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The problem of application of simulation methods and teaching tools in the educational process of higher education institutions

Abstract. Modern professional training of teachers requires the introduction of innovative technologies, in particular simulation technologies, which emphasize interactivity, creativity and the use of information and communication methods. These technologies are aimed at preparing for practical activities, developing critical thinking and gaining experience through the simulation of pedagogical situations. The purpose of the study was to analyze the features of the application of simulation methods and tools in the educational process of a higher school. The methods of analysis included the analysis of literary sources, the study of the practice of using simulation methods and teaching aids in the educational process, and questionnaires and surveys among students and teachers. Simulation methods and learning tools contribute to the development of critical thinking, interpersonal skills and the ability to adapt to different professional situations. The results of the study indicate the importance and effectiveness of the use of simulation technologies in the educational process of higher education institutions, which makes it possible to make the learning process interesting, visual and practical and to build it on the basis of activity and competence approaches. However, technical limitations and lack of training of teachers to use simulation methods and tools in the educational process are the main factors that complicate the implementation of simulation technologies in the educational process. Taking into account the potential advantages of the studied methods, the effectiveness of the application of simulation methods and training tools as a tool for improving the quality of professional training of future specialists has been proven. The practical significance of the work is that the results of the study can be used during the organization of the educational process of students of pedagogical specialties of higher education institutions, updating the methodological and practical component in the teaching of educational components

Keywords: simulation technologies; high school; students; teachers; training of specialists; interactive learning methods; virtual laboratories and simulations

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INTRODUCTION

The relevance of this study lies in the need to evaluate the effectiveness of simulation methods in the training of students, as well as in determining possible challenges and obstacles in their implementation. The modern world is marked by the rapid and constant development of technologies, which significantly affects various spheres of life, including education. Higher education institutions face various challenges related to the training of competent specialists in the modern world. In this context, the use of simulation methods and learning tools, which can provide a more effective and professional educational process, is of great importance.

In recent decades, simulation methods and learning tools have been widely used in the educational field. This is facilitated by the digitization and technologization of society, new methods and means of training organization appear, including virtual reality, simulations and interactions. They provide an opportunity for students of education not only to acquire theoretical knowledge, but also to gain real experience of critical and creative application of this knowledge when solving practical tasks, which contributes to increasing the level of their training and developing the necessary professional competencies (Basiuk *et al.*, 2018). However, despite the potential advantages of simulation methods and teaching tools, there are numerous problems that prevent their effective implementation in the educational process of higher education institutions. These problems include technical and financial limitations, the lack of appropriate training of scientific and pedagogical workers, as well as the need for constant updating of the content and optimal selection of teaching methods. In particular, the focus is on the integration of digital technologies into the educational process, the adaptation of courses to the needs of the modern labor market, and the development of critical thinking skills and problem analysis among students (Plahotnik & Shubina, 2021).

An overview of scientific research is presented, which is focused on the analysis of various aspects of the use of simulation methods and teaching aids in higher education institutions. The works selected for review highlight a wide range of approaches and research in this area. The author M. Diachenko-Bohun (2014) focuses on the consideration of active learning methods. The author analyzes how these methods can enrich the traditional educational process, in particular through the involvement of students in active participation in learning. L.V. Ivanova (2022) examines the use of multimedia technologies in education and emphasizes computer games and multimedia as means of increasing the effectiveness of the educational process. I. Marchuk (2019) analyzes the use of simulation methods for the development of students' economic competence. The formation of teachers and the formation of relevant competencies in them by means of innovative teaching technologies are studied by Yu. Boichuk & A. Boiarska-Khomenko (2022). Kong *et al.* (2017) in their work

consider the theoretical aspects of simulation modeling and its application in various fields of knowledge. Researcher N.P. Onyshchenko (2021) focuses on interactive learning methods, investigating their impact on improving the quality of education. It is also worth noting the work of Y. Pirozhenko & T. Burlaenko (2018), they investigated the use of multimedia tools in the educational process, including their impact on improving teaching methods. R. Pastuna-Doicela *et al.* (2023) consider virtual simulation as an innovative strategy in training students, which ensures the continuity of theoretical and practical training, promotes the development of cognitive, attitudinal and professional skills in students, and also ensures the integrity of the learning process. M.A. Stewart *et al.* (2023) in their publication explored the possibilities of using simulation tools, such as: Kahoot to encourage participation in interactive practical activities, Red Blood Cell Simulator to perform practical tasks independently at home, and Digital Differentials, which provided an opportunity to simulate a laboratory experiment. The use of these methods improves memorization of information, is an optimal and effective means of learning.

Together, these studies provide an in-depth analysis of the use of simulation and interactive methods in higher education, highlighting their potential to improve the quality and effectiveness of learning. The purpose of this article was to assess the current state of application of simulation teaching methods in higher education institutions, to determine their impact on the quality of education, and to identify opportunities for its further improvement. The scientific novelty of the work consists in a comprehensive approach to the assessment of the impact of the use of simulation methods and tools on the effectiveness of the organization of the educational process, as well as in the identification of trends and prospects for their further development in the context of the globalization of the educational space.

MATERIALS AND METHODS

The tasks of the research included the analysis of scientific publications, the evaluation of the effectiveness of the application of simulation methods during the teaching of various disciplines, as well as the study of the opinions of teachers and students regarding the effectiveness of using these methods. The research methodology involved the implementation of a number of components. The study focused on the use of simulation methods and learning tools in the educational process of the University of Grigory Skovoroda in Pereiaslav.

Among them: a review of the literature, which made it possible to conduct an analysis of scientific works on simulation teaching methods and to determine key parameters for research; the sample included the survey of 10 teachers and 50 students of Hryhorii Skovoroda University in Pereiaslav, and the selection criteria included

experience in using simulation methods and tools in education and a variety of educational specialties; data collection methods were selected (questionnaires, surveys, interviews and analysis of curricula for primary data collection); experimental research, which made it possible to conduct and analyze a series of educational activities (lectures, practical classes, practice), where simulation methods were used; statistical analysis of the collected data (the obtained data were analyzed to identify trends in the use of simulation methods and tools in the higher education process).

At the beginning of 2023, an in-person survey of groups of teachers and students was conducted, which made it possible to draw conclusions about the use of simulation learning technologies in practical classes, during the implementation of research projects and independent works. The questionnaire included a number of questions, in particular: Do the respondents understand the essence of the concept of "imitation technologies?"; Have they had the opportunity to use simulation technologies in their own practical activities? How often? Did the respondents feel the benefits of using simulation technologies in education? Were there any difficulties? Is it interesting to work with non-traditional means in classes? Were you able to increase the level of knowledge by using simulation technologies? The survey was conducted without violation of ethical norms, on a voluntary basis and anonymously. All participants were fully informed about whether anonymity was ensured, why the study was being conducted, how their data would be used, and whether there were any associated risks.

The conducted research included the description of a number of educational materials: questionnaires and surveys designed as specialized tools for collecting qualitative and quantitative data from teachers and students; technological tools: used specialized software (3D printer, audio concentrator and audio blocks, models of biological objects, interactive boards, computer simulation, etc.) to simulate the educational process; educational materials: an analysis of educational components, including the possibility of using simulation methods, was carried out. In particular, such educational practices as: Higher school pedagogy, Digital technologies in education, Modeling of educational and professional teacher training, Pedagogical skill, Foreign language for professional direction, Human anatomy, Biology teaching methodology, Biotechnology (Hryhorii Skovoroda..., n.d.).

RESULTS AND DISCUSSION

Simulation technologies in education include the use of various methods and tools that allow simulating real situations or processes for educational purposes. Simulation technologies in education consist in the creation of models, simulations that imitate real processes or situations of professional activity. This involves the use of virtual laboratories, simulation simulators, pedagogical

modeling, etc. As rightly noted by O. Budnyk *et al.* (2022) simulation methods involve activity and quasi-professional orientation of vocational training. They combine separate forms and methods of learning (concrete situation, role playing, discussion, etc.), but have greater flexibility, arbitrariness of imitation objects, provide for the introduction of unpredictable situations (Marchuk, 2019). As noted by D. Ostapchuk & N.M. Mironchuk (2017), the positive effect of the introduction of active (imitation) learning methods indicates the need to use them with students of higher education institutions of a pedagogical profile, which guarantees effectiveness and efficiency during the professional training of students for professional activities. In general, simulation technologies play an important role in modern education, helping to ensure high-quality and relevant training of students. However, their effective implementation requires careful planning, investment and continuous support. As noted O.I. Shapran & B.O. Bandur (2022) and mimetic methods in education can be very diverse and include a number of approaches and tools, among them: virtual laboratories and simulations, the case method, role-playing and scenario exercises, interactive learning platforms, the use of artificial intelligence and adaptive learning, modeling and gamification, video and audio materials, internship with the performance of a job role, simulation training.

Virtual laboratories and augmented reality in the educational process. Virtual laboratories and simulations are important tools in modern education, especially in the fields of natural sciences, social sciences and digital technologies. Virtual laboratories are software or platforms that simulate real laboratory conditions. Students can perform experiments, interact with virtual equipment, and analyze data as in a real laboratory. Simulations are the creation of computer models that simulate real processes or systems. Simulations can reproduce complex natural phenomena, digitization processes, or pedagogical scenarios. The advantages of using the above-mentioned simulation methods and tools include: safety (virtual laboratories allow students to experiment without risking health or safety); accessibility (students can conduct experiments at any time and from any place); saving resources (no real materials and equipment are needed, which reduces costs); repeatability (experiments can be repeated many times for a deeper understanding of the material); complexity (the ability to simulate complex or dangerous processes that are difficult or impossible to reproduce in real conditions). Virtual (VR) and augmented reality (AR) technologies offer unique opportunities to enhance learning and enable learners to explore different subjects and concepts in a more visual, interactive and motivating way. Among the advantages of using VR and AR in education, a number of components can be characterized. In particular, virtual reality (VR) is characterized by the following features (Table 1):

Table 1. Characteristic features of virtual reality VR and AR.

Characteristic	Virtual Reality (VR)	Augmented Reality (AR)
Immersiveness	Provides a sense of immersion in a virtual environment.	Creates a connection between virtual objects and real objects.
Practicality	It is used to create virtual laboratories, simulators and simulation of practical scenarios.	Allows you to supplement reality with information and create interactive scenarios.
Increasing motivation	Stimulates active learning through interactivity and enthusiasm.	Provides ease of access and can encourage learning through additional information.
Connection with the real world	-	Creates a connection between virtual and real objects, facilitating learning and research.
Additional Information	-	Supplements reality with additional information, expanding students' knowledge.
Ease of access	Requires special equipment for an immersive experience.	Can be used on modern smartphones and tablets, providing easy access (Virtual and augmented reality: how new technologies inspire learning..., 2019).

Source: developed by the author.

If these technologies are used effectively, they can significantly enrich the educational process and contribute to a better understanding of complex theoretical concepts.

Using the case method and role playing to develop critical thinking and professional skills. The case method, or case study method, is one of the key pedagogical approaches, especially popular in pedagogy and psychology, but it is also often used during training in other specialties (biology, digital technologies, etc.). This method includes the analysis of real or hypothetical scenarios (cases), which allows students to creatively and creatively apply theoretical knowledge in practice. Features of the case method in education are clearly reflected due to the presence of mandatory components. First, case studies are usually based on real situations, pedagogical cases, psychological issues, digitalization issues, etc., giving students the opportunity to immerse themselves in specific scenarios. Second, the case method involves in-depth analysis. Students are asked to study the case, analyze the problem and develop possible solutions. This requires a high level of analytical skills and the ability to uncover the essence of the problem. Thirdly, the case method facilitates the application of theory in practice. Students are given the opportunity to apply theoretical knowledge in real situations, which contributes to the development of critical and creative thinking skills.

Among the advantages of the case method:

- students learn to analyze complex situations, identify key problems and develop strategies to solve them;
- provide students with “real” experience in a safe academic environment;
- discussion of cases often takes place in groups, which contributes to the development of communication skills, the ability to interact and work in a team.

This method is often used as a basis for group discussions during classroom classes. Students can analyze the case in writing, developing their own solution strategies; can consider and play roles from different parties

involved in the case, presenting their solutions. The effectiveness of the method strongly depends on realism and relevance. Educators must possess discussion management skills and the ability to guide learners through complex analytical processes. Therefore, the case method is a powerful tool for preparing for challenges that may arise in real professional activity. It not only develops analytical and critical thinking, but also helps students develop the ability to apply theories in practical situations, preparing them to build successful careers. Role playing and scenario exercises are important tools in the educational process that allow students to simulate and recreate real professional situations. These methods contribute to the development of decision-making skills, interpersonal skills and other important competencies. Considering the features of role-playing and scenario exercises, one can highlight their key characteristics: simulation of real situations, where students participate in role-plays imitating real professional or social situations. It is important to note the variety of scenarios in such exercises, they can cover a wide range of situations, starting from business discussions and ending with crisis management. In addition, role-playing and scenario exercises contribute to the development of interpersonal skills. These exercises help students improve their communication skills, teamwork skills, and emotional intelligence in interpersonal relationships.

Among the advantages of using such simulation methods: students learn to make decisions in the context of real situations; role-playing games allow them to understand the vision and feelings of other people; exercises contribute to the development of communication, negotiation and teamwork skills; students learn to adapt and respond to unpredictable situations. However, when using such simulation methods and tools, it is necessary to take into account that role-playing and scenario exercises require careful preparation of scenarios and effective management of the simulation process and the diversity of learners and their ability

to adapt to different roles. Thus, role plays and scenario exercises are effective tools for developing critical thinking, interpersonal skills and the ability to adapt to different professional situations. According to O. Tsiuniak (2020), these methods provide students with the opportunity to actively participate in the educational process and develop the professional competences necessary for future implementation.

Development of interactive platforms and application of artificial intelligence in education. Interactive learning platforms are becoming more common in the educational process, especially in the context of the growth of online education. They include a variety of online resources that use interactive modules, quizzes, games, and other tools to increase student engagement and improve their understanding of course material (Table 2).

Table 2: Features of interactive learning platforms.

Characteristic	Interactive platforms
Interactive modules	Includes multimedia lectures, interactive exercises, simulations, etc.
Quizzes and assessments	They are used for self-testing of students' knowledge through quizzes and tests.
Game elements	Gamification is used to increase students' motivation and interest in the educational process.
Personalization of learning	Allows to adapt training to individual needs and level of students (Volkova, 2017).
Advantages	<ul style="list-style-type: none"> ➤ flexibility and accessibility: the ability to study the material at any time and from any place; ➤ student involvement: interactivity promotes active involvement of students in the educational process; ➤ individual approach: adaptation of training to the needs of each student; ➤ improving understanding: visualization and practical tasks help to learn the material better;
Problems	<ul style="list-style-type: none"> ➤ technical limitations: not all students have access to the necessary technical means; ➤ lack of personal contact: direct communication may be limited, which affects interaction; ➤ self-discipline and motivation: requires a high level of discipline and motivation for effective study;

Source: developed by the author.

Interactive platforms are used as a supplement to classroom classes to expand and deepen knowledge. Often, students use platforms for independent study of the material. According to L.V. Ivanova (2022), they are especially relevant for online courses, non-formal and distance education courses. Therefore, interactive learning platforms open up new opportunities for improving the educational process. They help adapt training to the individual needs of each student. However, the effective use of these resources requires taking into account various challenges and providing the necessary support from higher education institutions. The use of artificial intelligence and adaptive learning is one of the most innovative approaches in modern education. These systems use data on student performance and behavior to adapt learning materials and apply methods, providing a more personalized and effective educational process (Gundel, 2019).

The main features of artificial intelligence and adaptive learning:

1) Personalization of the educational process. Adaptation of educational materials according to the level of knowledge, learning style and needs of each student.

2) Analysis of data on success. Using artificial intelligence algorithms to analyze student performance, identify weaknesses, and suggest targeted tasks for improvement.

3) Adaptive tests and assessments. Tests that automatically adjust to the student's level of knowledge, providing more accurate assessment.

The use of artificial intelligence and adaptive learning provides a number of advantages, namely:

Effectiveness of learning. This approach takes into account the individual characteristics of students, which contributes to more effective learning of the material.

Support for different learning styles. Adaptive learning takes into account personal learning preferences, such as visual or auditory perception.

Continuous update of content. Automatic updating and adaptation of educational materials based on feedback and student success, which allows you to maintain the relevance of information.

Forecasting and identification of problematic issues. The use of artificial intelligence can help detect learning problems at an early stage and predict potential difficulties before they become critical.

Author F. Ke *et al.* (2021) writes that artificial intelligence and adaptive learning are widely used in distance education and online courses. Personalized learning allows students to work on their weaknesses individually. Among the problems during the application of artificial intelligence, the following can be distinguished: the effective use of artificial intelligence requires access to modern technologies and powerful software; it is important to ensure the protection of students' personal data and the ethical use of artificial intelligence; teachers must learn to qualitatively integrate these technologies into the educational process. Thus, artificial intelligence and adaptive learning open new horizons for the educational process, giving learners the opportunity to receive more personalized and effective learning. The use of these technologies can significantly improve the quality of education and ensure deeper assimilation of knowledge.

Modeling and gamification using video and audio materials in the educational process, as a technology for using game elements to attract students and increase motivation to study. By modeling pedagogical situations, students “immerse” themselves in the environment of the future profession and can feel themselves in the role of a specialist in a certain professional field (Diachenko-Bohun, 2014). Simulation modeling can be distinguished as a type of mathematical modeling. Researcher N.Y. Oliynyk (2020) notes that in the event that analytical models are not available or calculation methods have not been developed, they turn to a simulation model or simulator. Gamification is a technology that has great potential to improve learning and engage learners. It is based on the idea that game elements can be used to create a stimulating and interesting educational environment (Sagan, 2022). The main principles of gamification, on which the educational process is built:

Tasks and challenges. Educational material is presented in the form of interesting tasks and challenges that inspire students to actively participate in the learning process. Analogies with video games create an interactive and engaging educational environment.

Points and awards. The system of points and awards helps stimulate students to achieve specific goals and increases their motivation for active learning. This may include virtual or real rewards for results achieved.

Competition and cooperation. Gamification creates elements of competition and cooperation, developing not only individual skills but also teamwork skills. This contributes to the formation of communication skills and promotes mutual assistance between students.

Availability of feedback. Fast and effective feedback is an important element of gamification. It allows you to assess student achievement, receive feedback from them, and provide quick feedback that helps improve their learning.

Plot and story elements. Adding story elements makes learning more exciting and attractive. The use of stories can deepen understanding of material and promote a more emotional involvement in learning.

Gamification can be used effectively for a variety of purposes in learning, from improving outcomes to developing creativity, creativity and critical thinking. It is important to carefully consider and plan gamified learning scenarios so that they meet the specific educational goal and needs of students. Inclusion of multimedia resources to demonstrate complex concepts and support visual and auditory perception of information. Video production and animation are two powerful multimedia technologies that are used in the educational process to create visually attractive and interactive educational materials. Video materials and interactive animations are very important tools for quality learning, especially in distance learning. These technologies allow you to convey the key content of the educational material in the form of bright video presentations that are interesting, visual, concise and informative at the same time. The use of video and audio materials in education is one of the key elements of modern education, which helps make the educational process interesting, meaningful and balanced. Multimedia resources are effectively used for demonstrations, facilitate the process of information perception and provide a deeper understanding of the theoretical material.

Features of the use of video and audio materials include:

- 1) Visualization of concepts. Videos allow you to visualize complex ideas and processes, which contributes to better assimilation of the material;
- 2) Auditory perception. Audio materials can be useful for those who perceive information better by ear;
- 3) Increase engagement. Multimedia resources add variety to the educational process and contribute to the engagement of learners (Pirozhenko & Burlaenko, 2018).

The advantages of using video and audio materials in the educational process are that they help meet the needs of students with different learning styles (visual, auditory); use video and audio to review real cases, experiments, interviews with experts, etc. Table 3 shows examples of the use of video and audio materials in education.

Table 3. Types of video and audio materials used in education.

Types of video and audio materials in education	Description
Video lectures and presentations	To present new material and explain complex concepts.
Instructional videos and tutorials	Demonstration of practical exercises and demonstration of experiments.
Podcasts and audio lectures	For those who prefer to learn by ear or in combination with other activities.
Factors of the effectiveness of the use of video and audio materials	Main aspects
Quality assurance content	Creation of high-quality and relevant materials.
Technical requirements	Availability of access to the Internet and appropriate technical devices.
Balance between traditional and multimedia methods	Finding the optimal combination of traditional and multimedia methods.

Source: developed by the authors.

Therefore, video and audio materials are powerful tools in education that help improve learning, increase student engagement, and support a variety of learning

styles. Their integration into the educational process opens up new opportunities for deeper understanding and more effective application.

Internship with performance of a position role. Internship with performance of a job role is one of the most effective ways of practical training of students and young professionals for the real working environment. This method assumes that trainees will take on roles that correspond to their future professional responsibilities and perform real work tasks in real conditions.

A role-based internship includes several key features that promote development and valuable experience.

Real work experience. Internship allows you to gain practical experience in a real working environment, which is an integral part of understanding the specifics of the chosen profession.

Responsibility and independence. Interns not only observe the work of professionals, but also take an active part in solving real tasks, which contributes to the development of the ability to work responsibly and independently.

Mentoring and training. Experienced professionals often act as mentors, helping interns adapt and learn important skills that help them grow professionally.

Characterizing the advantages of internship with the performance of a job role, it should be noted that: internship allows you to develop practical skills necessary for the future profession; trainees learn to work in a team, understand the internal order and culture of interaction; an internship provides an opportunity to build professional contacts and a network that can contribute to career development. Among the key issues to anticipate when applying for a role-based internship is adaptation to the work environment, as adapting to a new environment can be a challenge for some interns. A balance between study and work is also important – interns need to find a balance between their study commitments and the work responsibilities of the internship. Thus, internships with the performance of a job role are extremely important for preparing young professionals for real working life. This is not only a way to gain practical experience, but also an important step for establishing professional contacts and career development.

Simulation training. Simulation training is an important component of the modern educational process, especially in areas where a high level of practical skills and understanding of complex processes are required. This method involves the creation of simulated situations or conditions that mimic real-life circumstances in order to teach and develop certain skills.

Features of simulation training: *realistic scenarios.* Simulation training often uses detailed scenarios that mimic real-life situations that professionals may encounter in their

work; *practical experience.* Participants have the opportunity to test their reactions and decisions in a safe, controlled environment; *application of theoretical knowledge.* Simulation training allows you to apply theoretical knowledge in practice, checking their effectiveness in real conditions.

Among the advantages of simulation training: participants can experiment and make mistakes without risking real projects or people's safety; simulation training encourages the analysis of situations, decision-making and critical thinking; preparation is carried out for real challenges and situations that may arise in professional life; active involvement of participants and a high level of motivation due to the practical nature of the training.

Among the key challenges that must be considered when using simulation trainings:

- development of realistic scenarios. Creating credible simulation scenarios can be complex and requires deep knowledge in a specific domain;

- technical support. High-tech simulations require significant investment in hardware and software.

Thus, simulation training is an important tool in the educational process, providing practical experience and preparation for real challenges in a safe environment. This method helps participants apply theoretical knowledge in practice, develop critical thinking and decision-making skills that are key to success in many professional fields. All these simulation methods and materials help students better understand and learn to apply theoretical knowledge, developing critical thinking, analytical abilities and professional skills. They also contribute to the flexibility and adaptability of the educational process, making it more relevant to the needs of the modern world. In order to investigate the problem of using simulation methods and teaching aids in the educational process of higher education institutions, the authors conducted a study. Based on the results of the research, university teachers actively use simulation technologies in practical activities. The conducted survey showed that 8 out of 10 teachers indicated that they regularly use simulation technologies in their pedagogical practice. This includes the use of virtual and interactive tools that facilitate more hands-on and engaging learning. The teachers of Grigory Skovoroda University in Pereiaslav use simulation methods with the aim of deeper understanding and assimilation of complex theoretical concepts by students, conducting virtual experiments and creating situational tasks, which allows students to better understand the theoretical material. The following means can be singled out for one's own professional activity (Table 4).

Table 4. Means of simulation technologies, which are used in professional activities by teachers of the Hryhorii Skovoroda University in Pereiaslav

Software simulators	<p>Example 1. Simulators for teaching pedagogy. Teachers of pedagogical disciplines use simulators that allow students to virtually experience different approaches to teaching and classroom management. This can include scenarios, lesson segments where students interact with virtual students, resolve conflicts, plan lessons, and assess student performance.</p> <p>Example 2. Simulators for language learning. At the Faculty of Ukrainian and Foreign Philology, simulators can be used to create simulated language environments where students can practice speaking and listening in a context that simulates real life situations.</p>
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Table 4. Continued

Virtual laboratories	Example 1. Virtual laboratories during the teaching of natural sciences. Science majors can use virtual labs to demonstrate complex experiments that would be dangerous or expensive to perform in real-world settings. Educators can perform virtual experiments, measuring reactions or simulating physical phenomena.
Interactive tools	Example 1. Interactive boards and programs. Interactive whiteboards and curriculum allow teachers to create an educational environment that engages all learners to interact in class. For example, teachers can use these tools to create interactive presentations, quizzes, and games that help students learn better. These examples demonstrate how simulation technologies are integrated into various aspects of the pedagogical process at the university, increasing the quality of learning and student engagement. They allow learners to gain practical experience and better understand complex theoretical concepts, thereby preparing them for real professional challenges.
Demonstration of complex concepts	Example 1. Interactive models in biology. Biology teachers use simulation technologies to demonstrate complex biological processes, such as cellular metabolism or genetic mutations. Interactive 3D models allow students to visualize these processes and better understand their dynamics.
Conducting virtual experiments	Example 1. Simulation of chemical reactions. Teaching the disciplines of the natural cycle, teachers use simulators to conduct virtual chemical reactions. Students can experiment with different reagents and conditions, observing the results in a safe and controlled environment.
Creation of situational tasks	Example 1. Role-playing games in pedagogy. Role-playing games are organized for teacher students, where they virtually act as teachers in the classroom. This allows them to experience different approaches to teaching, classroom management and interaction with students.

Source: developed by the author

Such applications of simulation methods and technologies play an important role in training students, allowing them to more effectively apply theoretical material in practical situations. This approach not only increases the effectiveness of learning, but also makes it more interesting and motivating for students. Problems and challenges faced by teachers when using simulation learning technologies:

First: *technical difficulties*. This can include hardware malfunctions that prevent effective delivery of classes, as well as software issues. Such problems may arise due to software incompatibility with existing hardware, as well as complications with updating and maintaining programs.

Second: *lack of resources*. Limited access to specialized simulation tools can limit the ability to dive deep into the subject. For some specialties, the lack of necessary simulation tools may be found. Teachers may also feel the need for additional training courses and workshops to develop their own skills in using simulation technologies.

Third: *the need for educational resources*. Teachers feel the need to create and provide methodological materials that will promote better learning and use of simulation tools in higher education.

The obtained results indicate the importance and effectiveness of the use of simulation technologies in higher education, at the same time indicating the need to solve technical and resource problems for their optimization and more effective application. Taking into account the data collected through questionnaires and surveys, the obtained results provide an understanding of the importance of applying simulation technologies in higher education, as well as highlight key issues and challenges that need to be considered in order to improve their effectiveness. The results showed that learners are more interested and involved in the educational process when interactive and simulation methods and learning tools are used. Educators noted that simulation technologies help students learn complex

concepts better because they can “see” and “try out” theoretical knowledge in practice. Many teachers noted that faulty or outdated equipment hindered the effective use of simulation-based learning methods. Also, the lack of access to modern simulation tools for certain specialties was indicated as a significant obstacle. Teachers expressed the need for advanced training and additional professional development in order to learn how to effectively use simulation technologies. The need to create and distribute detailed methodological guides and resources to support teachers in using these methods and tools was noted.

The results questionnaires and surveys of students of Hryhorii Skovoroda University in Pereiaslav regarding the use of simulation teaching methods reflect both positive feedback and a number of difficulties. Therefore, in order to achieve the maximum effectiveness of the application of simulation technologies in higher education, it is necessary to solve existing technical and resource problems, as well as to provide teachers with appropriate training and support. The majority of students (42 out of 50) responded positively to the use of simulation methods. They believe that this contributes to a better assimilation of the material and the development of practical skills. Psychology students indicated that virtual scenarios for counseling skills training helped them better understand real-life situations they may encounter in their professional activities. Students of science majors noted the benefits of virtual laboratories, which allow them to safely conduct complex experiments. One of the problems was that some students experienced stress and feeling overwhelmed by the need to adapt to new, more complex learning methods. Students experienced difficulties in mastering complex software tools for simulation, which required considerable effort and time, and noted problematic access to the necessary simulation tools. Some learners felt limited in their access to virtual language platforms that could improve their foreign language learning.

Prospects for the introduction of simulation methods in higher education. Based on the results of the survey of students of the Hryhorii Skovoroda University in Pereiaslav, the following conclusions can be drawn that the majority of students have a positive attitude to the use of simulation learning methods. They believe that these methods contribute to better assimilation of theoretical material and development of practical skills, making learning more motivating and action-oriented. Despite the overall positive attitude, students also faced some challenges. This includes the feeling of overload and stress from the need to adapt to new, more complex learning methods, unequal access to simulation resources, which limits their ability to fully use these methods in learning. The results prove that although simulation methods have significant potential for improving the quality of education and developing students' practical skills, there are certain challenges that need attention. In particular, it is important to focus on ensuring equal access to resources for all students, as

well as supporting their adaptation to new technologies in order to maximize the benefits of these learning methods. Conclusions from the survey emphasize the need for further development and integration of simulation technologies in the educational process. This includes improving technical support, ensuring equal access to resources for all learners, and providing additional support and guidance for those who have difficulty adapting to the new environment. Overall, these results indicate the significant potential of simulation methods in improving the quality of higher education, but also highlight the importance of addressing and solving identified challenges to achieve maximum effectiveness and accessibility of these methods for all learners. An analysis of curricula and courses that include the use of simulation methods was also conducted. The analysis was carried out as part of a study at Hryhorii Skovoroda University. Consider the table showing the main results of the analysis of curricula and courses that include simulation methods (Table 5).

Table 5. General results of the analysis of curricula and courses at Hryhorii Skovoroda University in Pereiaslav

Positive and negative aspects of integration of simulation methods	Details
Integration of simulation methods	A large part of the courses combined various simulation methods, especially in pedagogical faculties.
Variety of applications	The humanities used simulation methods to display social simulations.
Impact on engagement and success	Courses involving the use of simulation methods increased the level of motivation and success of students.
Challenges and limitations	Lack of technical equipment and resources at some faculties.
	The need to improve the qualifications of teachers for the use of simulation methods and teaching aids.

Source: developed by the author.

Table 5 summarizes the key aspects of the study and reflects both positive and negative aspects of the integration of simulation methods and means of initiation into the educational process of higher education. It was found that a significant number of courses integrated simulation methods into their curricula. This included a wide range of disciplines, from the natural sciences to the humanities. For example, some teaching courses included virtual labs to simulate teaching situations, and digital learning technology courses used software simulators to teach coding and software development. In the humanities, such as psychology and pedagogy, simulation methods were used to develop scenarios, fragments of lessons that simulated social and pedagogical situations. The analysis showed that courses that used simulation methods had higher levels of student engagement and better performance scores compared to traditional teaching methods. Students noted that simulation methods help them better understand complex theoretical concepts and learn to apply theoretical knowledge in practice.

However, after analyzing the results of the study, a number of problems were identified, in particular, the lack of technical equipment and resources at some faculties, which limited the opportunities for the full implementation

of simulation methods. In addition, the need to improve the qualifications of teachers for the effective use of these methods in education was noted. These results indicate the significant potential of simulation methods in improving the quality of higher education, but also emphasize the need for further investments in technical infrastructure and the development of scientific and pedagogical workers. To overcome the problems associated with the use of simulation methods and teaching aids in the educational process of higher education institutions, including the Hryhorii Skovoroda University in Pereiaslav, the following recommendations can be developed. Among the proposed steps to improve the educational process in a higher education institution, the following can be highlighted: improving the technical infrastructure (assessing the current state of technical equipment and software; ensuring regular updating and modernization of equipment; installing high-quality interactive whiteboards, computers and software in classrooms); training programs for teachers (organization of seminars and trainings for teachers on the use of simulation methods; development of methodical manuals and online resources for self-study; engagement of external experts to conduct master classes and workshops); student support (organization of orientation

sessions for students on the use of simulation methods; provision of psychological support for students who experience stress or difficulties in adapting to new methods; creation of student support groups and forums for sharing experiences and solving problems); ensuring equal access (implementation of a program to ensure equal access to simulation resources for all specialties; development of mobile laboratories and virtual platforms available to students regardless of their physical location); evaluation and tracking of effectiveness (regular evaluation of the effectiveness of simulation methods through the collection of

feedback from students and teachers; use of analytics to track student success and improve educational methods); cooperation with the industry (establishing partnership relations, concluding agreements with companies and organizations to find new bases with available resources for the application of simulation technologies; involving industry representatives to conduct guest lectures and practical classes). It is also possible to propose an oriented program plan for Hryhorii Skovoroda University in Pereiaslav aimed at improving the use of simulation methods and teaching aids (Table 6). It can look like this:

Table 6. Integration of Simulation Methods into the Educational Process.

Phase	Duration	Basic actions
1. Assessment and planning phase	1-3 months	<ul style="list-style-type: none"> ↘ audit of technical resources; ↘ collecting feedback from students and teachers; ↘ development of an implementation plan, determination of priorities and goals;
2. Learning and development phase	4-6 months	<ul style="list-style-type: none"> ↘ conducting trainings for teachers; ↘ development of online resources and methodical materials; ↘ providing support to students: orientation programs; ↘ psychological support;
3. Implementation and monitoring phase	7-12 months	<ul style="list-style-type: none"> ↘ updating equipment and resources; ↘ implementation of pilot projects; ↘ purchase and installation of new equipment and software; ↘ updating the infrastructure to support new methods;
4. The phase of evaluating the results and predicting further steps	After 1 year	<ul style="list-style-type: none"> ↘ analysis of the effectiveness of implemented methods based on academic results and feedback ↘ identification of areas for further improvement ↘ development of strategies for the development and improvement of the system ↘ planning updates of technical infrastructure and materials

Source: developed by the author.

This plan envisages a comprehensive and prognostic approach to improving the system of using simulation methods and tools in the educational process of Hryhorii Skovoroda University in Pereiaslav, focusing on technical modernization, development of scientific and pedagogical workers, support of students and continuous improvement of the educational process. These recommendations and programs will contribute to the more effective implementation and use of simulation methods and tools in the educational process, increasing the quality of education and the development of future professional skills of students.

Carrying out a comparative analysis of this research results and the research results of a number of foreign scientists who studied the peculiarities of the use of simulation technologies in the educational process, it should be noted that the research results A. Holoborodko *et al.* (2020) agree with the current results and prove that the methods of using media education are quite appropriate and effective tools for increasing learning motivation, the quality of the educational process, and the formation of analytical and critical thinking among students. In turn, A. Heiman *et al.* (2022) emphasize the importance of applying innovative approaches during the organization of various types of activities and reveal the main features of imitation and threshold models, as such, which are modern trends in creating a high-quality competitive environment in an educational institution.

CONCLUSIONS

Based on the analysis of the results of the student survey of Hryhorii Skovoroda University in Pereiaslav, the following general conclusion can be drawn: simulation teaching methods occupy an important place in the educational process and are positively perceived by the majority of students. These methods contribute to better assimilation of theoretical material, increase student engagement and help in the development of practical skills. Software simulators, virtual labs and interactive tools allow students to more effectively learn complex concepts and prepare for real professional challenges. At the same time, there are certain challenges and difficulties that need attention. Students faced stress and overload due to the need to adapt to more complex learning methods, and felt inadequate access to the necessary simulation resources, especially in less technologically oriented faculties. This highlights the need to ensure equal access to simulation resources for all students and support in adapting to new technologies. In order to achieve the maximum efficiency and availability of simulated training methods, it is necessary to solve the existing technical, resource and psychological problems, as well as to ensure a constant improvement in the quality of technical support and methodical support.

The effective implementation of simulation technologies in the educational process is a key factor in

improving the quality of education and ensuring practical training of students. Implementation of a comprehensive program that includes improvement of technical infrastructure, development of teaching staff, support of students and provision of equal access to educational resources will allow to maximize the benefits of simulation methods. It also includes regular evaluation and adaptation of methods to continuously improve them according to the changing needs of students and teachers. A key aspect is cooperation with industry and the use of advanced technologies, which will ensure the relevance of the educational process and prepare students for real professional challenges. The use of simulation technology has the potential to develop key skills students will need in the future. Thus, a systematic and multifaceted approach to the integration of simulation methods and tools into the

educational process will be an important step in training qualified specialists and increasing the university's competitiveness. The prospect of further investigations is the study of the effectiveness of the application of simulation technologies in the process of professional training of future teachers, the development of programs based on simulation modeling.

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CONFLICT OF INTEREST

There is none.

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Проблема застосування імітаційних методів та засобів навчання в освітньому процесі закладів вищої освіти

Анотація. Сучасна професійна підготовка викладачів вимагає впровадження інноваційних технологій, зокрема імітаційних, які надають акцент на інтерактивність, творчість та використання інформаційно-комунікаційних методів. Ці технології спрямовані на підготовку до практичної діяльності, розвиток критичного мислення та набуття досвіду через імітацію педагогічних ситуацій. Метою дослідження був аналіз особливостей застосування імітаційних методів та засобів у освітньому процесі вищої школи. Методи аналізу включали аналіз літературних джерел, вивчення практики використання імітаційних методів і засобів навчання в освітньому процесі та анкетування і опитування серед здобувачів освіти і викладачів. Імітаційні методи та засоби навчання сприяють розвитку критичного мислення, навичок міжособистісної взаємодії та здатності адаптуватися до різних професійних ситуацій. Результати дослідження вказують на важливість та ефективність застосування імітаційних технологій у освітньому процесі закладів вищої освіти, що дозволяє зробити процес навчання цікавим, наочним та практичним і побудувати його на основі діяльнісного та компетентнісного підходів. Проте, технічні обмеження та відсутність підготовки викладачів до застосування імітаційних методів та засобів у освітньому процесі є основними чинниками, що ускладнюють впровадження імітаційних технологій в освітній процес. Враховуючи потенційні переваги досліджуваних методів, доведено ефективність застосування імітаційних методів та засобів навчання як інструменту підвищення якості професійної підготовки майбутніх фахівців. Практичне значення роботи полягає у тому, що результати дослідження можуть бути використані під час організації освітнього процесу здобувачів освіти педагогічних спеціальностей закладів вищої освіти, оновлення методологічної та практичної складової у викладанні освітніх компонентів

Ключові слова: імітаційні технології; вища школа; здобувачі освіти; викладачі; підготовка фахівців; інтерактивні методи навчання; віртуальні лабораторії та симуляції