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Educational Process Organization in Higher Education: Technology and Innovation for Sustainable Development

By Natalia Derstuganova[1], Oksana Hubina[2], Svitlana Zheinova[3], Dosaaly Imanberdiev[4], Andrii Ostrohliad[5]

ABSTRACT:
Modern higher education system should be proactive in incorporating new innovative technologies to meet modern societal needs and improve the quality of learning in general. In the university, new digital solutions are now more focused on transformation processes and competency-based education. This article aims at examining the extent to which such technologies can be integrated within the organization of educational activities at higher institutions of learning. The study design involved surveys, data analysis and statistical analysis of the data gathered. On the basis of these results, the authors suggested a framework of the introduction of innovative technologies at different levels of study. At the undergraduate level, the emphasis is put on digital learning platforms, virtual laboratories, simulations and interactive tools. Master programs also focus on learning analytics, incorporation of education resources, and project-based practices. In the case of doctoral training, cloud-based services and virtual research laboratories are central. In order to quantify the results, certain measures of technological use in the learning process were created and their usefulness was statistically confirmed. The adaptive strategies of learning, digital resources, and the implementation of augmented and virtual reality can support the development of critical thinking, learning personalization, and communication and research skills in graduate and postgraduate students.

Keywords: future educators, pedagogical activity, general competencies, doctors of philosophy, innovative technologies, organization of the educational process, higher education institutions, sustainable innovations.

1. Introduction

The utilization of the latest technologies in the organization of the educational process in higher education institutions is becoming one of the main processes of developing professional and general skills of students, and, at the same time, improving the process of teaching. However, continuous refreshment of the methodologies, instruments, and learning materials is a prerequisite towards achieving quality learning outcomes. The speed of information technology development, the globalization of education, and accelerated digitalization pose various challenges to the organization of academic processes in universities. One of the key elements of the modern specialist training process is the process of acquiring universal competences, which should be based

[1]Department of Education and Educational Institution Management, Institute of Management, Classic Private University, Zaporizhzhia, Ukraine
[2] School of English, University of Leeds, Leeds, UK
[3]Department of Preschool Education and Social Work, Faculty of Social-Pedagogical and Artistic Education, Bogdan Khmelnitsky Melitopol State Pedagogical University, Melitopol, Ukraine
[4]Department of the Doctoral Studies, Kyrgyz National University named after Jusup Balasagyn, Bishkek, Kyrgyzstan
[5]Department of Physical Education and Sports, Zhytomyr Polytechnic State University, Zhytomyr, Ukraine

on interdisciplinary principles and practice-oriented methodology (Chen, 2024). The growth of blended and distance learning models is made possible by the introduction of digital platforms and online resources and the necessity to ensure the maintenance of academic mobility.

With this backdrop, additional research on new technologies is needed to establish the successful ways of promoting professional creativity, practice-based learning, and acquisition of requisite competencies among higher education students. Also important is the changing role of the educator: the further development of teaching requires the use of interactive techniques and high-tech tools, such as augmented reality and virtual reality, artificial intelligence applications, and other digital environments.

Simultaneously, the growing adoption of virtual and augmented reality, artificial intelligence tools, and digital platforms poses a significant pedagogical dilemma regarding how innovative tools may be balanced with the traditional mentoring role of a teacher. Technology can be used as a continuation of the work of the educator, rather than as a substitute, and allow providing more personalized attention, in-depth contemplation, and interactive cooperation. Higher education would be rendered effective by maintenance of the capacity of teachers to mentor, motivate and exemplify professional principles combined with strategic integration of sophisticated digitalized devices to enhance, not to diminish, the human aspect of education.

Other sustainable development education strategies are implemented through the framework of the United Nations sustainable development Goals (SDGs, 2015), especially Goal 4, Quality Education. This aim is impossible to reach without the proper usage of the digital learning possibilities and technology. Universal, dependable, and context-aware digital learning can also improve the equity of access to learning opportunities. It has been confirmed that educational technologies (EdTech) can play a role in achieving SDG 4 by increasing access, promoting inclusivity, and enhancing academic achievement (Costa et al., 2023). Through digital tools, it is possible to diversify access to learning, enhance the quality of learning resources and their relevance, build ICT-based lifelong learning routes, empower education management systems and ensure sustained oversight of learning activities. Not only will these measures contribute to the development of SDG 4, but they will also contribute to global issues, such as climate crisis. To that end, the Green School Accreditation program can be viewed as an international initiative that, on the one hand, minimizes the environmental impact of schools, and, on the other hand, improves the performance of students (Green School Accreditation, 2025).

Education 4.0 is one of the new model types of total integration of digital environments and innovative technologies to improve the quality of learning. It implements a competency-based model and is based on the practice of artificial intelligence and active learning (Clemente de Souza & Debs, 2024). The promotion of digitalization has changed the positions of relevant actors of the educational process: educators are becoming more participants in the roles of mentors whose task is to control the direction of learning in students, nurturing their possibilities to think critically and solve problems, and in the manner of teaching an effective method of retrieving information. Simultaneously, recent technologies offer learners broad access to mastering professional skills using a wide range of digital resources.

The wise application of EdTech is at the heart of digital transformation of higher education. The most significant thing to do is to determine, use, and assess the industries that best aid in building professional abilities in students (Zammit et al., 2024). To create an educational process based on the principles of digitalization, innovative approaches, mindful of labor market demands, are needed that are dependable, flexible, and adaptable. As a result, it is again necessary to systematize the existing tendencies and identify the technological tools that have the most significant effect on the organization of higher education.

The aim of this article is to generalize current trends and challenges related to the adoption of innovative technologies in higher education and to provide evidence of their effectiveness in structuring the educational process.

2. Literature Review

Learning with the integration of information software technologies is a new model of smart education that is being promoted in higher education. The modern educational process requires a combination of theoretical knowledge and practical work, often even directly at an enterprise that is a partner of the educational institution (Altes et al., 2024). In recent years, the teaching of virtual simulation content, modeling and practical review of professional cases on the educational platforms of higher education institutions has been widely used (Oliynyk et al., 2020). Wang et al. (2022) note that in some engineering courses, professional design and analysis software such as ABAQUS, MIDAS, Guanglianda, PKPM, and BIM can help stimulate students' learning interest, enhance students' ability to practice professionally, help students better understand professional theoretical knowledge, and increase the competitiveness of future professionals in employment. According to Yazici and Uzuner (2024), integrating traditional classroom instruction with online learning formats creates favorable conditions for unlocking the intellectual potential of university students. In a related study, Albaz and Khalifa (2024) examined the impact of technological education strategies and emphasized the importance of fostering intellectual capital within the higher education sector.

The information technology generation has caused a wave of digitalization in the world. The authors Novitskyi et al. (2025), Dotsenko et al. (2023) note that faced with the challenges of these new changes, universities around the world are actively exploring new models of education and ways to prepare higher education students in the digital era. Xu's (2024) study presents a flexible educational model focused on sustainable competence, AI+ education, service-oriented education, and meta-world education. According to the findings of the study conducted by Wang (2022), the model of collaboration via information technology can efficiently spur the levels of learning satisfaction and social assessment and foster the growth of creativity among higher education students. In a published study, authors Upadhayay et al. (2021) concluded that a good education contributes to the growth of the qualities, characteristics, attitudes, behaviors, beliefs, and psychological traits that comprise the personality of higher education students.

Higher education is a central part of students' learning and a key stage in the formation and sustainable development of their values (Abate et al., 2021). Various digital technologies are used to effectively develop 21st century skills in higher education, and

Suárez-Brito et al. (2023) evaluated the use of virtual simulations as a digital component of higher education training. The diversity of educational formats benefits university students, yet it can also result in a decline in overall educational quality. As highlighted by Lu and Shi (2020), the growing complexity of challenges in higher education requires institutions to fundamentally transform their teaching models in order to align with contemporary learning trends and enhance students' learning outcomes.

Simultaneously, one must keep in mind the possible risks that the massive adoption of digital solutions in the field of higher education implies. Inequalities in access to devices and reliable internet connectivity can support the social and economic supply of differences among students. The overuse of digital tools may also undermine the ability to develop interpersonal communication and decrease access to in-person academic support. As such, digital transformation initiatives such as hybrid learning formats, institutional support of digital inclusion, and the maintenance of a balanced mix of technological innovation with face-to-face interaction should include the application of risk mitigation strategies. These and other measures would make sure technology is used to improve and not to diminish the quality of education.

In today's world, digital technologies serve as a key engine for advancing national economies, particularly in the era of big data (Diaz et al., 2020; Fang et al., 2024). The rise of Big Data has turned it into a crucial instrument that enables organizations to operate more efficiently and strengthen their competitive advantages. The article by Chinsomboon & Piriyasurawong (2022) focuses on big data for higher education by presenting big data analytics for the training of higher education students.

Quality education that works to advance thinking innovation is the focus of positive teacher-higher education student interaction, lest mention more, the significant levels of quality learning contents and learning platforms. In the article by Bai et al. (2022), lessons and practice, the organization of a creative course on thinking, and logic are the main topics considered. Universities and colleges are seeking another form of innovative education. Li and Zhang (2021) describe the features of innovation education in the framework of scientific and innovative principles, which characterizes the need to form scientific and technological innovation teams.

Virtual reality technology is developing rapidly in the field of education, which is of great importance for higher education (Li et al., 2021). The application of video conferencing and virtual reality technology in education is developing rapidly, which is of great importance for learning (Pan et al., 2024). Xueliang & Qi (2020) presented an innovative study on classroom situational learning design to provide more perspectives and ideas for the diversified development of digital design in the educational landscape.

The use of digital and mobile technologies is reducing the lives of people by enhancing the manner in which activities in different industries are done, education being one of them. Mwandosya (2021) established that, mobile tool use by teachers and students in high education institutions not just enhances sharing of educational resources, but also helps students and teachers become more productive in the academic sphere, employing creativity in teaching and learning activities.

The article by Xie & Ding (2023) explores the potential opportunities and challenges that artificial intelligence creates for higher education from the perspective of students and teachers. AI tools and innovative technologies are having a profound impact

on higher education and offer enhanced educational opportunities for students and faculty, including personalized feedback, improved accessibility, interactive engagement, performance assessment, and new ways of teaching complex concepts.

3. Methods

The study of the use of novel technologies in higher education included the establishment of a pedagogical framework that was worked out by the authors and integrated digital and information-communication resources within bachelors, master, and doctoral education. The research took place in the 2022-2024 academic year at a number of universities in Ukraine and the United Kingdom (the Classical Private University, temporarily located in Zaporizhzhia after the war; the Bohdan Khmelnytskyi Melitopol State Pedagogical University, the University of Leeds, United Kingdom). It is worth noting that the sample size used in the research was only a few universities in Ukraine and a single university in the UK; this could be a limitation in the generalization of the results. The disparities in the institutional digital infrastructure and institutional traditions and cultures may impact the way innovative technologies are received and perceived. Thus, the samples of the future studies should extend to other universities in other regions and other socio-economic settings to help to test whether the offered model can prove its effectiveness with other higher education systems.

The result of the effectiveness of the application of the above technology was formed by questioning the teachers who evaluated the higher education students who used these technologies; the formation of professional competencies after completing the course program with the use of innovative technologies in the organization of the educational process was assessed.

Of the total 1342 students of higher education participated in the experiment. The prospective dynamism of the control group of higher learning applicants was taught by means of the conventional methodology and the experimental group by means of innovational technologies characterised in respect of each degree of education level. Their results were compared. Table 1 explains the higher education students in the control and the experimental group by sections of their educational degrees.

Table 1: Distribution of higher education students in the control and experimental groups

Educational level	Bachelor's degree	Master's degree	Doctor of Philosophy
Experimental group, number of higher education students	402	232	36
Control group, number of higher education students	402	232	36

Source: compiled by the authors

The survey measured the extent of competence development among students at different educational levels through the application of innovative technologies. Each level

was evaluated on a 10-point scale. The collected data were statistically verified using the Pearson $\chi 2$ test.

Within the study, two hypotheses were proposed:

H0: the use of innovative technologies does not enhance the organization of the educational process in higher education;

H1: the use of innovative technologies leads to improvements in the organization of the educational process in higher education.

To validate these assumptions, the performance of a control group taught with traditional methods was compared with that of an experimental group instructed using the technological approaches designed by the authors.

4. Results

Under the circumstances of the modern university, colleges and higher education establishments, it is necessary to present educational technologies to enhance the quality of the educational process and learning results of students of higher educational establishments and train highly qualified specialists as the end product of such a cycle. Thus, it is necessary to revise teaching methods and instruments, however, during the given process, one should consider the usage of a variety of new technologies with the help of which the educational requirements of the various levels of studying could be satisfied. The scheme of implementation of innovational technologies in the organization of the educational process based on the educational level of students in the higher education is presented in Fig. 1.

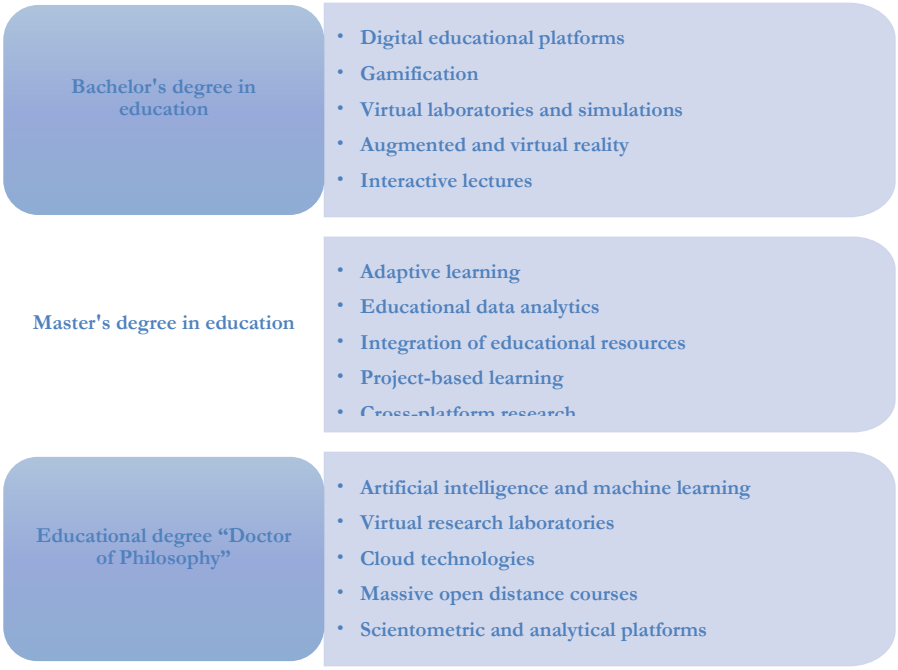

Figure 1: Implementation of innovative technologies in the organization of the educational process
Source: developed by the authors

The key goal of applying innovative technologies to organize the educational process for a bachelor's degree is to ensure accessibility of learning, to make the process of acquiring knowledge practice-oriented and interactive. It is proposed to use digital educational platforms to organize blended and online learning formats, such as Moodle, Google Classroom, Coursera, EdX, etc. It is also advisable to use mobile learning, which provides access to mobile applications and interactive textbooks, in the context of using blended and online formats. Gamification is a powerful tool for increasing the motivation of higher education students. The visualization of theoretical material and interaction between higher education students and teachers can be ensured through the introduction of interactive lectures and webinars. Typically, Zoom, MS Teams, BigBlueButton with support for interactive whiteboard options such as Miro, Jamboard are used for this purpose. The practical component of student training is supported through process modeling in virtual laboratories and simulators such as PhET, Labster, ANSYS, and MATLAB, as well as through the application of virtual and augmented reality technologies built on 3D modeling..

In order to develop the analytical and research activities of those students and to have the project competencies formed, the innovations are used in the learning environment as a part of the Master's degree applicants training. The primary technologies used to guarantee the organization of the educational process of the higher education students of this level are provided by the tools of artificial intelligence based on personality trajectory and adaptability of studying. It is advisable to form educational ecosystems to

integrate various resources to maximize the digitalization of the learning process. Prediction of students' educational outcomes and monitoring of their performance can be carried out through the use of educational data analytics and Big Data, and ML and AI tools allow to form personalized learning paths for higher education students based on the collected analytics and select learning content to suit their preferences and needs. The practical aspect of this activity is the introduction of project and team-based learning to work with startups and practical cases. Working with international databases helps to develop basic skills in collaborative learning and cross-platform research.

The training of PhD students is aimed at conducting research and preparing publications as a demonstration of their educational and scientific activities and increasing the level of interdisciplinary interaction. On the basis of massive open distance courses of such platforms as Coursera, EdX, FutureLearn, MIT OpenCourseWare, higher education applicants are offered advanced training, and cloud technologies such as Google Colab, Overleaf, GitHub allow for teamwork on projects.

Automated data search and generation of scientific hypotheses is ensured through the use of machine learning and hypothesis generation in research. Participation in scientific events is ensured through participation in scientific symposia and events held in a digital learning environment and virtual research laboratories that provide access to scientific equipment remotely. Also, students of this degree learn to work with scientometric and analytical platforms for analyzing research citations such as Scopus, Web of Science, Google Scholar, ORCID, Publons, etc. The use of innovative technologies at all levels of higher education provides access to practice-oriented and research-based learning through the introduction of interactive, digital and virtual learning tools.

In the context of bachelor's degree programs at the above-mentioned higher education institutions, Moodle, Google Classroom, and Microsoft Teams platforms were used to teach pedagogical, philological, and natural sciences. Laboratory work in natural sciences was conducted on the PhET Interactive Simulations platform. Interactive lectures were conducted using Mentimeter, Kahoot! and Padlet. The use of interactive learning tools for bachelor's degree accounted for 30% of the total number of hours.

In the context of master's degree programs at these higher education institutions, higher education students used Power BI and Google Data Studio platforms for data analytics in research. Higher education students of pedagogical specialties developed educational scenarios based on Coursera and EdX platforms. The use of interactive learning tools for the master's program was 40% of the total number of hours provided by the curriculum.

As part of the PhD program, the students worked with AWS and Google Cloud platforms, developed scientific computing projects based on cloud services, and tested machine learning algorithms in Google Colab. Postgraduate students conducted bibliometric analysis of Scopus, Web of Science, and Google Scholar publications using artificial intelligence tools. The use of interactive learning tools for PhDs accounted for 50% of the total number of hours.

Within bachelor's programs, the development of fundamental professional competencies is facilitated through the integration of innovative technologies. Table 2 presents the indicators reflecting the levels of competence acquisition achieved by students at this stage through the use of such technologies.

Table 2: Indicators of the levels of competence acquisition through the use of innovative technologies for the Bachelor's degree

Level	Indicator
Competency level	Acquisition of professional competencies through the use of digital technologies and interactive teaching methods.
Activity level	Application of digital education technologies in the educational process.
Instrumental level	Application of a wide range of learning tools, such as multimedia and digital technologies.
Communicative level	Application of innovative technologies for effective interaction of participants in the educational process.
Organizational level	Application of individual learning trajectories based on innovative technologies.

Source: developed by the authors

At the master's level, the integration of innovative technologies in the educational process fosters the development of students' competencies across research, design, management, analytical, and digital domains. Table 3 outlines the indicators corresponding to these competency levels, attained through the application of innovative technologies.

Table 3: Indicators of the levels of competence acquisition through the use of innovative technologies for the educational degree "Master"

Level	Indicator
Research level	Analysis, development and implementation of innovative technologies.
Project level	Creation of educational projects with the integration of innovative technologies.
Management level	Developing skills in organizing and managing innovative technologies.
Analytical level	Ability to think critically and apply AI and big data to personalize research.
Digital level	Implementation of developments of higher education students taking into account the requirements of the digital educational space.

Source: developed by the authors.

In doctoral programs, innovative technologies are primarily directed toward strengthening research competencies. Table 4 presents the indicators that illustrate the levels of competence acquisition achieved through the application of these technologies at the PhD level.

Table 4: Indicators of the levels of competence acquisition through the use of innovative technologies for the educational degree "Doctor of Philosophy"

Level	Indicator
Research level	Application of innovative technologies for research and data analysis.
Creative level	Ability to implement own research and make proposals for improving existing methods.
International cooperation level	Ability to scientific communication using innovative and digital technologies.
Academic level	Ability to strategically improve methods, tools, technologies through the use of innovative tools.
Social level	Formation of a culture for the responsible use of innovative technologies in research activities.

Source: developed by the authors.

Within the framework of the pedagogical experiment on the use of the set of innovative technologies suggested by the authors in master, bachelor, and doctoral programmes, a questionnaire survey took place. The participants in the study included 402 bachelors students, 232 masters students and 36 doctoral students in control and experimental groups. A second level of unsatisfactory was added to comply with the precision of the experiment and when the students could not prove competence formation. Table 5 summarises the results of the bachelor survey which are graphically depicted in Figure 2.

Table 5: The results of the application of innovative technologies for the organization of the educational process of bachelor's degree students

Learning outcome	**Number of percent (EG)**	**Empirical frequency ni (EG)**	**Number of percent (CG)**	**Empirical frequency ni1 (CG)**	(ni-ni1)^2	(ni-ni1)^2/ni1
Competency level	16,42%	66	3,23%	13	2809	216,08
Activity level	21,14%	85	16,67%	67	324	4,84
Instrumental level	25,87%	104	22,39%	90	196	2,18
Communicative level	20,15%	81	26,87%	108	729	6,75
Organizational level	10,70%	43	22,89%	92	2401	26,10
Unsatisfactory level	5,72%	23	7,96%	32	81	2,53
Total amount	100,00%	402	100,00%	402		258,47

Source: developed by the authors.

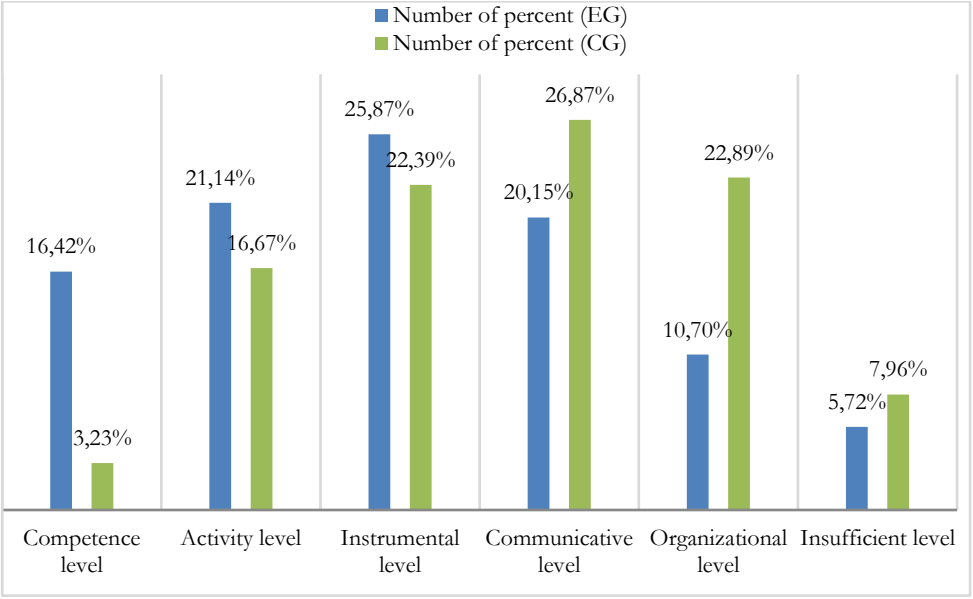

Figure 2: Visualization of the results of the application of innovative technologies for the organization of the educational process of bachelor's degree students
Source: developed by the authors.

The interpretation of the Figure 2 data indicates that with the increase in the level of the innovative technologies implemented into the educational process at the bachelor level, the number of students, exhibiting the indicators of competence, activity, and instrumentality increases accordingly. Thereby, the students are accumulating professional competencies by using, practicing, and applying digital tools and interactive practices, by using more educational activities with the support of digital technologies, by utilizing the widest possible range of resources, multimedia and other digital learning tools.

The critical values for the sample with n=6 are: $\varrho \leq 0.05 = 11.070$; $\varrho \leq 0.01 = 15.086$. With $\chi 2 = 258.47$, we accept hypothesis H1 about the positive impact of innovative technologies in the organization of the educational process through the use of technologies outlined by the authors for bachelor's students.

The findings of the master's level survey are summarized in Table 6 and illustrated in Figure 3.

Table 6: The results of the application of innovative technologies for the organization of the educational process of applicants for the educational degree "Master"

Level	**Number of percent (EG)**	**Empirical frequency ni (EG)**	**Number of percent (CG)**	**Empirical frequency ni1 (CG)**	(ni-ni1)^2	(ni-ni1)^2/ni1
Research level	15,52%	36	8,19%	19	289	15,21

Project level	26,29%	61	16,81%	39	484	12,41
Management level	23,71%	55	20,26%	47	64	1,36
Analytical level	17,67%	41	16,81%	39	4	0,10
Digital level	14,66%	34	31,03%	72	1444	20,06
Unsatisfactory level	2,16%	5	6,90%	16	121	7,56
Total amount	100,00%	232	100,00%	232		56,70

Source: developed by the authors.
Notes: EG, CG - experimental and control groups, respectively.

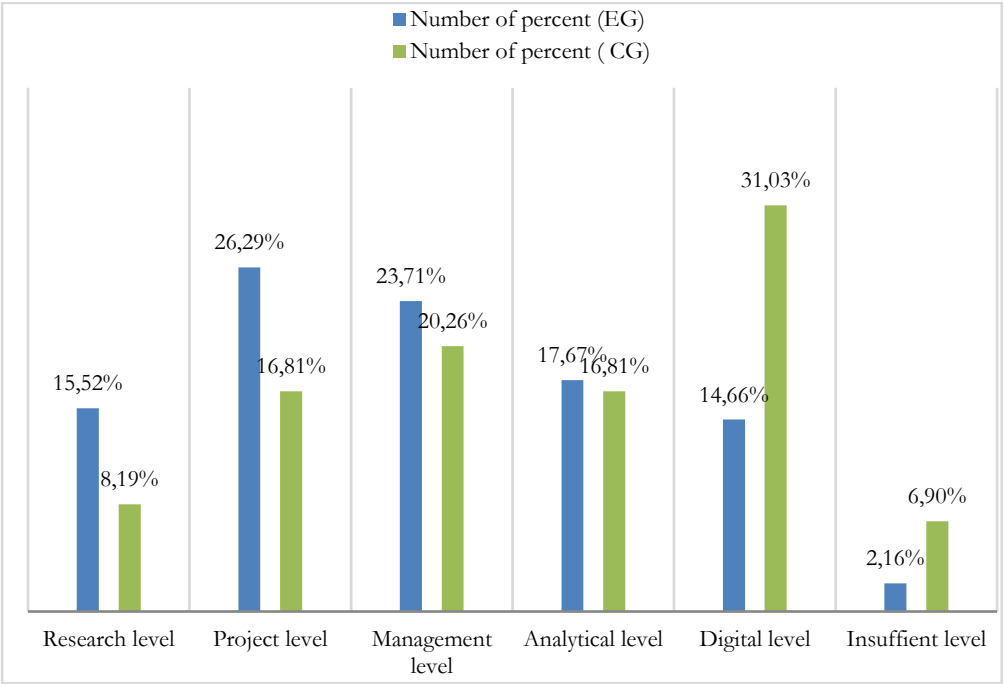

Figure 3: Visualization of the results of the application of innovative technologies for the organization of the educational process of students of the educational degree "Master"
Source: developed by the authors.

With $\chi 2 = 56.70$, we accept hypothesis H1 about the positive impact of innovative technologies in the organization of the educational process through the use of technologies outlined by the authors for students of the degree of Doctor of Philosophy.

The analysis of Figure 3, which illustrates the outcomes of applying innovative technologies in the educational process of master's students, demonstrates growth in research, project, and management indicators. This reflects students' enhanced capacity to analyze, design, and implement innovative technologies, develop educational projects incorporating these tools, and strengthen their competencies in organizing and managing technological initiatives.

Meanwhile, another question that could use further investigation is to evaluate the extent to which the skills that are acquired at the master level, specifically, project and management skills, translate into actual employment outcomes. A longitudinal design that monitors the career status of graduates and their performance in the labor market would be of great interest in terms of sustainability and practicality of the skills acquired in relation to innovative technologies. This would enable researchers to find out whether the competencies developed in the process of studying are sustainable and whether they lead to long-term professional success.

The results of the questionnaire survey of higher education applicants for the degree of Doctor of Philosophy are presented in Table 7 and Fig. 4.

Table 7: Results of the application of innovative technologies for the organization of the educational process of students of the degree of Doctor of Philosophy

Level	**Number of percent (EG)**	**Empirical frequency ni (EG)**	**Number of percent (CG)**	**Empirical frequency ni1 (CG)**	(ni-ni1)^2	(ni-ni1)^2/ni1
Research level	16,67%	6	5,56%	2	16	8,00
Creative level	25,00%	9	11,11%	4	25	6,25
International cooperation level	19,44%	7	19,44%	7	0	0,00
Academic level	19,44%	7	27,78%	10	9	0,90
Social level	13,89%	5	27,78%	10	25	2,50
Unsatisfactory level	5,56%	2	8,33%	3	1	0,33
Total amount	100,00%	37	100,00%	36		17,98

Source: developed by the authors.

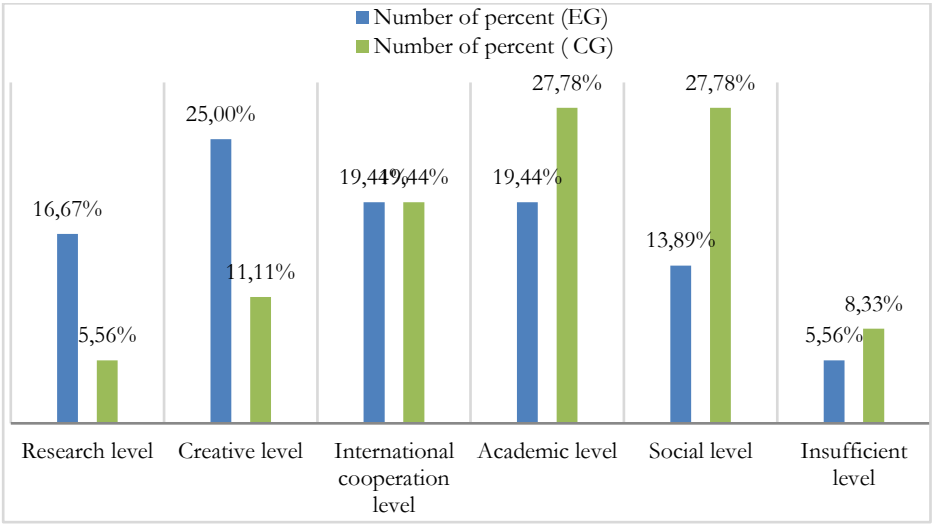

Figure 4: Visualization of the results of the application of innovative technologies for the organization of the educational process of applicants for the degree of Doctor of Philosophy
Source: developed by the authors.

With χ^2=17,98 we accept hypothesis H1 about the positive impact of innovative technologies in the organization of the educational process through the use of technologies outlined by the authors for students of the degree of Doctor of Philosophy.

Analyzing the visualization of the results of the application of innovative technologies for the organization of the educational process of students of the degree of Doctor of Philosophy, the number of higher education students who acquire indicators of research, creative and international cooperation level is increasing, which indicates the use of innovative technologies for research and data analysis, the acquisition of the ability to implement their own research and make proposals to improve existing methods and the ability to communicate scientifically with

It is also important to acknowledge that the universities involved in the study differed in their levels of digitalization. To address these disparities, inter-university seminars were organized, during which faculty and students shared their experiences in applying innovative technologies to the educational process and adopted best practices from one another.

5. Discussion

Ye et al. (2022) propose a model aimed at optimizing and enhancing learning processes. Their work introduces several innovative approaches designed to strengthen the engineering competencies of undergraduate students, enabling them to analyze and address challenges within complex engineering contexts. Although there is a gap between traditional and technological education, technological education has been the best and safest means of transferring information to students and through continuing education. The authors agree with the view that the human component is one of the most important

assets, and attention to intellectual capital is one of the most important challenges facing human resource management because of the urgent need to regulate creativity, innovation, and cognitive work. Unlike much of the previous research that has highlighted the role of intellectual capital and innovation in higher education primarily at a conceptual level, this study provides empirical verification of outcomes through statistical testing. Such evidence-driven confirmation reinforces the validity of arguments for wider adoption of educational technologies globally. By demonstrating measurable improvements in competencies and learning quality, the findings strengthen the case for integrating EdTech into sustainable education reform initiatives aligned with the UN Sustainable Development Goals. This empirical basis helps policymakers and institutions justify investments in digital transformation as not only innovative but also reliably effective. Intellectual capital focuses on the innovative and creative potential of human resources and how to identify, invest in, and retain it.

Due to the development of computer networking technologies, the challenge of implementing them into the physical education has become even more topical. In their article, Zhang and Xia (2021) also analyzed the role in providing physical education through computer-based learning programs to promote this field in higher education further. Equally, Ameno et al. (2023) emphasized that the adoption of industrial technologies into educational processes is a need. The COVID-19 pandemic supported the importance of ICT in the academic process, as it allowed learners to learn and practice the necessary skills, which in the end become a fixed attribute of the academic process. There is agreement amongst scholars that ICT has a positive impact on teaching and learning experience, in that, it creates an atmosphere of interactivity and collaboration.

In case of engineering and technical subjects, it is vital that a graduate should have expertise in applied technology, in addition to professional skills and training at the industry level. Zhu et al. (2021) studied an integrated curriculum concept with an engineering major helping develop training goals, system design, and course organization. Their theory was based on approaches to close the gap between higher vocational education and practical applications in engineering. In addition, information technologies give universities the instruments to gather, handle, and interpret the data that is central to assessing and upholding the high standards in higher education. They help in adhering to foreign standards and enhance interaction among involved parties. Institutions, with the aid of learning management systems, online testing platforms, and data analytics, can have access to accurate real-time data on student outcomes, teaching performance, and institutional satisfaction, and in doing so reinforce quality assurance systems.

Also in comparison to arts education, as Sweeny (2024) (among others) argues, using new technologies in education has numerous advantages, but the most important one is to involve the student to perform activities and learning situations that oppose their ideas and previous concepts. Leveraging new technologies sensibly in the art classroom supports experiential learning, encourages the inquisitive nature of students, and blends independent work in the context of a student workgroup. In addition, when ICT is used as an educational tool, we have seen some real benefits in terms of improving the creativity of our students, their metacognition and the quality of the lessons taught by the art teachers.

The application of information technology is growing more and more in quality management in higher education. Jesus-Silva et al. (2023) this article aims to explain how information technology affects quality management processes as well as the enhancement of academic excellence in the academic institutions of higher education. In their study, the authors also highlight that via online portals and platforms, students, faculty, administrators, and staff members can share information, exchange feedback, and participate in decision-making to create a more inclusive and transparent approach to managing quality management. However, it is important to underline that the successful introduction of IT in quality management requires a strategic approach and an institutional cultural background favouring innovation.

The article by Benitta et al. (2024) reveals the multifaceted potential of artificial intelligence in the transformation of higher education. The study sought to offer a broad understanding of how artificial intelligence is creating a paradigm shift in higher education. It outlines the features that have long characterized the traditional model of higher education, including a standardized curriculum, face-to-face communication, and traditional assessment methods. Artificial intelligence is changing the way educators approach live and interactive teaching. Virtual assistants and chatbots are becoming indispensable in the learning environment, as they help higher education students get ready-made information and support services. The use of virtual reality and artificial intelligence opens up new opportunities for art education, but when applying innovative technologies in the teaching of higher education students in artistic specialties, it is necessary to maintain a balance between digitalization and the development of traditional skills that are the basis of artistic skill.

Integrating innovative technologies into the educational process is a complex task that involves balancing advanced digital possibilities with the preservation of traditional pedagogical principles. Employing a well-chosen set of digital tools alongside diverse instructional strategies enables higher education students to fully realize their academic and professional potential.

6. Conclusions

Introduction of new innovative technologies to the organization of the educational process is necessary to form professional competencies of present-day higher education students. The research offered and statistically confirmed a program of implementation of digital tools according to the level of education. In the case of the bachelor's degree, the digital platform, gamification, virtual laboratories, simulations, augmented and virtual reality, and interactive lectures were detected as core. Master courses focus on adaptable learning, educational data science, resource and project-based learning, and cross-platform study. Artificial intelligence and machine learning, virtual research laboratories, cloud technologies, massive open distance courses and scientometric platforms are becoming more and more common in doctoral studies. The indicators of competence acquisition, at the level of bachelors, master and doctorate, were developed, and the statistical check of the results proved that the implementation of innovative technologies has a positive effect on the process of professional preparation of students. These results support arguments that have been primarily theoretical in nature, hence

bolstering the case across the globe to adopt EdTech and pursue sustainable education reform efforts. The study contributes to the alignment of digital transformation strategies with the Sustainable Development Goals as it proves that the set competencies can be increased measurably. Meanwhile, the study recognizes the research weaknesses associated with sample representativeness since the data were sampled on selected Ukrainian and UK universities. There could be institutional, cultural, and infrastructural divergences in the application and perception of innovations, which also explains why cross-regional studies could be done in the future. Furthermore, the master competencies gained much more ground in project and management areas, but additional research needs to assess the adaptation of these skills into employment figures by means of longitudinal studies of the labor market. The paper also acknowledges the possible risks of digitalization such as the lack of equal access to technology and reliance on online tools as these could endanger equity and diminish the value of interpersonal mentorship. Hybrid learning models, investment in digital inclusion, and the balance between technological innovation and traditional pedagogical values should be sought by institutions to counter these risks. Lastly, there are the problems of adaptability in the long-run due to the rapid development of technologies. It needs continuous monitoring, flexible solutions, and institutional evaluation mechanisms to affirm that the current digital solutions will continue to be relevant to meet the demands of the labor market and global challenges in the future. It is only through innovation coupled with adaptability that the field of higher education will be able to remain relevant and resourced in the age of continuous digital change.

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