ADVANCED LEARNING TECHNOLOGIES FOR HIGHER EDUCATION

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Abstract: The relevance of using modern educational technologies in higher educational institutions is increasing yearly, especially under the digitalisation and globalisation of the educational process. These technologies, including digital media communications, online platforms, and virtual and augmented reality (VR and AR), play a key role in improving students' quality of education and professional training. The study aims to assess the effectiveness of using modern educational technologies in higher educational institutions, with the object of the study being the educational processes in which these technologies are applied. The research methodology includes a literature review, questionnaires and surveys, a pedagogical experiment with control and experimental groups, and a statistical data analysis. The study's results showed that using digital media communications and online platforms significantly increases the interactivity and accessibility of educational resources, promoting active student engagement in the learning process and improving their academic achievements. Virtual and augmented reality (VR and AR) create immersive educational environments that facilitate a more profound understanding of the material and enhance student motivation. Distance learning requires the development of digital and communication skills, which is especially important in the context of the COVID-19 pandemic. The pedagogical experiment confirmed that the experimental groups of students taught using modern technologies showed better results than the control groups, who were taught using traditional methods. The practical significance of the obtained results lies in developing recommendations for the optimal use of modern educational technologies in higher educational institutions to improve the quality of education and professional training of students.

Keywords: modern educational technologies, digital media communications, online platforms, virtual reality, augmented reality, distance learning, digital skills, communication skills, higher education.

1 Introduction

In recent years, higher education institutions have faced the necessity to adapt to a rapidly changing digital landscape. Implementing modern educational technologies has become an integral part of the development strategies of universities worldwide. Digital media communication technologies, online platforms, and virtual and augmented reality (VR and AR) provide new opportunities for improving the quality of education and increasing its accessibility (Batsurovska et al., 2021; Kaplan & Haenlein, 2016). At the same time, implementing these technologies faces several challenges, such as insufficient preparedness of teachers and students to use new tools and teaching methods (Norkobilovna & Turakulova, 2020). It underscores the need for a systematic approach to training and developing digital competencies. Virtual and augmented reality, for example, can significantly enhance student engagement and facilitate a more profound understanding of the material (Garibli & Garibli, 2021). Distance learning, which has become particularly relevant in the COVID-19 pandemic, requires developing digital and communication skills to ensure an effective educational process (Jackson, 2021; Kolbina & Oleksenko, 2020). Despite numerous studies, there is a need for further assessment and optimisation of these technologies in higher educational institutions (Finin, 2018). This study aims to provide a comprehensive analysis of the application of modern educational technologies and their impact on the quality of education and professional training of students.

In recent years, modern educational technologies have become increasingly relevant and in demand in higher education institutions. In the context of the rapid development of digital technologies and the globalisation of the educational process, universities must adapt and integrate innovative teaching methods to improve the quality of education and the professional training of students. The literature emphasises that digital media communications and online platforms play a crucial role in ensuring the accessibility and interactivity of the educational process (Batsurovska et al., 2021; Kaplan & Haenlein, 2016). However, the implementation of modern technologies faces several problems and challenges. One such problem is the need for more competence of teachers and students in using new tools and teaching methods (Norkobilovna & Turakulova, 2020). In addition, there is a need to assess the effectiveness of various technologies, such as virtual and augmented reality (VR and AR), in enhancing students' academic achievements and motivation (Garibli & Garibli, 2021; Vaganova et al., 2020). There is a need for systematic study and evaluation of the effectiveness of these technologies to develop recommendations for their optimal use in educational institutions. Therefore, this study aims to provide a comprehensive analysis and evaluation of the impact of modern educational technologies on the quality of education and the professional training of students in higher education institutions.

This study aims to investigate and evaluate the effectiveness of using modern educational technologies in higher education institutions to improve student's quality of education and professional training.

Objectives:

1. To analyse the system of training specialists using modern learning technologies.
2. To conduct a pedagogical experiment with the participation of control and experimental groups of students to assess the impact of modern teaching technologies (online platforms, VR and AR technologies, interactive teaching methods, etc.)
3. To test experimentally the effectiveness of the proposed technology.

2 Recent research and publication analysis

2.1 Digital media communication technologies and competence-based approach

Batsurovska et al. (2021) study the technology of acquiring competencies by bachelor's degree students in a digital media communication environment. The publication emphasises the importance of digital media communications for enhancing students' competencies. Batsurovska (2021) explores the technological model for training master's degree students in electrical engineering. The work shows that digital tools contribute to a more profound mastery of professional skills. Norkobilovna & Turakulova (2020) describe the competency-based approach of teachers when implementing modern educational technologies. The study shows that this approach promotes the practical adaptation of teachers to new educational technologies. Bilous & Demianiuk (2022) analyse the conditions and methods of implementing modern technologies in education. The authors argue that the digital education transformation increases students' professional training levels. Garibli & Garibli (2021) investigate the application of modern educational technologies and their impact on national interests. The work emphasises the importance of a competency-based approach to education development. The studies highlight the importance of digital media communications and a competency-based approach to improve the quality of higher education. A competency-based approach allows students and teachers to apply the acquired knowledge and skills professionally and effectively.

2.2 Using online platforms and e-learning

Batsurovska et al. (2022) describe the technology of using 3D models of electrical engineering in laboratory work. Nagayev et al. (2021) investigate the impact of online platforms on the

organisation and management of the educational process. The authors emphasise that modern technologies promote active student engagement in educational activities. Babenko et al (2023) analyse the impact of the online environment on creating coursework. Kaplan & Haenlein (2016) examine the impact of massive open online courses (MOOCs) and miniature private online courses (SPOCs) on higher education. The authors argue that these technologies can significantly change traditional educational models. Hulivata & Nikolina (2019) describe the features of implementing educational content using modern technologies. Hevlych & Neskorodieva (2022) investigate the use of distance educational technologies in modern learning. Kolbina & Oleksenko (2020) analyse the implementation of distance learning in Ukraine. The study highlights the importance of online platforms for the continuous educational process. Kruty et al. (2019) investigate methods of e-learning for students. The authors emphasise that such methods contribute to improving the educational process. Online platforms and e-learning significantly enhance the interactivity and accessibility of educational resources (Kovalenko & Hontarenko, 2023).

2.3 Virtual and augmented reality (VR and AR) in education

Garibli & Garibli (2021) investigate the application of VR and AR technologies in the educational process and their impact on student engagement. Vaganova et al. (2020) analyse methods of applying VR and AR in adult education. The authors argue that such technologies create more immersive and interactive educational environments. Dauitbayeva et al. (2022) examine the role of web technologies in the educational process and their impact on teaching. Smagulov & Hajmuldanov (2019) describe methods of using VR and AR technologies for student testing. The authors emphasise that VR and AR technologies significantly improve the quality of education. Priadko et al. (2022) analyse the features of using multimedia technologies, including VR and AR, in the educational process. Eshaliyev & To'rayev (2019) investigate modern trends in the use of information technologies, including VR and AR, in the educational process. Virtual and augmented reality technologies significantly enhance the level of engagement and the quality of learning. They create immersive educational environments that facilitate a more profound understanding of the material.

2.4 Digital and communication skills in distance learning

Jackson (2021) investigates the impact of virtual technologies on education during the pandemic. Kolbina & Oleksenko (2020) analyse the experience of implementing distance educational technologies in Ukrainian universities. Safari & Noori (2019) consider the challenges of the educational system from the perspective of modern technologies. The authors emphasise the importance of digital skills for effective learning. Bettinger et al. (2017) analyse the impact of virtual classrooms on student success. The study shows that digital and communication skills significantly affect academic performance. Gorbenko & Kim (2021) study the technology of using 3D models for laboratory work, highlighting the importance of digital skills for successful task completion. The work confirms the necessity of developing digital and communication skills in the learning process. Salomova (2021) investigates the use of modern information technologies in the educational process. Dakaliuk (2020) analyses information and communication technologies to activate independent student work. The authors argue that digital and communication skills contribute to more effective learning in the context of distance education. Digital and communication skills play a crucial role in distance learning. Virtual technologies ensure the continuity and quality of the educational process despite external constraints.

3 Research methods

Comparative analysis. Comparative analysis is conducted to identify differences and similarities in using modern technologies in different educational systems and institutions.

Questionnaires and surveys. The method of questionnaires and surveys among students of higher education institutions is used to collect primary data.

Experimental research. A pedagogical experiment is conducted to assess the effectiveness of modern technologies in the educational process. The experiment results are compared to determine modern technologies' impact on education quality.

Statistical analysis. Statistical analysis methods include calculations of average values, analysis of variance (ANOVA), correlation analysis and other methods.

4 Research results

A pedagogical experiment was conducted during the study on implementing modern teaching technologies in higher education institutions. The experiment involved 217 students from various specialities over one academic year. The specialities involved were 174 “Automation, Computer-Integrated Technologies and Robotics”, 172 “Electronic Communications and Radio Engineering”, 051 “Economics/International Economics”, 073 “Management/Management of Organisations and Administration”, 013 “Primary Education”. The control group comprised 108 students, while the experimental group comprised 109 students taught using modern educational technologies.

The experiment was conducted in three higher education institutions:

1. National Technical University “Igor Sikorsky Kyiv Polytechnic Institute” (34 students in the experimental group and 33 students in the control group).
2. Taras Shevchenko National University of Kyiv (35 students in the experimental group and 36 students in the control group).
3. Ivan Franko National University of Lviv (40 students in the experimental group and 39 students in the control group).

The experimental group was taught using modern technologies, including online platforms and virtual and augmented reality, while the control group was taught using the standard programme. The experiment lasted two semesters of the 2023–2024 academic year and included three stages: diagnostic, formative, and control (Table 1).

Table 1. Experimental Research Structure

Experiential learning stages	Key objectives
1. Diagnostic	Determining the initial level of student's knowledge and skills
2. Formative	Checking the effectiveness of using modern technologies in education
3. Control	Assessment of students' knowledge and skills

Source: compiled by the author

Calculating the average value of a single indicator:

$$U = \frac{T+P+K+S}{n} \quad (1)$$

U – a unified indicator of the level of training specialists using modern teaching technologies in higher education institutions,
T – the quality of students' theoretical training,
P – the quality of students' practical training,
K – the quality of professional training based on modern technologies,
S – students' self-assessment,
n – the number of areas in which measurements were made.

The objective is to define the criteria and levels of specialist training using modern teaching technologies in higher education institutions. The following section will describe the criteria for training specialists using modern teaching technologies in higher education institutions.

Table 2. Content of Components for Assessing the Status of Education and Training of Specialists Using Modern Technologies in Higher Education Institutions

Title	Assessment	Assessment description	Calculation method
Part I. Checking the state of education and training of specialists using modern technologies			
Checking the quality of theoretical training of students	Assessment of students' knowledge based on the results of semester control.	The percentage indicators characterising students' theoretical training are presented. The diagnostics are carried out by analysing the scores in the disciplines provided by the educational programme.	$T=\frac{N}{N_{max}}100\%$ T – the percentage of the quality of students' theoretical training; N – the initial score in the discipline for the semester; N_{max} – the maximum number of points in the discipline per semester
Checking the quality of students' practical training	Assessment of students' knowledge based on the results of internships.	Diagnostics are performed by analysing the scores of the results of the internships provided by the educational programme.	$P=\frac{M}{M_{max}}100\%$ P – percentage of the quality of practical training of students; M – the initial score for the internship; M_{max} – the maximum number of points for the internship
Checking the quality of professional training based on modern learning technologies	Assessing the skills of using modern technologies in the educational process.	Assessment is conducted through practical assignments and projects in which students demonstrate the application of the technologies they have learnt.	$K=\frac{Q}{Q_{max}}100\%$ K – a percentage indicator of the quality of professional training of students based on modern teaching technologies; Q – a quality indicator based on the results of practical tasks and projects in which students demonstrate the application of the studied technologies; Q_{max} – the maximum number of points on the self-assessment scale
Part II. Examining the state of education and training of specialists using modern technologies			
Self-esteem of higher education students	Testing skills and knowledge of using modern technologies in the educational process through a questionnaire.	The assessment is carried out by self-assessment of the skills of using modern technologies in the educational process (Appendix A)	$S=\frac{L}{L_{max}}100\%$ S – the percentage of quality of skills and knowledge on the use of modern technologies in the educational process through self-assessment; N – quality indicator on the self-assessment scale; N_{max} – maximum number of points on the self-assessment scale

Source: compiled by the author

Table 3. Overview of Levels of Specialist Training Using Modern Teaching Technologies in Higher Education Institutions

Criterion	Level	Description
Criterion 1: Knowledge of digital technologies	L1a	Basic knowledge of the critical concepts and principles of digital technologies.
	L2a	In-depth understanding of key aspects of digital technologies, including software and hardware.
	L3a	Expert knowledge of all aspects of digital technologies, including the latest trends and developments.
Criterion 2: Skills in working with online platforms	L1b	Ability to use the basic functions and tools of popular online learning platforms.
	L2b	Confident use of online platforms for educational activities, interaction with other participants in the educational process and assessment of progress.
	L3b	High proficiency in online platforms, including adaptation and customisation for specific educational purposes.
Criterion 3: Using virtual and augmented reality technologies	L1c	Basic skills in working with virtual and augmented reality tools in the educational process.
	L2c	Confident use of VR and AR to create interactive learning materials and conduct practical classes.
	L3c	Expert knowledge of virtual and augmented reality technologies, including the development and integration of own applications and training scenarios.
Criterion 4: Digital communication skills	L1d	Basic verbal and written communication skills in a digital environment, including email and instant messengers.
	L2d	Ability to communicate effectively, actively participate in distance learning using videoconferencing and other digital tools, and analyse own performance.
	L3d	High level of communication competence in the digital environment, including organising and managing online discussions, projects and collaborative work.

Source: compiled by the author

Three levels of specialist training using modern technologies in higher education institutions are defined:

1. High level (90-100%). Students demonstrate deep and comprehensive knowledge of digital technologies. They know the basic concepts and understand the latest trends and developments using virtual and augmented reality technologies. They can develop and integrate their programs and scenarios, creating fully immersive educational environments. A high level of digital communication skills includes organising and managing online discussions and projects, coordinating collaborative work, resolving conflicts, and ensuring effective interaction among all participants in the educational process.

2. Intermediate level (75-89%). Students have confident knowledge of digital technologies, including understanding various types of software and their functions. They can effectively use technologies to solve educational tasks and develop simple programs or projects. Confident use of virtual and augmented reality technologies. Students can create complex, interactive educational materials and conduct virtual tours and laboratory work. The ability to effectively

communicate in a digital environment, including conducting distance classes, using video conferencing and other digital tools to organise online lessons and interact with students.

3. Basic level (60-74%). Students have basic knowledge of digital technologies, including the basic concepts and principles of working with software and hardware. They understand what software and hardware are and how they interact. The ability to use the basic functions of popular online platforms, such as course registration, viewing educational materials, and participating in online discussions. They understand how platforms are organised and what opportunities they provide. Basic skills in virtual and augmented reality tools: they can be used to create simple interactive materials and apply them in educational situations. Basic skills in verbal and written communication in a digital environment.

The essence of training specialists using modern teaching technologies in higher education institutions lies in integrating digital tools and methods to improve the quality of education.

- Online platforms such as Moodle, Coursera, and others allow the organisation of the educational process in a virtual environment. They provide access to educational materials and enable online classes, testing, and interaction between students and teachers. These platforms allow students to learn at their convenience, review materials, and receive instant feedback.
- Virtual and augmented reality technologies create interactive educational materials and simulations, allowing students to immerse themselves in learning and explore complex concepts in a safe and controlled environment.
- Interactive methods, such as interactive whiteboards, educational games, and simulations, promote active student engagement in the learning process. These methods stimulate critical thinking, problem-solving, and collaboration among students.
- An important aspect of training specialists is developing digital competencies, such as the ability to work with software, analyse data, program, and use various digital tools in professional activities.
- In the learning process, students study theoretical foundations and apply modern technologies in practice. It includes performing practical tasks, projects, and laboratory work using VR, AR, online platforms, and other digital tools.

Table 4 presents the average indicators before and after implementing the proposed teaching technologies in the experimental groups EG-1, EG-2, and EG-3 and control groups CG-1, CG-2, and CG-3. The values of the indicators of the levels of training of specialists using modern teaching technologies in higher education institutions, namely primary (R 1), secondary (R 2), and high (R 3), are provided.

Table 4. Average Values of the Indicators of Training Specialists Using Modern Teaching Technologies in Higher Education Institutions in the Experimental and Control Groups in Percentage Terms

Groups	Before the experiment (%)			After the experiment (%)			Increase (%)		
	R_1	R_2	R_3	R_1	R_2	R_3	R_1	R_2	R_3
CG-1	62,9	63,6	63,1	69,2	67,8	73,8	6,3	4,2	10,7
CG-2	62,4	61,7	60,1	71,1	70,3	68,9	8,7	8,6	8,8
CG-3	60,8	61,9	60,8	65,9	77,1	71,2	5,1	15,2	10,4
Average	62,03	62,40	61,33	68,73	71,73	71,30	6,70	9,33	9,97
EG-1	61,1	60,7	60,2	88,2	79,5	82,8	27,1	18,8	22,6
EG-2	61,3	62,2	62,3	85,4	77,2	78,8	24,1	15	16,5
EG-3	61,8	63,4	61,8	79,9	86,2	81,3	18,1	22,8	19,5
Average	61,40	62,10	61,43	84,50	80,97	80,97	23,10	18,87	19,53

Source: compiled by the author

The experimental study showed a significant increase in the indicators of specialist training using modern teaching technologies in higher education institutions. In the experimental groups (EG-1, EG-2, EG-3), there was a substantial increase in student training levels after the introduction of modern educational technologies compared to the control groups (CG-1, CG-2, CG-3), where the training was conducted using the traditional programme. In the experimental group EG-1, the initial level increased by 27.1%, the intermediate level by 18.8%, and the high level by 22.6%. In group EG-2, the increase was 24.1% for the initial level, 15% for the intermediate level, and 16.5% for the high level. Group EG-3 showed an increase of 18.1% for the initial level, 22.8% for the intermediate level, and 19.5% for the high level. The control groups also demonstrated an increase in indicators, but it was significantly lower. In group CG-1, the increase in the initial level was 6.3%, the intermediate level 4.2%, and the high level 10.7%. In group CG-2, the increase in the initial level was 8.7%, the intermediate level was 8.6%, and the high level was 8.8%. In group CG-3, the increase in the initial level was 5.1%, the intermediate level 15.2%, and the high level 10.4%.

Thus, the experimental groups showed significant improvement in indicators after the introduction of modern teaching technologies, indicating an increase in the effectiveness of the educational process due to the use of these technologies. The most significant increase was observed in group EG-2, which is associated with more intensive use of technologies and better adaptation of students to new teaching methods. The increase in indicators in group EG-1 is minor compared to other experimental groups, possibly due to the initial level of student preparation, making further significant improvement challenging. Group EG-3 also demonstrated a substantial increase, especially in the intermediate level indicator, indicating the successful application of technologies to improve students' knowledge with an intermediate level of preparation. In the control groups, where traditional teaching methods were used, the increase in indicators was significantly lower, confirming the effectiveness of modern technologies in improving the quality of education.

Figure 1 presents the histogram of the levels of specialist training using modern teaching technologies in higher education institutions in experimental and control groups before and after the experiment.

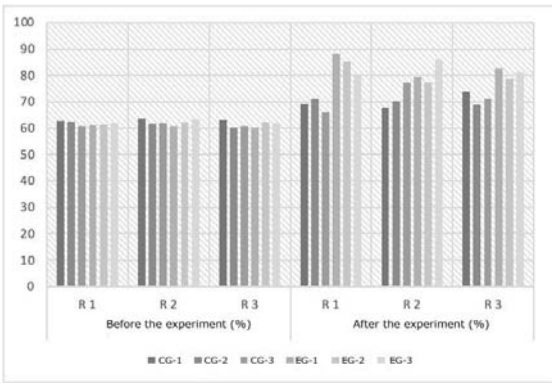

Figure 1. Histogram of the Levels of Training of Specialists Using Modern Teaching Technologies in Higher Education

Institutions in the Experimental and Control Groups before and after the Experiment

Experimental group 1 (EG-1) showed an increase in the initial level by 27.1%, the intermediate level by 18.8%, and the high level by 22.6% due to the implementation of modern educational technologies. In experimental group 2 (EG-2), the initial level increased by 24.1%, the intermediate level by 15%, and the high level by 16.5% due to the active use of digital technologies. Experimental group 3 (EG-3) demonstrated an increase in the initial level by 18.1%, the intermediate level by 22.8%, and the high level by 19.5% due to advanced educational methods. In the control groups, where traditional teaching methods were used, the increase in indicators was significantly lower. It confirms the effectiveness of modern teaching technologies in improving the quality of education. The comparative histogram of the average levels of specialist training based on modern teaching technologies in higher education institutions in the experimental and control groups before and after the experiment is presented in Figure 2.

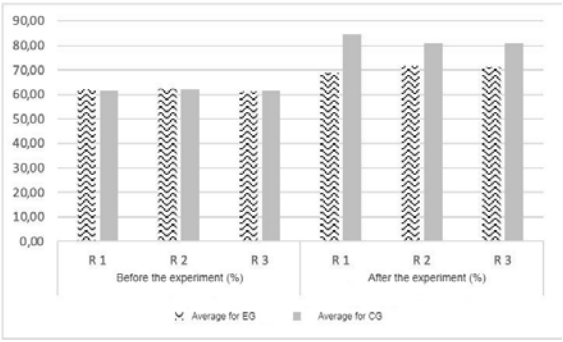

Figure 2. Comparative Histogram of the Average Levels of Specialist Training Based on Modern Teaching Technologies in Higher Education Institutions in the Experimental and Control Groups before and after the Experiment

Experimental group 1 (EG-1) showed an increase in the intermediate level from 61.40% to 68.73%, indicating the high effectiveness of modern educational technologies. Experimental group 2 (EG-2) demonstrated an increase in the intermediate level from 62.40% to 71.73%, confirming the importance of actively using digital resources. In group EG-3, the intermediate level increased from 61.33% to 71.30%, which confirms the successful application of advanced teaching methods. In the control groups (CG-1, CG-2, CG-3), where traditional methods were used, the increase in indicators was significantly lower. It underscores the advantages of modern technologies in improving the quality of education.

For a more detailed analysis, we analysed variance (ANOVA) to determine the statistical significance of differences between the groups.

Explanation of calculations and statistical analysis.

The following data were used in the analysis:

1. Average values of specialist training indicators (R1, R2, R3) before and after the experiment for experimental (EG) and control groups (CG).
2. Growth of indicators (difference between values before and after the experiment).

For each indicator (R1, R2, R3), the average values before and after the experiment, as well as the average growth, were calculated:

- *Average values before and after the experiment:* the calculation was carried out by averaging the values for all groups (EG and CG separately) before and after the experiment.
- *Average growth:* growth was calculated as the difference between the values before and after the experiment.
- *Statistical analysis ANOVA:* ANOVA (analysis of variance) tests the significance of the difference between groups. The difference in the average values of the indicators before and after the experiment was tested to see if it was statistically significant.
- *F-value:* shows the ratio between the mean squared deviations between groups and within groups.
- *p-value:* the probability that the observed differences between groups occurred by chance.

The results of the ANOVA statistical analysis are presented in Table 5.

Table 5. Results of ANOVA Statistical Analysis

Level	F-value	p-value
R1	15,647	0,0027
R2	26,637	0,0004
R3	38,920	0,0001

The results show that the differences in indicators before and after the experiment are statistically significant (p-value < 0.05) for all three levels (R1, R2, R3). It confirms that the implementation of modern teaching technologies significantly impacted the indicators of specialist training. The results of the statistical analysis (ANOVA) showed that the implementation of modern teaching technologies significantly impacted the indicators of specialist training.

5 Discussion

The use of modern educational technologies in higher education institutions is becoming an increasingly important aspect of the educational process. Various studies show that the integration of digital media communications, online platforms, virtual and augmented reality (VR and AR), and distance learning contributes to improving the quality of education and enhancing the professional training of students (Batsurovska et al., 2021; Kaplan & Haenlein, 2016). Virtual and augmented reality (VR and AR) technologies in education have also shown positive results. Garibli and Garibli (2021) note that VR and AR create immersive educational environments that increase student motivation and promote a deeper understanding of the material. Vaganova et al. (2020) confirm that such technologies are particularly effective in adult education, improving the comprehension and retention of educational material. Distance learning, which became relevant during the COVID-19 pandemic, requires special attention to developing digital and communication skills. Jackson (2021) and Kolbina and Oleksenko (2020) emphasise that these skills are critically important for successful distance learning. However, Safari and Noori (2019) note a need for constant updating and adaptation of educational programmes to meet modern requirements.

However, there remain questions that require further study. For example, it is necessary to explore in more detail the impact of specific technologies on different categories of students and to develop methodological recommendations for their practical application in various educational contexts. In addition, it is essential to consider cultural and social aspects when implementing new technologies in the educational process (Hevlych & Neskorodieva, 2022). Thus, modern education requires a comprehensive approach to integrating new technologies that provide not only technical but also methodological and pedagogical support for teachers and students.

6 Conclusion

The use of modern educational technologies in higher education institutions plays a crucial role in improving the quality of education and the professional training of students. Studies have shown that digital media communications and online platforms significantly enhance the interactivity and accessibility of the

learning process. Virtual and augmented reality (VR and AR) technologies create immersive educational environments that facilitate a more profound understanding of the material and increase student motivation. Distance learning requires the development of digital and communication skills, which is especially important in the context of the COVID-19 pandemic. A pedagogical experiment confirmed that students taught using modern technologies demonstrated better academic results than traditional teaching methods. Further research should be aimed at developing methodological recommendations for the practical application of modern educational technologies.

Literature:

1. Babenko, D., Dotsenko, N., & Gorbenko, O.: Technology of creation term papers in electrical engineering disciplines in the online learning environment. *2023 IEEE 5th International Conference on Modern Electrical and Energy Systems (MEES)*, 2023. (pp. 1-5). Kremenchuk, Ukraine. https://doi.org/10.1109/MEES61502.2023.10402391
2. Batsurovska, I., Dotsenko, N., Gorbenko, O., & Kim, N.: The technology of competencies acquisition by bachelors in higher education institutions in the conditions of the digital media communication environment. *ICNTLLSC 2021 International Conference on New Trends in Languages, Literature, and Social Communications (ICNTLLSC 2021)*. https://doi.org/10.2991/assehr.k.210525.025
3. Batsurovska, I.: Technological model of training of masters in electrical engineering to electrical installation and commissioning. *Journal of Physics: Conference Series*, 2021, 1946(1), 012015. https://doi.org/10.1088/1742-6596/1946/1/012015
4. Batsurovska, I. V., Dotsenko, N. A., Soloviev, V. N., Lytvynova, S. H., Gorbenko, O. A., Kim, N. I., & Haleeva, A. P.: Technology of application of 3D models of electrical engineering in performing laboratory work. In *Proceedings of the 9th Workshop on Cloud Technologies in Education*, 2022, 9, 323-335. https://doi.org/10.55056/cte.123
5. Bettinger, E. P., Fox, L., Loeb, S., & Taylor, E. S.: Virtual classrooms: How online college courses affect student success. *American Economic Review*, 2017, 107(9), 2855–2875. https://doi.org/10.1257/aer.20151193
6. Bilous, I. I., & Demianiuk, A. V.: Modern educational technologies in the conditions of the development of the information society. *Innovative Pedagogy*, 2022, 1(54), 9–12. https://doi.org/10.32782/2663-6085/2022/54.1.1
7. Dakaliuk, O.: Information and communication technologies as a means of activating students' independent work in the conditions of distance learning. In *Modern information technologies and innovation methodologies of education in professional training: Methodology, Theory, Experience, Problems*, 2020, 58, 35–42.
8. Dauitbayeva, A. O., Tileubai, S. S., & Kenjebekova, A. B.: Modern web technologies in the educational process and their role in teaching. *Korkyt Ata Atyndagy Kyzylorda Universitetinin Habarsysy*, 2022, 2(61), 118–123. https://doi.org/10.52081/bkaku.2022.v61.i2.069
9. Eshaliyev, O. S., & To'rayev, R. N.: Modern trends in the use of information technologies in the educational process. *Theoretical and Applied Science*, 2019, 79(11), 434–436. https://doi.org/10.15863/tas.2019.11.79.88
10. Finin, H. I.: Modern information technologies in educational practices of an educational institution. *Bulletin of the Yaroslav Mudryi National Law University*, 2018, 1(36), 43–51. https://doi.org/10.21564/2075-7190.36.123065
11. Garibli, E., & Garibli, A.: Modern educational technologies and national interests. *Turkish Journal of Computer and Mathematics Education*, 2021, 12(6), 1348–1355. https://doi.org/10.17762/turcomat.v12i6.2475
12. Hevlych, I., & Neskorodieva T.: Use of distance learning technologies in the modern educational process. *Bulletin of Khmelnytskyi National University*, 2022, 315, 66–68. https://doi.org/10.31891/2307-5732-2022-315-6-66-68
13. Hulivata, I., & Nikolina, I.: Modern educational technologies: Peculiarities of introducing educational content. *Physical and Mathematical Education*, 2019, 21(3), 48–52. https://doi.org/10.31110/2413-1571-2019-021-3-007
14. Jackson, E. A.: Efficacy of virtual technology as the way forward for teaching and learning with the experience of a global pandemic. *Educational Challenges*, 2021, 26(2), 6–12. https://doi.org/10.34142/2709-7986.2021.26.2.01
15. Kaplan, A. M., & Haenlein, M.: Higher education and the digital revolution: About MOOCs, SPOCs, social media, and the cookie monster. *Business Horizons*, 2016, 59(4), 441–450. https://doi.org/10.1016/j.bushor.2016.03.008
16. Kolbina, T., & Oleksenko, O.: Implementation of distance learning in Ukraine. *Educational Challenges*, 2020, 25(1). https://doi.org/10.34142/2709-7986.2020.25.1.04
17. Kovalenko, O., & Hontarenko, I.: Modern electronic educational technologies in the process of e-learning. *Educational Challenges*, 2023, 28(1), 98–112. https://doi.org/10.34142/2709-7986.2023.28.1.08
18. Kruty, K., Zdanevych, L., Demianenko, O., Pakhalchuk, N., Perminova, L., & Garachkovska, O.: E-learning methods in students' education. *International Journal of Innovative Technology and Exploring Engineering*, 2019, 8(12), 251–256. https://doi.org/10.35940/ijitee.l3621.1081219
19. Nagayev, V., Gerliand, T., Kyrepin, V., Nagayeva, G., Sosnytska, N., & Yablunovska, K.: Pedagogical technology of management of students' educational and creative activities in the process of professional training of engineers. *2021 IEEE International Conference on Modern Electrical and Energy Systems (MEES)*, 2021, 1-4. https://doi.org/10.1109/MEES52427.2021.9598806
20. Norkobilovna, J. S., & Turakulova, S.: Competent approach of the teacher in the introduction of modern educational technologies. *International Journal of Advanced Academic Studies*, 2020, 2(2), 135–137. https://doi.org/10.33545/27068919.2020.v2.i2c.96
21. Priadko, O., Bordeniuk, S., Lishafai, O., Lytvynenko, N., Maslova, T., & Kryvoruchko, Z.: Special aspects of using modern multimedia technologies within the educational process. *International Journal of Information and Education Technology*, 2022, 12(12), 1436–1442. https://doi.org/10.18178/ijiet.2022.12.12.1769
22. Safari, M., & Noori, B.: The educational system challenges from the perspective of modern technologies. *Open Journal of Social Sciences*, 2019, 7, 400–407. https://doi.org/10.4236/jss.2019.73033
23. Salomova, R. V.: Use of modern information technologies in the educational process. *The American Journal of Social Science and Education Innovations*, 2021, 3(3), 514–517. https://doi.org/10.37547/tajssei/volume03issue03-81
24. Smagulov, E., & Hajmuldanov, E.: Methods of using modern educational technologies and tests by students. *ҚазҰУ Хабаршысы,* 2019, 58(1). https://doi.org/10.26577/jes.2019.v58.i1.013
25. Vaganova, O. I., Rudenko, I. V., Bekirov, S. N., Abbasova, L. I., & Kutepov, M. M.: Modern technologies of adult education. *Revista Amazonia Investiga*, 2020, 9(28), 57–64. https://doi.org/10.34069/ai/2020.28.04.7

Primary Paper Section: A

Secondary Paper Section: AM, IN

Appendix

Appendix A. Questionnaire for Self-Assessment of Skills in Using Modern Technologies in the Educational Process

Instructions:
Please rate your skills in using modern technology in the classroom according to the following criteria. Select the answer that most closely matches your skill level for each question.

Criterion 1: Knowledge of digital technologies

What is your knowledge of the basic concepts and principles of digital technologies?
☐ I have basic knowledge and understand the basic concepts.
☐ I have a deep understanding of the critical aspects of digital technologies.
☐ I have expert knowledge and understand the latest trends and developments.

How well do you know your software and hardware?
☐ I understand the basic functions and principles of operation.
☐ I use technology effectively to solve learning problems.
☐ I develop innovative solutions to improve the learning process.

Criterion 2: Skills in working with online platforms

How would you rate your skills in using the basic functions of the most popular online platforms?
☐ I can use the basic functions (registering for courses, viewing materials).
☐ I can create and deliver courses, upload materials, and conduct webinars.
☐ I can adapt and customise platforms for specific educational purposes.

How do you assess your skills in interacting with learners through online platforms?
☐ I maintain contact and interaction with learners.
☐ I effectively track learner progress and provide feedback.
☐ I analyse the effectiveness of learning and make improvements.

Criterion 3: Use of virtual and augmented reality technologies

How would you rate your skills in using virtual and augmented reality tools?
☐ I can use basic tools to create simple interactive materials.
☐ I can create complex and interactive learning materials, virtual tours and labs.
☐ I develop my own apps and scenarios for VR and AR training.

How effectively can you integrate VR and AR into the learning process?
☐ I use VR and AR to create basic learning materials.
☐ I integrate VR and AR into the learning process to provide hands-on learning.
☐ I create fully immersive learning environments and analyse their effectiveness.

Criterion 4: Digital communication skills

How would you rate your basic verbal and written communication skills in a digital environment?
☐ I can use email and instant messengers to communicate.
☐ I can effectively conduct remote classes using video conferencing.
☐ I organise and manage online discussions and projects.

How confident are you in organising and managing online discussions and projects?
☐ I coordinate collaborative work in a digital environment.
☐ I resolve conflicts and ensure effective interaction between all participants.
☐ I develop strategies to improve digital communication in the educational process.

Thank you for your participation!