2022). The survey findings completely coincide with these theoretical questions. At the same time, the instructors and students admit that the effective communication between different departments at the educational institution are essential to ensure the successful implementation of digital tools. The respondents show that effective organization of educational process facilitates the implementation of digital tools and helps alleviate the challenges arising when innovative technologies are introduced.

At the same time, it can be concluded that the organizational level is realized due to the following measures: (1) development of a comprehensive digital learning strategy; (2) providing adequate

funding and resources to support digital infrastructure; (3) implementation of the guidelines for the responsible and ethical use of digital tools; (4) creation of professional development opportunities for instructors; (5) maintenance of international cooperation projects; (6) monitoring and evaluation of the impact of digital tools on teaching effectiveness; (7) encouragement of innovation and experimentation with new digital tools. Moreover, it is necessary to admit that both instructors and students encourage the extension of organizational level and consider all the stakeholders of educational programs must cooperate and determine the priority directions of digitalization within the institution of higher education.

Obviously, at the organizational level, digital transformations have the potentials to enhance efficiency of the educational process and improve learning outcomes. However, they also bring the challenges related to infrastructure, resource allocation, and introduction of educational practices. The institutions of higher education must invest in digital infrastructure, including reliable internet access and digital devices, to ensure equitable access for all students. Additionally, they must provide adequate support and training for instructors to integrate technology into their teaching activities. Also, it is important solve the issues related to data privacy, security, and digital literacy. Despite these challenges, digital transformations in education lead to more flexible and personalized learning experiences, preparing students for the demands of the digital age.

The methodical level refers to the selection, integration, and evaluation of teaching approaches and methods to integrate digital tools within the educational process (Szűts et al., 2023). Methodical planning is essential for designing instructional activities to promote active engagement and personalized learning (Ivanenko et al., 2023). The questionnaire conducted among the instructors and bachelor students testifies that methodology of the educational process is an important component of digitalization and contributes to the development of effective strategies for integration of digital tools for teaching and learning. Additionally, the analysis of perspectives regarding the use of digital tools in education showed the both teachers and instructors determine teaching technologies and methods as important requirements to the creation of digital educational environment.

During the survey it was found that the instructors must provide clear guidelines and support for students on how to use digital tools effectively, as well as establish mechanisms for objective assessment and immediate feedback to monitor the impact of digital transformations on teaching efficiency and students' learning outcomes. Also, the findings demonstrated that the methodical level suggests the introduction of the following measures: (1) designing of instructional activities that promote active learning and engagement among students; (2) incorporation of a variety of digital tools, such as multimedia presentations, interactive simulations, and online learning platforms, to create positive educational environment; (3) providing the structured guidance to help students use digital tools; (4) organization of students' collaboration using digital tools; (5) integration of objective assessment strategies, such as online quizzes and surveys to monitor students' progress and provide immediate feedback; (6) encouragement of self-regulated learning; (7) using learning analytics and assessment results to identify further improvement; and (8) development of essential digital skills among students.

It can be concluded that, at the methodical level, digital transformations have the potentials to revolutionize teaching and learning methodologies. Technology offers new tools and platforms that enhance traditional methods, making learning more interactive, engaging, and personalized. However, the effectiveness of these digital tools depends on how they are integrated into the curriculum and instructional practices. Instructors must select digital resources carefully according to the learning objectives and promote meaningful engagement. Additionally, they must ensure that digital tools are used to foster critical thinking, creativity, and teamwork.

The content level is related to curriculum design and instructional materials development (Bader et al., 2022). The content dimension means careful selection and adaptation of digital content and resources to the educational objectives and students' needs (Timotheou et al., 2023). These ideas correspond with the results of empirical research that shows digitalization of the educational process suggests the development of high-quality educational materials, such as multimedia presentations, interactive simulations, and online textbooks. At the same time, it was proved that digital content must be customized and personalized to meet the students' individual needs and preferences, providing opportunities for self-paced learning and differentiated instruction.

The in-depth analysis of opportunities of digital transformation and the factors influencing the use of digital tools in education, as well as investigation of perspective directions for digital transformations to enhance the efficiency of teaching allowed to outline the content level as a combination of theory and practice of pedagogical interventions oriented towards the formation of necessary competencies among students. The survey resulted in the presentation of the measures that should be realized at the content level. They include the following: (1) creation of high-quality digital content; 2) using a variety of digital resources, including text, images, videos, simulations, and interactive activities; (3) customization of digital content to meet the specific needs and preferences of students; (4) upgrading of the digital content regularly; (5) integration of real-world examples and case studies into digital content; (6) providing the opportunities for student interactions around digital content, such as discussion forums, peer reviews, and collaborative projects; (7) making the digital content accessible to all students; and (9) cultivation of creativity, critical thinking, decision-making, and leadership.

In the content level, digital transformations enhance access to a wide range of educational materials and resources, including multimedia, simulations, and interactive tools. This can enrich the learning experience and tailor the activities to diverse learning styles. At the same time, it was noticed that there are concerns about the quality of digital content. Instructors must critically evaluate digital resources to ensure they are accurate, relevant, and meet the curriculum standards. There is also a risk that reliance on digital content may neglect the importance of contextualized and culturally relevant content. Accordingly, implementation of digital transformations at the content level requires careful analysis and adaptation of digital educational materials to meet the needs of diverse students and enhance the educational environment.

Therefore, it was found that implementation of digital tools within the educational process is usually complicated and multifaceted. But if introduced effectively, they definitely may lead to the improvements of educational environment making it collaborative, dynamic, innovative, and technology-enhanced. At the same time, digital technologies enhance the efficiency of teaching through the use of various digital platforms and LMS encouraging personalized learning, building individual learning trajectories of students, promoting engaging and interactive learning.

Conclusions and Implications

It was found that in the context of the research, digitalization means changes in many spheres, in education in particular, where teaching and learning practices are moving from face-to-face meetings to more distant and algorithm-based ways to operate. The study showed that digital transformation in education has an important role as it revolutionizes teaching and learning. Using a number of digital tools, the educational institutions can overcome the barriers of traditional teaching, creating technology-enhanced collaborative environment and incorporating flexible instructional models. At the same time, a successful digital transformation in education requires that educational institutions

develop a clear vision and establish strong leadership support to driving change or fostering a culture of innovation. Additionally, the researchers proved that integrating digital technologies into the curriculum is necessary because students need to develop digital literacy skills, technological proficiency, and 21st-century competencies to carry out professional activities. Digital tools enrich instructional delivery, enabling teachers to design interactive, multimedia-rich lessons, personalized learning pathways, and collaborative learning activities.

The results showed that digitalization brings new opportunities in education, revolutionizing traditional teaching and learning practices. The answers of instructors and students proved that integrating digital tools within the educational environment can enhance the efficiency of teaching since digitalization enables accessibility to educational materials, personalized learning. Also, digital transformations positively affect organization of interactive instruction and collaborative learning. Furthermore, it was found that digital tools facilitate implementation of innovative teaching technologies to support communication among students and instructors. Introduction of new methods promotes students' active engagement, motivation, and attention. Comparing the answers of instructors and students it is possible to make a conclusion that they support the positive impact of digital transformations on the efficiency of teaching equally and consider digital tools to be integral components of the educational process at the Ukrainian educational institutions. At the same time the special attention was paid towards instructors and students' perceptions of digital transformations in education. The results found that instructors describe it as dynamic, interactive, flexible, innovative, motivating, creative, and technology-enhanced.

The Ukrainian context create special conditions for digital transformations at the educational institutions. The research results showed that instructors and students differentiate ten factors influencing the use of digital tools in education: government policies and regulations, technological infrastructure improvement, instructors' professional development and support, integration of digital tools into curriculum, students' access to digital devices, financial availability of educational institutions, maintenance if international collaboration, data privacy, and encouragement of educational research. The analysis of perspectives regarding the use of digital tools in education is important since it provide comprehensive understanding of the problem, identify possible barriers and challenges associated with integration of digital tools within the educational process. Instructors' perspectives on using digital tools include enhanced teaching effectiveness, facilitated instructional delivery, personalized learning, extended access to educational materials and resources, promotion of active learning and students' engagement, and creation of diverse environment. Students' perspectives on using digital tools in education include the following: increase of engagement and interest, flexibility, access to educational resources, building of individual learning trajectories, improved communication in the classroom, news skills development such as digital literacy, ICT competency, creativity, critical thinking, and decision-making, facilitation of communication between students and instructors, providing immediate feedback, introduction of objective assessment through automated assessment platforms.

The implementation of digital transformations in education to enhance the efficiency of teaching requires a comprehensive approach that addresses four levels of the educational process: conceptual level (orientation towards the development of fundamental principles, philosophies, and pedagogical theories explaining the effective teaching practices); organizational level (development of strategic plans that support the integration of digital tools into teaching practices); methodical level (selection, integration, and evaluation of teaching approaches and methods to integrate digital tools within the educational process); and content level (curriculum design and instructional materials development). The implementation of the recommendations outlined definitely may lead to the improvements of

educational environment making it collaborative, dynamic, innovative, and technology-enhanced, and, therefore, enhancement of the efficiency of teaching.

The findings can be implemented by academic staff of the educational institutions to increase the efficiency of teaching through the use of digital tools. Also, the concepts developed during the research can be applicable by research groups or methodist teams to develop applicable model for modernization of educational process while implementing digital transformations.

Suggestions for Future Research

The study outlined the opportunities, factors, and prospective dimensions of digital transformations to enhance the efficiency of teaching at the educational institutions. From this point of view, digital transformation refers to the integration of digital technologies to revolutionize teaching, learning, and administrative processes within educational institutions. It involves using a wide range of digital tools, platforms, and resources to enhance the efficiency, accessibility, and effectiveness of instructional delivery. This includes incorporating digital learning materials, such as online textbooks, multimedia presentations, and interactive simulations, into curriculum design, as well as utilizing communication and collaboration tools to facilitate remote learning and virtual classrooms. The study of enhancement of teaching efficiency requires in-depth examining the most effective pedagogical approaches for integrating digital tools into teaching practices.

During the research it was found that implementation of digital transformations in education take place in four levels: conceptual, organizational, methodical, and content. Each of the levels requires a set of certain measures to enhance the efficiency of teaching. But the researchers did not reveal the personal level of implementation of digital tools since it is essential for organization of personalized learning and build individual learning trajectories. At the personal level, the use of digital tools in education involves instructors and students incorporating technology into their individual learning and teaching practices. From instructors' side, it includes creating multimedia-rich lesson plans, using educational apps for classroom management or student assessment, and participation in online professional development to enhance their teaching skills. From students' side, digital tools offer opportunities for positive interactions with peers and instructors, formation of professional competencies through interactive exercises, simulation-based activities, and educational games. Further research must consider the analysis of implementation of digital tools at the personal level to enhance the efficiency of teaching.

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