ASSESSING THE IMPACT OF INNOVATIVE TEACHING STRATEGIES ON HIGHER EDUCATION OUTCOMES

[a]MYKHAILO PODOLIAK, [b]LIUDMYLA MAZURENKO, [c]VOLODYMYR BINKEVYCH, [d]TETIANA AHIBALOVA, [e]OKSANA KALASHNYK

[a, c]Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies of Lviv, Lviv, Ukraine.
[b]Naval Institute of the National University "Odesa Maritime Academy", Odesa, Ukraine.
[d]Kharkiv National Automobile and Highway University, Kharkiv, Ukraine.
[e]Kharkiv State Academy of Design and Arts, Kharkiv, Ukraine.
email: [a]misha.podol@gmail.com, [b]ruzam11_@ukr.net, [c]binkevych_volodymyr@ukr.net, [d]tanika.fem@gmail.com, [e]oksana.kalashnik1985@gmail.com

Abstract: Innovations open new opportunities for developing creativity, critical thinking and other key competences necessary for success in modern society. In order to create a modern educational system that actively uses innovative technologies and integrates into the global educational space, it is necessary to investigate how effective the implementation of innovative approaches to teaching in higher education is and to rethink the role of the teacher, who should become not only a carrier of knowledge, but also a facilitator of the educational process. The purpose of the study is to examine how innovative technologies change the educational process in higher education institutions, to identify the most relevant digitalisation tools in education, and to substantiate a comprehensive approach to assessing the effectiveness of implementing innovations in teaching in higher education, taking into account the rethinking of the role of the teacher and their impact on the formation of students' professional competences. The study used a comprehensive toolkit that included general scientific methods: document analysis, generalisation, synthesis, system analysis, analytical diagnostics, forecasting, and statistical data analysis. The study paid considerable attention to the impact of information technologies on the professional development of educators, in particular, analysing how the use of new technologies contributes to the development of such competences of higher education students as creativity, critical thinking, the ability to learn independently and collaborate, and how this affects their motivation and academic achievements. It has been found that innovative technologies in higher education contribute to improving its quality by expanding access to knowledge, personalising learning and improving communication. The study's results allowed for substantiating a comprehensive approach to assessing the effectiveness of innovations in teaching in higher education, with the introduction of digital solutions and the latest interactive tools, which is a prerequisite for their successful implementation and improvement of the quality of education.

Keywords: Innovative technologies in higher education, digital tools, advantages and risks of implementation, efficiency of use, professional competences, educational process.

1 Introduction

Over the past decade, higher education has been actively integrating innovative technologies, reflecting global trends in the development of information and digital technologies. Along with the growing role of technology in everyday life, its presence and influence on the educational process in higher education institutions has increased significantly. The Education 4.0 paradigm is shaped by the Fourth Industrial Revolution, which provides the educational process with the necessary technological tools. However, the crisis caused by the pandemic has shown that education systems were not sufficiently prepared for the challenges of the digital era, which manifested in the lack of necessary equipment, software and digital skills among teachers and students.

In modern higher education, the priority is to find new, innovative teaching methods that impart knowledge to students and develop a wide range of competences necessary for success in a dynamic world. This requires introducing modern technologies, actively using problem-based and project-based learning, and continuously assessing competence development to train highly qualified professionals. If innovative methods are available to all participants in the educational process, the full realisation of learning potential and the development of the necessary competences can be achieved.

2 Literature review

Recent decades have been marked by active scientific research into how digital transformation affects various spheres of public life, focusing on technologies such as artificial intelligence, the Internet of Things and big data. Boulton (2020) considers digital transformation as a deep and comprehensive process that inevitably leads to changes in all areas of activity related to the possibilities of remote collaboration, quick access to information resources, personalisation and openness of the digital space, which erases geographical boundaries. The work of many scientists, including Haleem et al. (2022), emphasises the importance of the synergy of artificial intelligence and the Internet of Things in the context of the digital transformation of society, where each of these technologies has its potential. However, their combination opens up new opportunities for innovation.

Pandemic-related restrictions have accelerated the development of global research in digital educational technologies, as there is an urgent need for new solutions to ensure quality education in distance learning. Naciri et al. (2020) emphasise that the COVID-19 pandemic has necessitated the transition to distance learning, and mobile devices have become one of the main tools to ensure the continuity of the educational process, the ability to learn anytime and anywhere. Pelletier et al. (2023) drew attention to an urgent problem: the need to constantly update and improve the latest learning technologies to the changing requirements of our time. They note that artificial intelligence and other digitalisation tools are changing the game's rules in higher education, requiring us to adapt to new realities and develop new approaches. Zawacki-Richter et al. (2019) conducted a comprehensive analysis of the current state of technology use in higher education and proposed a detailed typology, structuring various tools and platforms according to specific criteria, which allows for a better understanding of their functions and capabilities.

In the current scientific debate on education, the effectiveness of innovative technologies in higher education and science is ambiguous and depends on many factors, including the specifics of the educational institution and research area. The study by Lai & Bower (2019) particularly emphasises the importance of this aspect. A systematic approach to analysing innovative teaching technologies allows the creation of optimal models of their application in various fields of knowledge. Kim et al. (2019) and Haidabrus (2022) in their scientific works demonstrate that innovative learning technologies deserve academic recognition in the higher education system and should become the basis for practical actions aimed at modernising higher education to meet the demands of modern challenges. Particular attention is paid to distance learning systems, in particular, the use of the Moodle platform in the educational process, the effectiveness of which in the educational process was studied by Gamage et al. (2022).

The teacher is crucial in transferring knowledge and developing professional competences in students. The study by Castro (2019) emphasises how complex the relationship between people and technology in the educational process is in the context of using modern teaching methods. Besehanych et al. (2023) rightly point out that the professional development of teaching staff should accompany the introduction of innovative technologies because the teacher is an essential participant in the educational process, building his/her relationship with students based on mutual respect and understanding. The readiness of teachers to change is becoming an urgent issue, as noted by Scherer et al. (2021). The innovative approach of the teacher stimulates the cognitive activity of students, promoting deep learning and the formation of competences necessary for the future profession, the research and evaluation of which requires constant monitoring to eliminate the possible gap between the digital capabilities of the present and the skills of participants in the educational process. The systematic combination of innovative teaching methods and effective forms of assessment contributes to the comprehensive development of students and the formation of the necessary competences for successful professional activity in a dynamic world, as proved in their work by Shuliakov et al. (2024).

The issues of interactive learning, in particular its features, methods of assessment and improving the performance of all participants in the educational process, are discussed in detail in many scientific

works, such as Aljawarneh et al. (2019). Nakagawa et al. (2020) investigate such assessment's medical and physiological aspects, focusing on what communication conditions most effectively maintain student concentration during distance learning. They argue that distance learning negatively affects the level of communication among students, which in turn leads to a decrease in concentration on the learning process. Biometric information can serve as an effective tool for measuring learning outcomes. The creation of visual diagrams that show how students interact with different educational technologies was investigated by Bond et al. (2020). Although the study demonstrated positive results of using new teaching methods, not all aspects were considered sufficiently; in particular, these methods' long-term effects remain unexplored. Further research on using innovative technologies in higher education is necessary to optimise the learning process, increase its efficiency, and develop the competences necessary for students to work in the modern information society.

3 Research aims

The study aims to identify the key factors that contribute to the effective implementation of new teaching methods and their impact on the quality of training and to determine a comprehensive approach to assessing the effectiveness of teaching innovations in higher education, taking into account the rethinking of the role of the teacher and their impact on the formation of students' professional competences.

4 Research methods

The study used general scientific methods, including generalisation, synthesis, system analysis, analytical diagnostics, forecasting, and statistical, regression and correlation data analyses. The analytical diagnostics method was used to study critical indicators of society's digitalisation, such as the dynamics and assessment of Internet access and digital skills at the primary level and above in the EU countries, which allowed us to get a general idea of the progress made by the European Union in this area in recent years. The information obtained through quantitative analysis of open data from Eurostat (n.d.) on digital skills and Internet access was visualised using the graphical method, allowing for exploring the existing progress patterns and interrelationships. Moreover, the forecasting method allowed us to substantiate predictive data on the possible future dynamics of these processes. To ensure the reliability of the existing forecast, we used the regression analysis method to build a trend line for the indicator of digital skills at primary level and above among the population of EU countries, as well as the correlation analysis method to understand how closely this indicator is related to the indicator of Internet access.

Using the analytical method allowed us to identify the strengths of modern educational, innovative technologies that contribute to developing the educational potential of all participants in the educational process and to highlight the risk aspects that hinder these processes. Thanks to the systemic and structural approach, we were able to comprehensively analyse how innovative approaches to teaching in higher education contribute to the development of student's creative abilities and increase the efficiency of teachers. Using this methodology allowed us to systematise scientific information on methods for assessing the effectiveness of innovations in higher education and substantiate a comprehensive approach to assessing the effectiveness of innovative approaches to teaching in higher education.

5 Results

Global trends in the digital transformation of society are reflected in higher education, which is actively implementing innovative teaching technologies. The pandemic has opened up new educational horizons, demonstrating the potential of innovative learning as an independent and effective educational tool. The continuity of education in higher education institutions has become possible thanks to introducing an innovative model that combines distance, digital, and virtual technologies. The cyclical nature of the development of innovative technologies in higher education demonstrates their ability to adapt to new challenges, and their resilience to change makes them a critical factor in modernising the educational process (Figure 1).

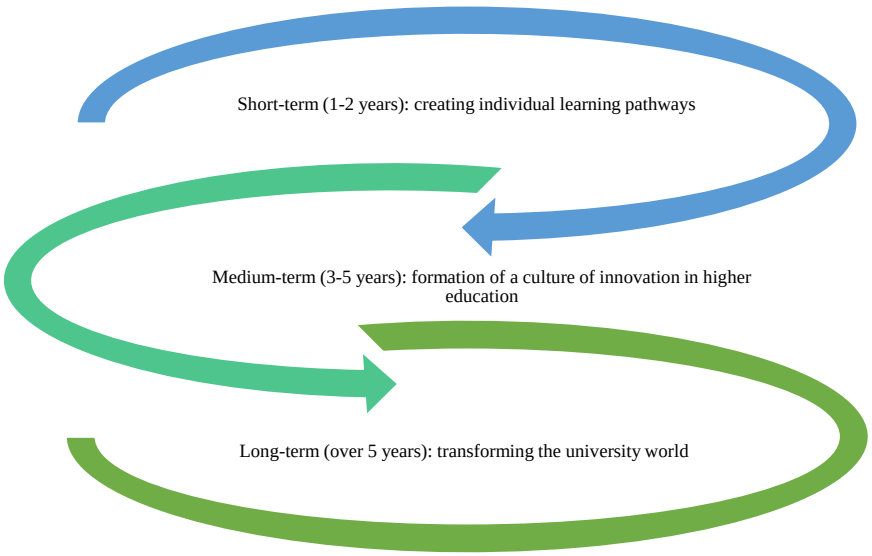

Figure 1: Life Cycle of Innovative Technologies in Higher Education.
Source: Compiled by the author based on (Pelletier et al., 2023).

The successful implementation of innovative technologies depends on the ability of the educational community to adapt to change (Rani et al., 2021). There is a steady upward trend in the level of digital skills of the population, as evidenced by a decrease in the number of people with no digital skills at all and an increase in the proportion of those with primary and higher levels of digital literacy. In addition to the traditional division into low and high readiness levels, some studies reveal a more complex picture, where teachers' readiness level to implement innovative technologies can vary considerably. There is a mismatch between the level of digital literacy of teachers and students and their understanding of how these skills can be used in teaching (Fitzgerald et al., 2023).

On 23 November 2023, the European Council adopted recommendations that set the main directions for developing digital education and training in Europe. These recommendations aim to ensure access to quality digital education for all citizens, enhance the digital competences of the population and promote innovation in education. This package of measures is designed to ensure that education is ready for digital transformation, allowing it to meet the demands of today's dynamic world (Devlin, 2024). As part of the Digital

Decade initiative, the EU aims to ensure that 80 % of the adult population has essential digital competences by 2030. Based on the results of the regression analysis without and with projected data, we obtained a result that may indicate that the forecasts provided are justified, in terms of increasing digital skills of the primary level and above in the EU countries, and the correlation coefficient of 0.95 obtained suggests a close relationship between Internet access and digital skills of the population (Figure 2).

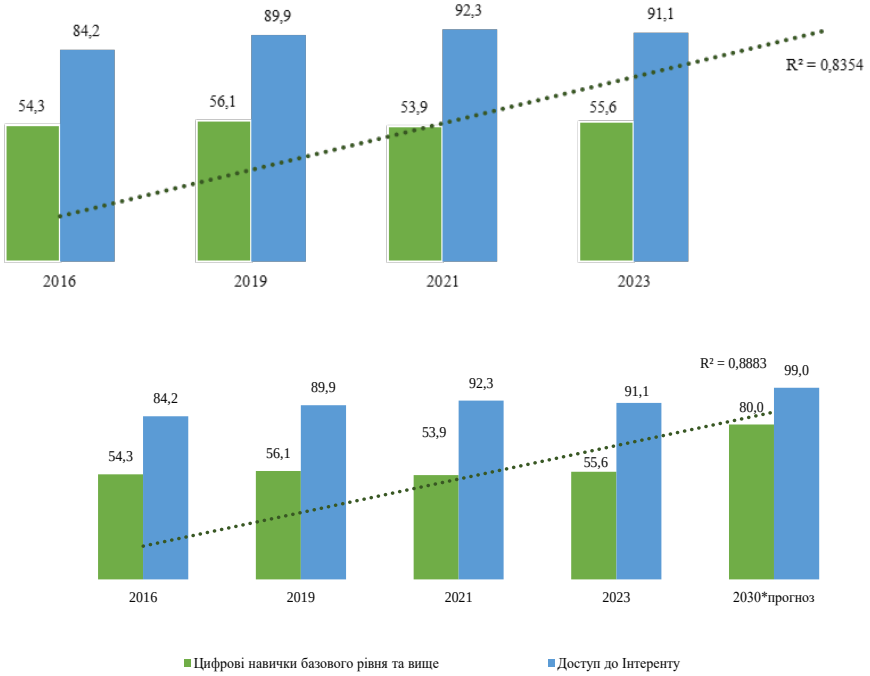

Figure 2: Dynamics and Forecasting of Internet Access and Digital Skills at Basic Level and Above in EU Countries.
Source: Compiled by the author based on data from (Eurostat, n.d.).

Among the modern pedagogical innovations are interactive methods, multimedia, telecommunications and virtual reality, which create a more effective learning environment. Teachers actively use various online platforms and applications, such as Zoom, Google Meet, Skype, Microsoft Teams, Classtime, and Cisco Webex Meetings, to make distance learning effective and close to traditional learning. In addition, online courses on the Prometheus, VUMonline, and Khan Academy platforms and video lectures on YouTube, EdEra and WiseCow have become popular. The variety of innovative learning tools in 2024, according to the Centre for Learning &Performance Technologies' annual survey (2024), is shown in Figure 3. This year's top new product is another artificial intelligence chatbot, Microsoft's Copilot, and there are 3 more new AI chatbots on the list — Perplexity, Claude and Gemini from Google, which suggests that in 2024, artificial intelligence has gained popularity among all participants in the educational environment (Top 100 Tools for Learning 2024, n.d.).

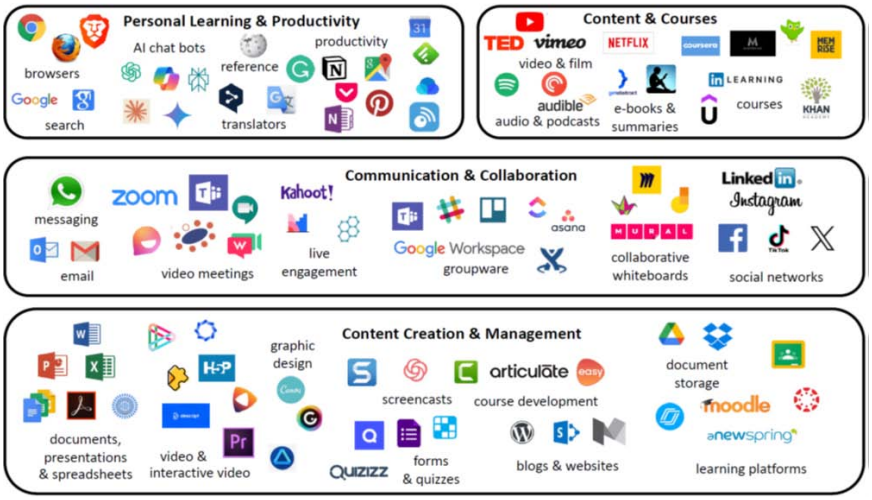

Figure 3: The Most Popular Educational Innovations by Category.
Source: (Top 100 Tools for Learning 2024, n.d.)

Distance learning conditions require innovative technologies that facilitate students' active involvement in learning and developing their professional competences. Studies show that students who study with the help of innovative technologies gain more profound experience, interact more actively with each other, and develop greater independence in learning, among other benefits of using innovative technologies in higher education (Figure 4).

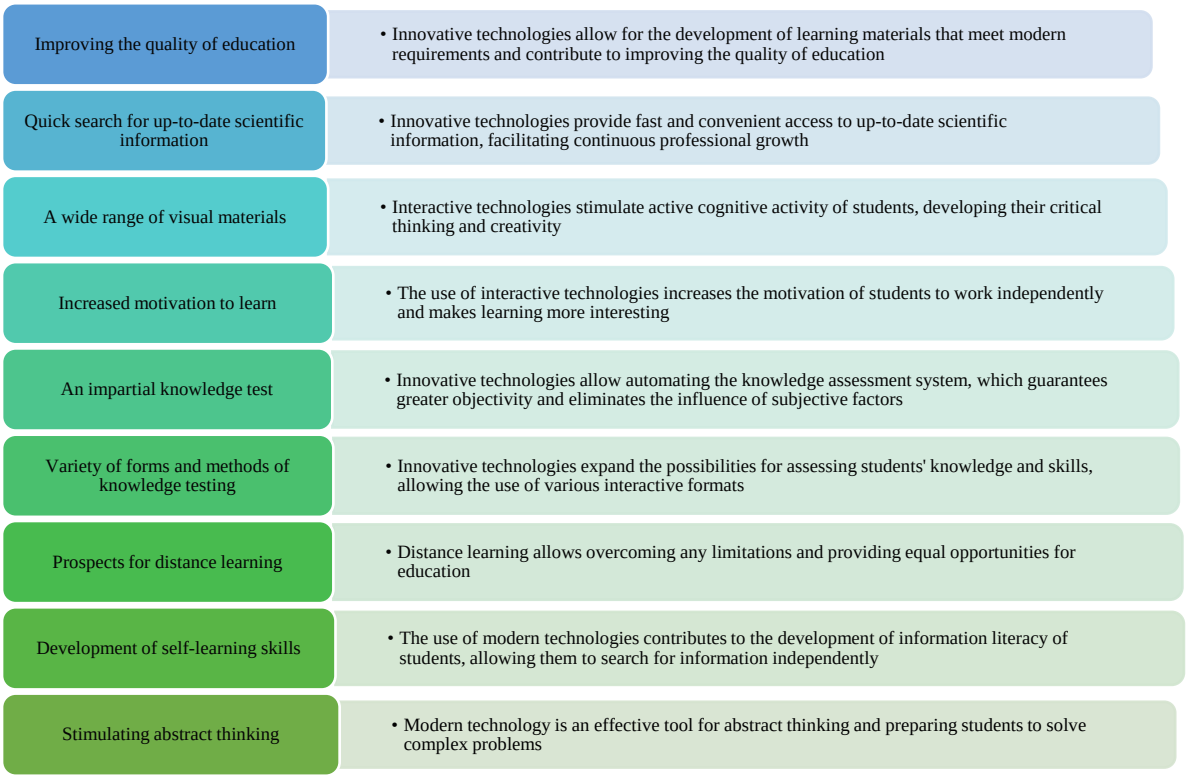

Figure 4: Benefits of Using Innovative Technologies in Higher Education.
Source: Compiled by the author based on (Besehanych et al., 2023).

Effective distance learning involves using technologies that focus on the learner as a subject of learning, enabling them to acquire knowledge and develop professional skills independently with the support of a teacher. By integrating innovative technologies into the learning process, such as online platforms, virtual reality, and artificial intelligence, the role of each participant in the educational process is enhanced, especially the activity of students in the search for new knowledge (Abuhassna et al., 2020). This approach to learning allows students to actively interact with the teacher online, solve complex practical problems, develop critical thinking, and create learning models on their own.

Innovative technologies in education open up new opportunities for expanding access to knowledge, flexible learning, increasing student engagement, and ensuring the mobility of teachers and students (Smith & Hill, 2018). However, along with its benefits, the technologisation of education also carries certain risks: over-reliance on technology, unequal access to learning, threats to data privacy and security, the potential loss of human values and a tendency towards consumerism (Figure 5). In order to fully utilise the potential of innovative technologies in education and minimise the associated risks, it is necessary to ensure proper training of educational stakeholders and develop effective information security strategies.

Risks of implementing innovations in higher education	
	Over-reliance on innovative technologies creates vulnerability to potential problems that may arise in the event of their malfunction or technical failures
	Lack of equal access to digital resources creates barriers to learning, especially for vulnerable groups of students
	Inadequate protection of personal data collected through digital technologies can lead to serious consequences for their privacy and security
	The lack of proper competence of teachers in the field of innovative technologies can hinder their implementation in the educational process
	Excessive automation can reduce students' motivation to learn and limit their ability to express themselves creatively

Figure 5: Risks of Implementing Innovations in Higher Education.
Source: Adapted from (Mamedova, 2023).

Evaluating the effectiveness of new technologies in teaching in higher education plays a crucial role in improving the entire educational process. Through a systematic approach and various methods and tools, it is possible to obtain objective information about the effectiveness of technologies and optimise the learning process to achieve better results. Assessment serves as a tool to determine students' achievement levels and identify their strengths and weaknesses (Geng et al., 2019). Since the traditional classroom learning format cannot be directly transferred to the online environment, experts are developing new, more effective assessment systems that consider the specifics of distance learning and modern requirements for students' competences. European assessment systems are highly flexible, using various criteria adapted to each student's needs, regardless of the place of study. In order to complete an assessment, students must not only maintain academic integrity but also fulfil all technical requirements (Wojciech et al., 2021). Regardless of the type, effective learning has many common attributes: collaborative, exploratory and experiential. This means that students are not limited to the role of passive listeners, but become active participants in class discussions, conduct their research and apply their knowledge in practice. Teachers play a crucial role in engaging students in distance learning — with the help of modern technologies, they can turn virtual classrooms into lively and exciting learning spaces (Bond et al., 2019).

The specificity of innovations in higher education lies in their ability not only to solve specific problems but also to create new opportunities for the development of the educational process and the formation of competences in students and even teachers. In addition, universities should focus on making the educational process accessible to all students, taking into account their unique needs, which requires the development and application of innovative technologies that allow them to adapt the learning material to the needs of each individual.

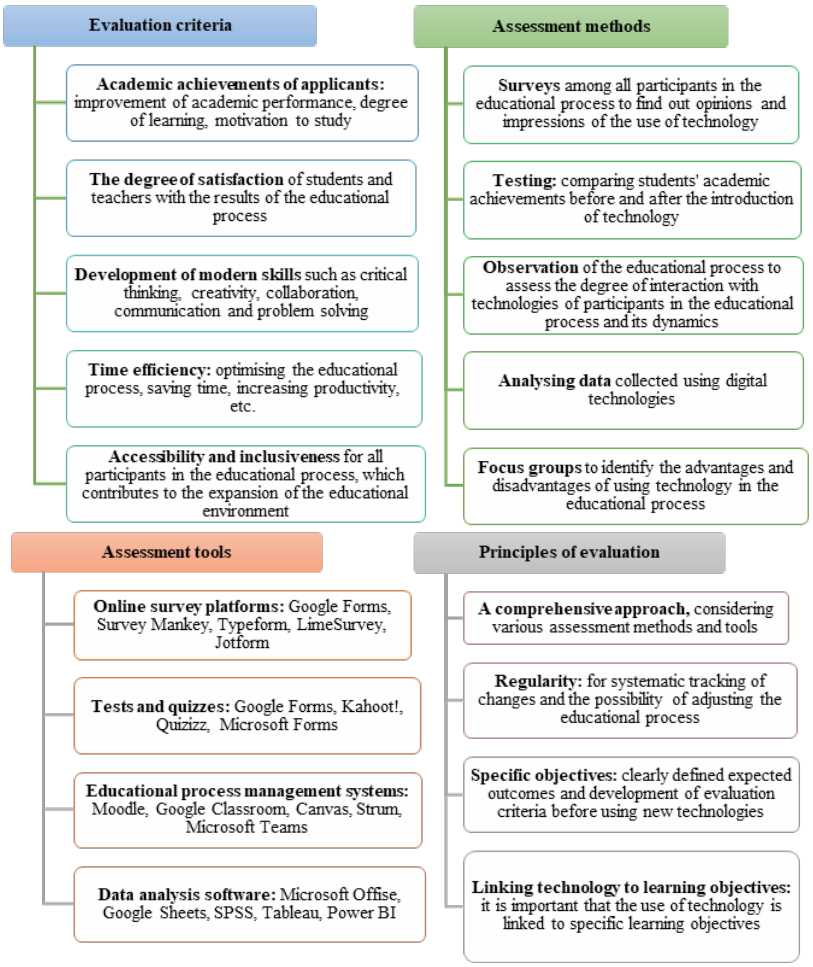

Figure 6: Comprehensive Approach to Evaluating the Effectiveness of New Approaches to Teaching in Higher Education. Source: Constructed by the author.

Measuring the effectiveness of innovative pedagogical technologies in higher education is a critical process that allows for determining the effectiveness of new teaching methods, their impact on the quality of education, and student satisfaction. It ensures continuous improvement of the level of education and adaptation of the educational process to the requirements of the modern world in such areas as:

- Improving the quality of education achieved through assessment can identify those methods that contribute to students' better learning and the development of their critical thinking, creativity, and other essential skills.
- Optimisation of the learning process: Analysis helps us see the advantages and disadvantages of different methods, which allows us to adjust training programmes and methods as needed.
- Increasing student satisfaction, which, through evaluation, allows us to understand how satisfied students are with new teaching methods and whether they meet their needs and expectations.
- Justification of further innovations, where the assessment results are the basis for making decisions on introducing new technologies and teaching methods in the future.
- Increasing the prestige of a higher education institution when the successful implementation of innovative approaches increases its competitiveness and attractiveness to potential applicants.

Integrating digital technologies into the educational process requires universities to introduce new technical tools and take a comprehensive approach, including developing detailed approaches that can cover changes in the organisational structure, learning processes, and interaction of all those involved in learning. The main task is to preserve the personal approach to learning even with modern technologies, as it contributes to developing vital competences such as critical thinking and creativity.

6 Discussion

The rapid development of technology is radically changing all aspects of modern society. Focusing on innovation and searching for new ideas are some of the most critical trends in the modern world. Modern transformations also affect education and need to be updated to meet today's requirements. To meet the challenges of the modern world, education must be innovative, equipping young people with the skills they need to live in a dynamic and complex environment. Modern higher education is increasingly focused on developing students' competences and preparing them for life in a dynamic world. This is achieved by introducing innovations such as project-based learning, interaction pedagogy, artificial intelligence, distance education, and gamification.

Thanks to informatisation, education has undergone profound transformations: learning formats have changed, progressive methods of organising the educational process have emerged,

and distance learning has become an integral part of it, which has dramatically changed the modern educational space. Traditional teaching methods have undergone significant changes due to the introduction of digital technologies, making the educational process more dynamic and interactive (Abad-Segura et al., 2020). In particular, higher education has adapted flexibly, ensuring the continuity of the learning process even in conditions of limited face-to-face communication (Selznick et al., 2021). Distance learning technologies have become a massive phenomenon in education, especially after the introduction of quarantine restrictions due to the COVID-19 pandemic. This form of learning has become a globally recognised component of modern education, offering a variety of formats that meet the needs of those who want to improve their professional skills and those who seek higher education (Naciri et al., 2020).

Scientific research shows that the use of innovative technologies contributes to the modernisation of higher education, and in particular, it has a positive impact on students' experience, interaction, and independence (Shen & Ho, 2020). Information technologies create conditions for an individual approach to each student, adapting the learning process to their needs and pace; they make education more open, interactive and individual; open educational resources allow everyone to acquire knowledge at a convenient time and place (Ouyang et al., 2022). As educational innovations do not stand still, a promising area for further research is a detailed study of the European experience of using interactive teaching methods. This will allow for the identification of best practices and adaptation to the realities of each national educational system.

7 Conclusion

The study aimed at substantiating approaches to assessing the effectiveness of innovations in teaching in higher education, taking into account their impact on the formation of professional competences of students, allowed us to draw the following conclusions:

- The active integration of innovative teaching methods is a prerequisite for effective learning in a combination of classroom and distance learning. In response to today's challenges, education should focus on creating an innovative educational environment, allowing students to learn effectively in combined formats. Innovative teaching methods should aim to develop the vital knowledge, practical skills, and critical thinking necessary for successful professional activity.
- The systematic use of modern information technologies intensifies the learning process, making it more exciting and compelling. They change the role of the teacher, turning him or her into a learning facilitator who stimulates students' creativity and helps them develop critical thinking, becoming more effective and sought-after professionals. Students, in turn, show greater interest in new knowledge and learn to acquire information on their own, contributing to their comprehensive development and preparation for the requirements of the modern labour market.
- The introduction of digital tools in education opens up new opportunities for the comprehensive development of future specialists' professional competences, regardless of their field. This gives them the necessary knowledge and skills to work successfully in today's dynamic world. The technologisation of education creates the conditions for research to determine the effectiveness of different approaches to acquiring professional competences. Thanks to various digital tools and platforms allowing large-scale experiments, large amounts of data are collected and analysed.
- Evaluation of the effectiveness of innovative approaches to teaching in higher education is an integral part of their implementation, as it allows for continuous improvement of the quality of education and adaptation of the educational process to the requirements of the modern world. A comprehensive approach to evaluating the effectiveness of innovative processes in teaching in higher education allows for a more complete and objective picture of the results than individual, isolated evaluation methods, takes into account the capabilities of digital tools and provides up-to-date, consistent and visualised information on the results of the evaluation.

Summing up, it can be noted that the use of the latest technologies in higher education has great potential in training specialists who will be able to realise themselves in a dynamic world successfully; however, to achieve maximum efficiency, it is necessary to overcome several challenges related to the digital divide between individual countries, the lack of a transparent, unambiguous methodology that complicates the qualitative assessment of the effectiveness of the use of innovative approaches by teachers in higher education, and the relatively high cost of specific tools of innovative

Literature:

1. Abad-Segura, E., González-Zamar, M.-D., Infante-Moro, J. C., Ruipérez García, G.: Sustainable Management of Digital Transformation in Higher Education: Global Research Trends. *Sustainability*, 2020. 12(5), Art. No. 2107. https://doi.org/10.3390/su12052107
2. Abuhassna, H., Al-Rahmi, W. M., Yahya, N., Zakaria, M. A. Z. M., Kosnin, A. B. M., Darwish, M.: Development of a new model on using online learning platforms to improve students' academic achievement and satisfaction. *International Journal of Educational Technology in Higher Education*, 2020. 17(1). https://doi.org/10.1186/s41239-020-00216-z
3. Aljawarneh, S. A.: Reviewing and exploring innovative ubiquitous learning tools in higher education. *Journal of Computing in Higher Education*, 2019. 32(1), 57-73. https://doi.org/10.1007/s12528-019-09207-0
4. Besehanych, I. V., Kolesnyk, A. V., Kushch, Yu. I.: Analysis of the effectiveness of innovative educational platforms in the process of professional training of biologists in higher education institutions of Ukraine. *Academic visions*, 2023. 19. https://academy-vision.org/index.php/av/article/view/335 (in Ukrainian).
5. Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., Kerres, M.: Mapping research in student engagement and educational technology in higher education: a systematic evidence map. *International Journal of Educational Technology in Higher Education*, 2020. 17(1). https://doi.org/10.1186/s41239-019-0176-8
6. Bond, M., Bedenlier, S.: Facilitating Student Engagement Through Educational Technology: Towards a Conceptual Framework. *Journal of Interactive Media in Education*, 2019. 2019(1). https://doi.org/10.5334/jime.528.
7. Boulton, C.: What is digital transformation? A necessary disruption. *CIO*, 2020. https://www.cio.com/article/3211428/ what-is-digital-transformation-a-necessary-disruption.html
8. Castro, R.: Blended learning in higher education: Trends and capabilities. *Education and Information Technologies*, 2019. 24(4), 2523-2546. https://doi.org/10.1007/s10639-019-09886-3
9. Devlin, P.: Online Learning Statistics: The Ultimate List in 2024. Updated on January 11, 2024. https://www.devlinpeck.com/content/online-learning-statistics
10. Eurostat: Emissions of greenhouse gases and air pollutants. *Eurostat*, n. d. https://ec.europa.eu/eurostat/web /environment/information-data/emissions-greenhouse-gases-air-pollutants
11. Fitzgerald, R., Huijser, H., Altena, S., Armellini, A.: Addressing the challenging elements of distance education. *Distance Education*, 2023. 44(2), 207-212. https://doi.org/10.1080/01587919.2023.2209527
12. Gamage, S. H. P. W., Ayres, J. R., Behrend, M. B.: A systematic review on trends in using Moodle for teaching and learning. *International Journal of STEM Education*, 2022. 9(1). https://doi.org/10.1186/s40594-021-00323-x
13. Geng, S., Law, K. M. Y., Niu, B.: Investigating self-directed learning and technology readiness in blending learning environment. *International Journal of Educational Technology in Higher Education*, 2019. 16(1). https://doi.org/10.1186/s41239-019-0147-0

14. Haidabrus, B.: Information technology and management in higher education and science. *Future Education*, 2022. 26-35. https://doi.org/10.57125/fed.2022.25.12.03
15. Haleem, P. A., Javaid, D. M., Qadri, P. M. A., Suman, D. R.: Understanding the Role of Digital Technologies in Education: A review. *Sustainable Operations and Computers*, 2022. (3), 275-285. https://doi.org/10.1016/j.susoc.2022.05.004
16. Kim, H. J., Hong, A. J., Song, H.-D.: The roles of academic engagement and digital readiness in students' achievements in university e-learning environments. *International Journal of Educational Technology in Higher Education*, 2019. 16(1). https://doi.org/10.1186/s41239-019-0152-3
17. Lai, J. W. M., Bower, M.: How is the use of technology in education evaluated? A systematic review. *Computers & Education*, 2019. 133, 27-42. https://doi.org/10.1016/j.compedu.2019.01.010
18. Mamedova, H.: Innovations in education as an important factor in the development of the educational system. *Hrani*, 2023. 26(5), 149-154. https://doi.org/10.15421/1723115 (in Ukrainian).
19. Naciri, A., Baba, M. A., Achbani, A., Kharbach, A.: Mobile Learning in Higher Education: Unavoidable Alternative during COVID-19. *Aquademia*, 2020. 4(1), Art. No. ep20016. https://doi.org/10.29333/aquademia/8227
20. Nakagawa, Y., Sripian, P., Sugaya, M.: Evaluation of distance learning on concentration and relaxation by EEG and HRV. SenSys '20: The 18th ACM Conference on Embedded Networked Sensor Systems. *ACM*, 2020. 762-763. https://doi.org/10.1145/3384419.3430602
21. Ouyang, F., Zheng, L., Jiao, P.: Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020. *Education and Information Technologies*, 2022. 27, 7893–7925. https://doi.org/10.1007/s10639-022-10925-9
22. Pelletier, K., Robert, J., Muscanell, N., McCormack, M., Reeves, J., Reeves, J., Arbino, N., Grajek, S., Birdwell, W. T., Liu, D., Mandernach, J., Moore, A., Porcaro, A., Rutledge, R. Zimmern, J.: *2023 EDUCAUSE Horizon Report Teaching and Learning Edition*. Boulder, CO: EDUCAUSE, 2023. https://www.learntechlib.org/p/222401/
23. Rani, G., Kaur, P., Sharma, T., Sharma, A.: *Digital Education Challenges and Opportunities. In 2021 6th International Conference on Signal Processing, Computing and Control (ISPCC)*. N. Y.: IEEE, 2021. https://doi.org/10.1109/ispcc53510.2021.9609425
24. Selznick, B. S., Dahl, L. S., Youngerman, E., Mayhew, M. J.: Equitably Linking Integrative Learning and Students' Innovation Capacities. *Innovative Higher Education*, 2021. 47, 1–21. https://doi.org/10.1007/s10755-021-09570-w
25. Scherer, R., Howard, S. K., Tondeur, J., Siddiq, F.: Profiling teachers' readiness for online teaching and learning in higher education: Who's ready? *Computers in Human Behaviour*, 2021. 118, 106675. https://doi.org/10.1016/j.chb.2020.106675
26. Shen, C.-W., Ho, J.-T.: Technology-enhanced learning in higher education: A bibliometric analysis with latent semantic approach. *Computers in Human Behaviour*, 2020. 104, Art. No. 106177. https://doi.org/10.1016/j.chb.2019.106177
27. Shuliakov, I. M., Oliinyk, O. V., Derevianko, I. V.: Development of key competencies of students in a higher educational institution: approaches, methods and evaluation of results. *Academic visions*, 2024. 32. https://academy-vision.org/index.php/av/article/view/1203 (in Ukrainian).
28. Smith, K., Hill, J.: Defining the nature of blended learning through its depiction in current research. *Higher Education Research & Development*, 2018. 38(2), 383-397. https://doi.org/10.1080/07294360.2018.1517732
29. *The Job Skills of 2023. The Fastest-Growing Job Skills for Institutions*. Coursera, 2023. https://istu.edu.ua/wp-content/uploads/2023/02/eBook-Job-Skills-of-2023.pdf
30. *Top 100 Tools for Learning 2024 — Results of the 18th Annual Survey published on 2 September 2024*. Top 100 Tools for Learning, 2 September 2024. https://toptools4learning.com/
31. Zawacki-Richter, O., Marín, V. I., Bond, M., Gouverneur, F.: Systematic review of research on artificial intelligence applications in higher education — where are the educators? *International Journal of Educational Technology in Higher Education*, 2019. 16(1). https://doi.org/10.1186/s41239-019-0171-0
32. Wojciech, W., Sobczyk, W., Waldemar, L., Pochopień, J.: Future educator's digital learning assets: global challenges of our time. *Future Education*, 2021. 1(2), 32-41. https://doi.org/10.57125/FED/2022.10.11.17

Primary Paper Section: A

Secondary Paper Section: AM