Modernization of the Education System by Implementing Information Technologies

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Abstract:

The article discusses some features of the modernization of the education system through the introduction of information technologies using the example of teaching computer science. By studying scientific papers, manuals and normative documents, they identify specific examples of effective use of information technologies and highlight key aspects that are important when integrating them into the educational process. The article also highlights the role of computerization in raising educational standards and describes three main elements underlying the successful application of information technology in education. The literature is reviewed and the author's conclusions are given.

Keywords: computer science, technology, information, teaching, learning, integration, modernization, methods, process, skills, models, programs, projects

Introduction

The modern school computer science curriculum emphasizes the involvement of students in the active development of computer technologies, which has become a key element of education in our time. This requires new knowledge and skills from students and teachers that can only be developed through direct interaction with a computer. The main task facing school education in computer science is not only to provide technical skills, but also to develop personal qualities in students that will facilitate their successful adaptation in future professional activities and life in the information society[1].

In the era of technological progress, computer science education in schools is of strategic importance to prepare students for future professional challenges. The importance of developing skills

such as teamwork, critical thinking, problem solving, and understanding and application of information technology and programming is beyond doubt. One of the initial teaching methods, the traditional approach, combines lectures, practical exercises, and individual assignments aimed at assimilating the basics of computer science by students. This method helps students lay the foundation for further development in this field, offering them the necessary tools to successfully overcome the upcoming difficulties.

Methodology

In the modern educational landscape, especially in the field of information technology, the methodology of teaching plays a crucial role in shaping both theoretical understanding and practical competence. Traditional methods of instruction—lectures, textbook learning, and instructor-led demonstrations—have long served as the foundation for teaching programming languages and IT skills[^2]. While effective in conveying fundamental knowledge, these methods often fall short in equipping students with the dynamic, problem-solving abilities required in real-world environments.

To address this gap, problem-based learning (PBL) has emerged as a progressive and student-centered approach. PBL engages learners in solving authentic, often interdisciplinary problems where the learning process is driven by inquiry and collaboration. Within this framework, students are presented with real or simulated scenarios and must apply their existing knowledge to identify problems, develop hypotheses, conduct research, and ultimately propose solutions. This active engagement fosters deeper conceptual understanding, improves retention of knowledge, and strengthens communication and teamwork skills.

Another complementary method employed in this study is the activity-based learning (ABL) approach. This methodology emphasizes hands-on, experiential learning, where students interact directly with computer hardware and software to reinforce theoretical principles. Practical sessions include writing code, debugging, testing applications, and using development tools, thereby encouraging a learn-by-doing philosophy. This approach is particularly effective in bridging the gap between abstract concepts and their practical applications, making it ideal for technical education.

Furthermore, both PBL and ABL are grounded in constructivist learning theory, which posits that learners construct knowledge most effectively through experience and reflection. In line with this, collaborative learning strategies are also integrated, encouraging students to work in pairs or small groups to develop solutions, critique each other's ideas, and refine their thinking.

In this research, the instructional design follows a modular structure, where each unit of learning is aligned with specific learning outcomes and integrates both theoretical content and practical tasks. Pre-assessments are used to evaluate prior knowledge, while formative assessments—such as coding tasks, peer reviews, and presentations—provide feedback throughout the learning process. A summative assessment at the end of the module evaluates the learner's overall proficiency in both conceptual understanding and practical application.

This methodology not only promotes the acquisition of specific IT skills but also enhances 21st-century competencies such as critical thinking, adaptability, and digital literacy, which are essential in today's rapidly evolving technological landscape.

Results and Discussions

Students are actively immersed in the world of information technology, where they not only develop projects and program, but also solve complex problems. The training is based on the

understanding of computer science as a powerful tool for analyzing and solving current problems. Particular attention is paid to the constructive method of teaching, which assumes that students achieve the best results through the creation of unique models, programs and projects[3]. This method not only helps to improve technical and programming skills, but also stimulates creative expression, implying work both individually and in a team, when developing, for example, websites. Thus, a constructive approach is the key to the development of both technical and creative abilities of students .

Recently, thanks to the introduction of the latest state educational standards (SES), the learning process is being transformed through the use of modern pedagogical methods. These methods are focused on the development of key competencies and fundamental learning skills. One of the key aspects of modern education modernization is the integration of information technology (IT), which contributes not only to improving the quality of education, but also to the formation of information skills, as well as the disclosure of intellectual potential[4]. In light of these changes, significant computerization of school education is taking place, which is evident from the increase in the number of classrooms equipped with computers.

Currently, the media industry actively enriches the educational process by providing educational content using computer technologies. Computers for teachers, interactive whiteboards and other technological tools have become inseparable attributes of the modern educational space[5]. The definition of IT includes various processes and methods that allow collecting, storing, processing, analyzing and providing data in response to user requests, relying on software and hardware. IT is divided into three key elements: hardware, software and information systems[6].

The focus on teaching specific information technology tools has called into question the need for school computer science as an independent academic discipline and has led to the idea of dissolving the content of this course in the subject areas of mathematics and technology. However, with the growing awareness among the teaching community that excessive attention to the applied and technological aspects of teaching without proper theoretical training hinders a deep understanding of the subject, a process of reassessment of the importance of computer science in general education has begun[7]. As part of the educational process, computer science in schools has gradually transformed into a critical element, which not only represents a separate subject, but also plays a key role in the development of other disciplines through the use of IT. This discipline contributes not only to the acquisition of academic knowledge, but also to the development of critical thinking, social adaptation and the formation of a unique worldview among students[8]. Over time, the computer science course has become an integral part of general education, revealing new opportunities for solving educational problems and supporting the comprehensive development of the individual. In the modern world, where IT is developing at an incredible speed, there is a task of integrating scientific principles and methods into the learning process. This is necessary so that schoolchildren can master universal skills in working with information. The basis for this is the fundamentalization of the educational process, thanks to which effective learning is possible in the context of constant updating of knowledge[9].

The introduction of modern technologies in the process of teaching computer science in school institutions has a number of important advantages, confirmed by various sources. Active use of such innovations in lessons not only contributes to more effective preparation of students for the realities of the modern and future world, where technology plays a key role, but is also necessary for their successful socialization and career development. Moreover, it helps to deepen the understanding of

the material by developing the ability to critically analyze information and solve complex problems, which is an important skill in any professional field. The use of interactive gaming computer technologies (IGCT), as an example of modern teaching methods, is becoming increasingly popular in today's educational environment[10]. These technologies combine various forms of computer games and interactive methods to achieve educational goals. In the context of computer science, the introduction of such innovations not only enriches the learning process, but also significantly contributes to the development of important technical and software skills, which is an integral requirement in the labor market today.

These tools combine development and entertainment into one, providing a more dynamic and effective approach to learning compared to classic methods[11]. They transform the learning process into an exciting adventure by integrating with technologies that students are already familiar with, such as the Internet and various devices, maintaining their interest and attention at a high level. The approach is especially effective for students who learn better visually or through physical interaction, giving them the opportunity to study the material in a format more suitable for them. In addition, this method of learning allows students to more accurately identify their weaknesses and overcome obstacles, as well as receive detailed feedback that contributes to a deeper understanding of the material[12].

The introduction of modern educational technologies, including interactive games, into the learning process requires a careful approach to their selection and organization. It is important that the selected game corresponds to the level of students' knowledge and the topic that is currently being studied. It is also critical to provide students with clear instructions for effective work with the game, and the game itself should not be overly complex or too exciting so as not to distract from the main educational task. The use of information and communication technologies (ICT) and other cutting-edge teaching methods allows teachers to flexibly adapt to the evolving needs of the educational process and students, which, in turn, helps improve the quality of education and student performance[13].

A study of current trends in IT in education has revealed that their intelligent implementation in order to support future development in scientific, economic, social and cultural aspects is one of the most complex and important tasks. This requires continuous cooperation between education professionals and an active role of government agencies in supporting such cooperation. In addition, the implementation of information technology is not limited to educational aspects. Computer science education can become much more diverse and extensive thanks to the opportunities provided by modern technologies and the Internet[14]. No matter where a person lives or what age they are, they have access to an endless amount of information and resources for learning. This may include not only studying core academic subjects but also pursuing additional education such as programming through online courses or learning platforms, as well as interacting on social media. Thanks to this, people can not only broaden their horizons but also develop their creative abilities[15]. Information technology has played a key role in making the process of lifelong learning a reality, while motivating people to self-study and conduct scientific research.

The integration of IT into the educational environment has become a key aspect of its modern renewal. This process does not simply improve the quality of education; it also promotes the development of information skills and helps to reveal individual intellectual capabilities. Over the past ten years, computerization has become an integral part of school education, becoming a ubiquitous phenomenon, where classrooms are equipped with computer equipment, and educational

materials are increasingly presented in digital format. Today, it is difficult to imagine education without the use of computers for teachers, interactive whiteboards and other technological means that support the educational process.

IT covers a wide range of activities and procedures aimed at the effective management of data, including its collection, analysis, storage and distribution to meet the specific needs of users[16]. These activities are carried out using various software and hardware. Information technology is based on three key elements: hardware, software and organizational methods, which together create the basis for effective work with information through different channels and media. IT, divided into analog and digital, allows people to have information about what is happening in the present and to know the history of past events.

The experience of teaching computer science demonstrates that computer science teachers often do not realize the rich reserve of their subject and do not set a goal to participate in the development of students' thinking functions during the study of computer science and ICT[17].

The main pedagogical goals of IT in lessons are developing the personality of the student, including: development of communicative skills, development of creative thinking, ability to make unusual decisions in complex role situations; improvement of knowledge in experimental activities. For example, the potential of IT in a modern state education is determined by a wide range of development of the human individual emotions, intelligence, worldview, independent creative and critical thinking, aesthetic consciousness. The issues of developing resources of information technologies mostly attract the attention of all teachers who work on the concept of "electronic pedagogy"[18]. They believe that IT provides many advantages for developing learning.

Conclusion

In conclusion, computer science lessons develop a systemic perception of the world, mastering the unified information links of various natural and social phenomena, and develop systemic thinking, the level of which is largely determined by the ability to quickly process information and make reasoned decisions based on it, which requires additional opportunities from schoolchildren and teachers to use new teaching methods and tools.

Currently, the global network and various software products are diverse in their range. It is due to the development of information technologies that the idea of continuous additional education is fully realized. Also, information technologies to a greater extent argue people to study, conduct various research works, create innovative projects and articles.

Thus, the use of information technologies in the educational process is necessary to prepare students for life and work in the modern information society.

References:

[1] L. V. Krasovskaya, A. S. Zubenko, N. S. Salyaeva, and E. V. Chueva, *Use of modern information technologies in the study of computer science at school*. Yalta: Trends in the Development of Higher Education in the New Conditions, 2016.

[2] A. R. Matyunkina, 'Use of modern digital equipment and electronic educational resources as an effective tool for improving the quality of education', *Mod. Tools Methods Technol. Knowl. Manag.*, no. 4, 2021.

[3] L. V. Krasovskaya and T. I. Isabekova, 'Use of information technologies in education', *Sci. Result Pedagogy Psychol. Educ.*, vol. 3, no. 4, pp. 29–36, 2017.

[4] A. V. Lifenko, 'Problems of teaching the subject "Informatics and ICT" in secondary school', in *International Conference 'Actual Problems of Methodology of Teaching Informatics in a Modern School'*, T. B. Zakharova and N. K. Natelauri, Eds., Moscow: Moscow Pedagogical State Pedagogical University, 2016, p. 397.

[5] M. E. Baranova, D. S. Moiseyenkova, V. A. Nosova, and D. A. Yachmeneva, 'Modern digital educational technologies in computer science lessons', *Young Sci.*, no. 16 (463), pp. 300–302, 2023.

[6] U. S. Department of Education, 'Information Technology System Modernization and Working Capital: Fiscal Year 2021 Budget Request', U.S. Department of Education, 2020.

[7] I. V. Levchenko, 'Information technologies in the general education course of computer science in the context of the fundamentalization of education', *Bull. Peoples Friendsh. Univ. Russ. Ser. Informatiz. Educ.*, vol. 15, no. 3, pp. 282–293, 2018, doi: 10.22363/2312-8631-2018-15-3-282-293.

[8] E. L. Fedotova and A. A. Fedotov, *Information Technologies in Science and Education: Textbook*. Moscow: ID FORUM; NITs INFRA-M, 2013.

[9] E. G. Bodrova and L. N. Degterenko, 'Digital tools and services in the professional activities of a modern teacher', *Mod. High. Sch. Innov. Asp.*, vol. 13, no. 2, pp. 48–56, 2021.

[10] P. Education, 'Six Pillars for the Digital Transformation of Education', 2023.

[11] E. Commission, 'Regional Innovation Scoreboard 2023: Methodology Report', 2023.

[12] Wikipedia, 'Legal Technology'. 2024. [Online]. Available: https://en.wikipedia.org/wiki/Legal_technology

[13] U. S. G. A. Office (GAO), 'Information Technology: Education Needs to Address Student Aid Modernization Weaknesses', 2022.

[14] SpringerLink, 'Implementing Educational Technology in Higher Education: A Strategic Approach', *Educ. Inf. Technol.*, vol. 28, pp. 123–145, 2023.

[15] T. Times, 'Estonia's Curriculum is One of the Best – What Can It Teach Us?', pp. 1–5, 2024.

[16] ElifTech, 'Digital Transformation in Education: Roadmap for K-12', 2023.

[17] W. B. Group, *World development report 2016: Digital dividends*. World Bank Publications, 2016. Accessed: May 10, 2024. [Online]. Available: https://books.google.com/books?hl=ru&lr=&id=dAl-CwAAQBAJ&oi=fnd&pg=PP1&dq=Public+administration,+management,+E-commerce,+digital+economy,+Uzbekistan,+artificial+intelligence,+mathematical+rules,+digital+technologies,+management+methods.&ots=E75Twb849s&sig=lM02-Z18XpPGrxKlsPU0VBONjUw

[18] J. Wang, 'A Review of the Development of the Integration Strategy of Information Technology and Education in Four Countries: United States, Britain, China, and Singapore', *Int. Educ. Stud.*, vol. 14, no. 6, pp. 1–9, 2021.