THE IMPACT OF INFORMATION TECHNOLOGIES ON LEARNING AND EDUCATION: ANALYSIS OF INNOVATIVE METHODS AND STRATEGIES

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Abstract: The present academic paper is devoted to studying the impact of information technologies on modern education and learning, as well as analyzing innovative methods and strategies used in the educational process. The academic paper explores the benefits and drawbacks of using information technologies in education and considers innovative techniques such as Flipped Classroom, adaptive learning, massive open online courses (MOOCs), specialized learning programs, and the application of virtual reality (VR). Based on the analysis of innovative methods and strategies, the scientific article examines how modern approaches are changing traditional education and contributing to the quality of learning. The research points to the necessity of integrating information technologies into the educational process and permanently improving methods to achieve better results in modern education. The academic paper also emphasizes that the application of information technologies in education requires careful planning and support for teachers and education seekers to use these tools effectively. In conclusion, the research points out that the information technologies not only transform the way of learning and education but also create new opportunities for improving the learning and development of education seekers.

Keywords: adaptive learning, massive open online courses (MOOCs), virtual reality (VR) in education, gamification in education, interactive technologies in education.

1 Introduction

It is impossible to overestimate the influence of information technologies on contemporary education. These technologies have revolutionized the learning process, changing the way we acquire knowledge. Modern education faces numerous challenges and opportunities brought by information technologies. Information technologies are revolutionizing traditional approaches to learning, from open access to knowledge to personalized learning and interactive methods. Information technologies make it possible to create individualized curricula that take into account each education seeker's needs and interests, and the use of interactive methods and innovative technologies can increase the level of knowledge acquisition. All these aspects emphasize the relevance of the impact of information technologies on education and the necessity of analyzing and implementing innovative methods and strategies in the modern educational process.

The purpose of the research is to analyze the impact of modern information technologies on the processes of learning and education and to explore how innovative methods and strategies of learning based on information technologies transform traditional approaches to education.

Research objectives:

1. Analysis of the impact of information technologies on modern educational space and learning processes.
2. Consideration and description of innovative teaching methods based on the application of information technologies.
3. Study of modern strategies and approaches to education that actively use information technologies to improve learning outcomes.

2 Literature Review

Many scientific works have been devoted to the issues of innovation and the features of introducing information technologies into the education system. Johnson, Adams Becker, Estrada and Freeman (2015) describe recent trends in higher education, including the use of information technologies. The research on the interaction between democracy and education in contemporary society by Noddings (2013), the idea of connectionism and its effects on modern education by Siemens (2014), and the introduction to the analysis of learning and knowledge data are noteworthy (Siemens & Gašević, 2012). Identification of key trends and innovations in higher education, including the use of technologies, belongs to the research of Johnson, Adams Becker, Cummins, Estrada, Freeman and Ludgate (2013). Isak (2023) defines the role and place of information technologies as a significant component of modern educational society. Babenko, Batsurovska, Gorbenko, Andriushchenko and Kim (2019) explore the use of monitoring of information and educational environment in the education system, which may be relevant for developing effective learning strategies.

The achievements of scientists in numerous domains are examined in the context of analyzing innovative methods and strategies in education. For instance, the features of the "Flipped Classroom" methodology have been studied by Mahesh (2023), where the scholar insists on the effectiveness of the "Flipped Classroom" methodology, which is confirmed by the effectiveness of education seekers' outcomes, and it is of particular importance for understanding the impact of this methodology on learning; Paramita (2023) also analyzes the effectiveness of the "Flipped Classroom" methodology and its impact on learning outcomes in higher educational institutions.

Fadieieva (2023) conducts a literature review on the issue of adaptive learning. This scientific work is essential for understanding the development of adaptive learning over the past decade and identifying key themes and directions in the field. The authors Wu, Wang, and Liu (2023) consider the issue of self-regulated life-long learning using adaptive approaches, which is useful for understanding self-learning technologies and adaptive learning strategies. Their analysis provides information on technological solutions for implementing adaptive learning in universities.

Batsurovska (2021) considers the features of using massive open online courses (MOOCs) in the e-learning system. Daniel (2012) conducts an analysis of massive open online courses (MOOCs) and considers their possibilities and constraints. Siregar Siahaan, Claudia Hasya and Sitompul (2023) investigate information about computer networks and their use for educational purposes. Bashabsheh, Alsharu & Fakri (2023) study the features of legal protection of computer programs. Alipour and Khatib (2018) consider the peculiarities of applying virtual reality (VR). The source provides information on the benefits, challenges and trends in this sphere. It is important since it points to the possibilities of using virtual reality in education and learning. Batsurovska, Dotsenko, Soloviev, Lytvynova, Gorbenko, Kim, Haleeva (2022) point out the possibilities of using 3D models in training, in particular, in laboratory works. Deterding, Dixon, Khaled and Nacke (2011) define gamification and consider it as an approach to learning in their scientific works. The researcher Malamed (2012) provides a detailed description of gamification as a teaching method and provides examples of its application. The author offers practical recommendations for implementing gamification in teaching and learning.

Molokanova and Hordieieva (2023), Horokhivska and Demchuk (2023) explore the issues of project-based learning. The authors propose ways to improve project-based learning in Ukraine, consider project-based learning as a factor in the professional

development of scientific and pedagogical staff and its impact on the educational process in educational institutions. Shvardak (2017) and Vemian and Soltysiuk (2014) studied problem-based learning in modern schools and the methodology of problem-based learning as a special structure of education seekers' creative learning activities. Information on blended learning and international approaches to it is presented by Bonk and Graham (2012). The scholars provide a detailed overview of blended learning and its variations. Doolittle, Wojdak and Walters (2023) explore active learning and provide a limited systematic review of this approach. By the way, the consideration of active knowledge-based learning also deserves attention (Ciravegna et al., 2023). Bakker, Hoof and Welling (2023) have studied active learning strategies with a focus on specific learning objectives.

Anderson and Dron (2011) analyze the evolution of pedagogical approaches in distance education. This source provides information on developments and modifications in distance learning methods. Anderson and Dron (2011) also consider the topic of distance education, in particular, the difference between traditional, content-oriented and more interactive learning methods. Batsurovska, Havrysh, Hruban and Novikov (2021) discuss the methods of organizing conferences for specialists through distance learning, which can be useful for improving the quality of education in a remote format. Kay (2012) conducts a literature review on using video podcasts in education and provides information on their effectiveness.

Siemens and Gašević (2012) consider the analysis of learning data and the importance of collecting and analyzing information to optimize the learning process through information technologies. Ramos and Soliven (2020) studied the impact of webinars on education seekers' learning process. Tarusan, Naparan and Celesio (2022) analyze the learning experiences of teachers participating in webinars. Zavolodko and Kasilov (2020) studied the use of interactive tools in online education. Maher, Baeseman, Liggett and Sparrow (2011) studied how free online webinars can meet the needs of international career development.

In general, these sources include various aspects of learning, the use of information technologies and methods in education; however, as a result of processing the sources, no sufficient analysis of the impact of information technologies on learning and education and consideration of innovative methods and strategies in the education system in the context of information technologies was revealed.

3 Applied Methods

The survey in the present paper was conducted using the following research methods:

1. Literature review: analysis of scientific publications, studies and articles on the impact of information technologies on education and innovative teaching methods.
2. Analysis of statistical data: use of statistical data and reports from educational organizations to assess trends in the use of information technologies in education.
3. Comparative analysis: comparing the learning outcomes and achievements of education seekers who use information technologies with those who study using traditional methods.

4 Research Results

Information technologies are revolutionizing training by providing access to a huge number of learning resources via the Internet. They contribute to the personalization of learning, allowing education seekers to choose individual development paths and use adaptive learning platforms. Interactive technologies, such as virtual reality and games, can make learning more fun and engaging. Information technologies help education seekers develop the digital skills they need for a successful future career. Educational institutions and teachers should develop strategies to successfully integrate these technologies into training and ensure the quality of education. Information technologies have significantly transformed the modern educational process. They are intensively transforming modern education, making it more accessible, personalized and engaging. Educational institutions and teachers need to develop strategies for the successful integration of technologies in the learning process and provide education seekers with the opportunity to develop in this direction.

Information technologies in education have both benefits and drawbacks (Table 1).

Table 1. Benefits and drawbacks of information technologies in education

Benefits	**Drawbacks**
Access to unlimited information: The Internet and digital resources provide education seekers with access to a vast amount of knowledge and educational materials.	*The lack of personal contact:* Real-time interaction with teachers and the community can be limited in online learning.
Personalized training: Technologies make it possible to create training programs that take into account the education seekers' individual needs and pace of learning.	*Problems with the quality of information:* The Internet also contains incorrect or unverified information that can confuse education seekers.
Interactive and engaging learning experience: The use of virtual reality, games, and other interactive technologies makes learning fun and engaging for education seekers.	*Dependence on technologies:* When the learning system is dependent on technology, there is a risk of losing access to learning in the case of technical problems.
Increasing productivity and convenience: Information technologies simplify learning and data management processes, which increases productivity.	*The lack of motivation:* Some education seekers may feel a lack of motivation in online courses because they don't have the external pressure and communication with classmates.
Global access: Online courses and distance learning allow education seekers to study anywhere in the world.	*Data privacy issues:* Storing and processing the personal data of education seekers online can create privacy and security issues.

The analysis of innovative training methods and strategies involving the application of information technologies reveals a wide range of opportunities for improving the process of education and knowledge acquisition.

Let's consider modern innovative methods and strategies in education in the context of the impact of information technologies and their benefits for learning.

1. Flipped Classroom (the method of inverted class)

The education seekers study new material before the classes, using videos, online resources and other sources, and then actively discuss and apply the knowledge gained in the classroom. The "method of inverted class" or "Flipped Classroom" methodology is an innovative approach to teaching, where the traditional order of the lesson is inverted (Naik, 2023). The education seekers acquire this material independently before the class, typically through videos or other online resources, rather than learning it during the lesson. Along with this, the classes are used for discussion, problem-solving, group work and solving specific tasks related to the material that education seekers have previously acquired.

The "Flipped Classroom" methodology is actively used in modern education and helps improve learning efficiency, engage

education seekers in active participation, and develop their critical thinking and collaboration skills.

2. Adaptive Learning

Adaptive learning is a methodology that uses information technologies to create individualized learning paths for education seekers based on their needs, abilities, learning pace, and academic performance. This approach enables education seekers to study the material at their own pace and focus on the topics they need to achieve their specific learning goals.

This type of training also helps increase education seekers' engagement, since they feel that their learning needs are being taken into account. In addition, this approach simplifies the assessment of education seekers' progress and makes it possible for teachers to focus on individualized improvement of teaching methods. Adaptive learning helps ensure efficient and effective learning where one can develop skills and gain knowledge according to one's individual needs. It is especially useful in the modern educational environment, where education seekers have different levels of knowledge and learning speeds.

3. Massive Open Online Courses (MOOCs)

These are online courses that provide access to higher education from the world's leading universities and organizations without restrictions on location and time. They are popular for self-study and professional development. Figure 1 shows the evaluation of the dynamics of using massive open online courses (MOOCs) during the period from 2011 to 2023.

The estimated number of MOOCs' users is based on the general growth in popularity of these courses and the possible number of users during this period. According to these estimates, in 2011, MOOCs were fairly new and had a limited audience. However, their popularity has been growing since 2012. In the following years, in particular, in 2013–2014, the number of users has grown to more than 4 million. The number of users increased significantly starting in 2015 and surpassed 100 million in 2018. 2020 was a particularly important year, when the popularity of MOOCs increased due to the COVID-19 pandemic, and the number of users reached more than 160 million. Forecasts for 2021 indicate a further increase in this figure, up to more than 180 million users. These dynamics show how MOOCs have become an important means of learning and self-development for millions of people around the world, particularly, due to their accessibility and flexibility.

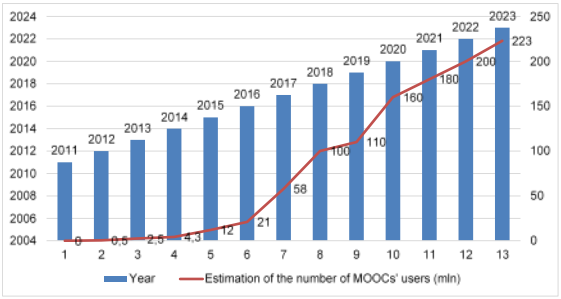

Figure 1. Dynamics of using MOOCs

The main features of MOOCs include accessibility and diversity of courses; flexibility and quality of learning; open access to materials and the possibility of certification. MOOCs provide learning opportunities for millions of people around the world. Many MOOCs are developed by leading universities and experts, which guarantees high-quality learning. Such courses contribute to developing self-discipline skills and working skills in the online environment, which are important in modern society.

4. Specialized Computer Programs for Training.

These programs are intended for learning and developing specific skills and knowledge. Figure 2 provides examples of specialized training programs and their purposes.

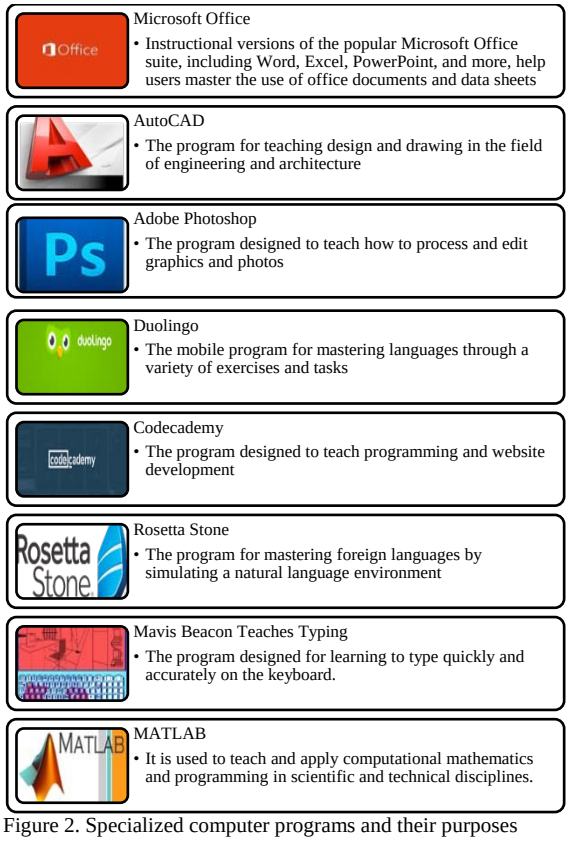

Figure 2. Specialized computer programs and their purposes

These programs help education seekers acquire new skills and knowledge in various fields using interactive and practical learning methods. They help improve skills and career opportunities and can be available in both online and traditional formats, giving education seekers the flexibility to choose the way they want to study. Specialized programs are focused on current trends and requirements of the labor market in the relevant industry.

5. Virtual Reality (VR)

The use of VR for immersive learning and simulations is especially relevant in medicine, engineering, and other industries. VR is an immersive technology that creates a simulation of the world around us and gives the users the feeling of being in another place or environment that does not exist in reality. It is achieved with the help of special headsets (for example, virtual glasses) that provide visual and audio immersion, as well as other technologies for interacting with this virtual environment. VR for learning is an innovative approach that uses virtual reality technology to create a simulated learning environment in which education seekers can learn, practice, and develop their skills.

6. Gamification

This is the method of using game elements to stimulate motivation and active learning, in particular, in serious games. Gamification in education is an approach that uses gaming elements and techniques to stimulate motivation, improve academic achievement, and engage education seekers in the learning process. Gamification promotes active participation in the learning process, including problem solving and task completion, and its systems can be sequential in nature, which encourages education seekers to complete tasks step by step and

achieve learning outcomes. Gamification systems can provide feedback on education seekers' academic performance and progress. Gamification in education promotes active learning and helps education seekers better acquire material and develop important skills such as problem solving and collaboration.

7. Problem-based and Project-based Learning

It involves creating tasks and projects that encourage education seekers to solve real problems and make projects. Problem-based and project-based learning are pedagogical approaches aimed at actively engaging education seekers in learning through solving real-world problems or creating projects. Problem-based and project-based learning emphasizes the development of teamwork and cooperation skills. They can be successfully applied in various areas of education, including higher, secondary and primary schools. These methods of training are designed to prepare the education seekers to work in a modern society where it is essential to possess analytical, creative and communication skills. They contribute to education seekers' intrinsic motivation since learning becomes more meaningful and practical.

8. Blended Learning

This approach combines traditional classes with online resources and education seekers' active work in the network. It develops self-study skills and increases the accessibility of materials. Blended learning, also known as hybrid learning, is a pedagogical approach that combines elements of traditional in-class instruction with the use of technologies and online resources. Blended learning makes it possible to choose the place and time of study, which increases the flexibility of the learning process. Blended learning helps education seekers develop the skills they need for working and living in a digital society and allows them to combine different learning methods to achieve better results.

9. Active Learning

This approach involves engaging education seekers in dynamic activities, such as discussions, group work, and projects, using technology to facilitate interaction and engagement. The implementation of active learning with the help of information technologies is a modern approach to education that stimulates the active participation of education seekers in the learning process with the help of various technological tools and resources. The application of interactive tasks makes it possible to implement active learning. Information technologies make it possible to create interactive exercises, tests and tasks that encourage education seekers to think actively and solve problems. Web-based platforms for collaboration enable users to work together on projects and tasks even when they are far away from each other.

10. Interactive Webinars and Online Seminars

Webinars and online seminars provide an opportunity for education seekers to interact with teachers and coursemates in real time, despite the physical distance. Interactive webinars and online seminars are important components of modern distance education and have a number of features that make them effective and popular. They provide remote interaction. Interactive webinars and online seminars allow education seekers and teachers to interact without the need to be present in the classroom. Webinars are usually held on specialized web platforms that provide access to tools for video conferencing, communication and collaboration. Participants can communicate in real time using chats, webcams, and microphones to share ideas and questions.

5 Discussion

Some experts believe that Flipped Classroom makes it possible to use classroom time more efficiently; however, there are limitations in access to technology for all education seekers. The discussion concerns the extent to which education seekers can be independent in mastering the material before the class. The importance of an individual approach to education seekers, which provides adaptive learning, is emphasized. There are concerns about the quality of algorithms for adapting and protecting the privacy of education seekers' data. The discussion focuses on the recognition of MOOCs' diplomas and their importance in the labor market. Supporting students in the transition between learning formats is an important aspect. The issue is being worked about active learning methods that are most suitable for different subjects and audiences. The discussion focuses on supporting teachers and infrastructure for active learning. The effectiveness of webinars and seminars as learning tools is also discussed. The development of interactive methods for conducting webinars and ensuring active participation of users is an important aspect.

6 Conclusions

Therefore, information technologies influence modern education in a significant way. They make learning more accessible, flexible, and interactive for participants in the educational process. The innovative training methods, such as Flipped Classroom, adaptive learning, MOOCs and the use of virtual reality, make a significant contribution to improving the efficiency of learning and engaging the education seekers. Gamification in education is becoming increasingly popular, encouraging education seekers to actively participate and gain new knowledge. Problem-based and project-based learning contributes to the development of critical thinking and practical skills of participants in the educational process. Blended learning, which combines traditional and online approaches, opens up new opportunities for individualizing learning and improving the quality of education. All the innovative approaches and methods outlined create a powerful potential for improving education in the modern world. It is crucial to continue exploring, developing and implementing them to ensure quality education and prepare the education seekers for the challenges of our time. The mentioned innovations also pose new challenges and tasks for educational institutions and teachers. Information technologies require not only technical training but also new pedagogical strategies and approaches to learning. Instead of merely acting as information intermediaries, teachers should encourage education seekers to actively participate in the learning process. Thus, information technologies have become an integral part of education; they have a significant impact on the way of learning and the educational process. It is crucial to include these technologies in the educational process and continue to develop cutting-edge teaching approaches and strategies in order to achieve the best results.

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Primary Paper Section: I

Secondary Paper Section: IN, AM