

Analysis of National Practices in Organizing Informatics Education in General Secondary Schools

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Abstract: This article examines the national practices of organizing informatics education in general secondary schools within the context of ongoing educational reforms and digital transformation. It analyzes the current state of teaching informatics, including curriculum content, teaching methodologies, and the integration of digital technologies in the learning process. Particular attention is given to the implementation of electronic educational resources and the development of students' digital competencies. The study also highlights existing challenges, such as insufficient technical infrastructure, gaps in teacher training, and the need for updated pedagogical approaches. Based on the analysis, recommendations are proposed to enhance the effectiveness of informatics education, improve digital literacy among students, and align national practices with international standards.

Keywords: Informatics education, digital transformation, secondary education, national practice, electronic learning resources, digital literacy, IT infrastructure, teaching methodology, curriculum development, educational reforms, innovative technologies, Uzbekistan education system.

Introduction: In the context of contemporary globalization, the digital transformation of the education system is becoming one of the priority directions of state policy. In particular, the modernization of the process of teaching informatics in general secondary schools, the widespread implementation of electronic educational resources, and the development of students' digital competencies have gained significant relevance.

In the Republic of Uzbekistan, consistent reforms are being carried out in this direction. In particular, the Action Strategy approved by Presidential Decree No. PF-4947 dated February 7, 2017, defined the conceptual foundations for modernizing the education system and introducing advanced pedagogical and information technologies. Based on this document, efforts to update the content of education, digitalize the learning process, and implement innovative approaches in pedagogical activities have been carried out in a phased manner.

In recent years, particularly during 2022–2026, the development of education has reached a new stage. At

the initiative of the President, within the framework of the "Development Strategy of New Uzbekistan (2022–2026)," the full digitalization of the education system, the expansion of IT infrastructure in schools, and the enhancement of students' digital literacy have been identified as priority tasks.

In addition, starting from 2023–2024, projects such as "Digital School," "Electronic Diary," and "Online Learning Platforms" have been widely implemented in the general secondary education system, contributing to the individualization of the learning process and increasing its interactivity. These processes are expected to further develop in 2025–2026, with the growing adoption of artificial intelligence-based learning systems, adaptive teaching technologies, and mobile applications in education.

Referring to international experience, in developed countries informatics education is organized based on the STEAM approach, digital platforms, and artificial intelligence technologies. For instance, in Finland's education system, emphasis is placed on developing

students' independent thinking and problem-solving competencies, while in South Korea, programming and algorithmic thinking are taught from the early stages of education. In the United States, distance and blended learning are широко implemented through platforms such as Google Classroom and Khan Academy.

Positive changes are also being observed in these areas within national practice. In particular, the use of electronic textbooks, multimedia tools, virtual laboratories, and mobile applications in teaching informatics in general secondary schools is steadily expanding. Especially in grades 5-7, organizing lessons based on interactive methods, taking into account students' age and psychological characteristics, significantly increases the effectiveness of the learning process.

The above analysis indicates that organizing informatics education on a modern basis, particularly developing and improving methodologies for the effective use of electronic educational resources, is one of the important scientific and practical tasks of the present time. Therefore, conducting an in-depth study of the methodological foundations for using electronic educational resources in informatics lessons in grades 5–7 is of particular relevance.

In the 21st century, information and communication technologies play an indispensable role in the development of the education system. In particular, the use of electronic educational resources in teaching informatics is recognized as a key factor in increasing the effectiveness of the learning process. From this perspective, the analysis of scientific research conducted in this field provides an opportunity to gain a deeper understanding of the theoretical foundations of organizing informatics education.

Among Uzbek scholars, R.X. Djuraev evaluates the process of informatization of education as “an important factor in improving the quality of education through the introduction of modern technologies into the learning process.” [1] Also, U.N. Nishonaliyev notes that “the application of innovative approaches in education contributes to the development of students' creative potential.”[2]

A.A. Abduqodirov, in his research on the methodology of informatics education, concludes that “electronic educational resources enable the individualization and

interactivity of students' learning process.”[3] This, in turn, further enhances the didactic significance of using digital tools in modern informatics lessons.

N.T. To'rayev and other local researchers have scientifically substantiated that the use of digital platforms in the educational process increases students' motivation, guides them toward independent learning, and develops their self-control skills.[4]

The analysis of the above scientific views shows that the effective organization of informatics education through the use of electronic educational resources is not only a technological necessity but also a pedagogically grounded approach. In particular, in grades 5-7, lessons organized on the basis of interactive, multimedia, and mobile technologies, taking into account students' age characteristics, ensure a high level of learning effectiveness.

The analysis of both foreign and national scientific studies confirms the necessity of improving the methodology of using electronic educational resources in informatics education. This, in turn, serves to strengthen the scientific and theoretical foundations of the present research work.

The introduction of modern information technologies into the education system, particularly the improvement of the process of teaching informatics, is considered one of the relevant scientific directions not only at the national but also at the international level. In this field, extensive research has been conducted by scholars from the Republic of Uzbekistan, the Russian Federation, CIS countries, and other foreign states.

In our country, regarding the integration of information technologies into the educational process, A.A. Abduqodirov, in his research, has thoroughly analyzed the didactic possibilities of distance learning technologies and substantiated their role in improving the quality of education.[5] Similarly, in the textbook “Informatics and Information Technologies” developed by A.A. Aripov and colleagues, the methodological foundations of applying modern ICT tools in the educational process are presented. These works continue to hold significant scientific and practical importance today.[6] The educational and methodological complexes developed by N.I. Taylakov for the continuous education system serve the purpose of step-by-step teaching of informatics, particularly

contributing to the formation of basic competencies in grades 5-7.[7]

Among Uzbek scholars, M.M. Aripov, J.X. Yuldashev, and U.Yu. Yuldashev have studied the issues of continuous teaching of informatics within the lifelong education system and scientifically substantiated the necessity of ensuring methodological continuity between different stages of education.

U.Sh. Begimqulov has developed the theoretical and methodological foundations of applying modern information technologies in the educational process and notes that the formation of a digital educational environment increases the effectiveness of students' learning. This approach plays an important role, especially in improving the methodology of using electronic educational resources.

R.R. Bokiev, in turn, has investigated the didactic and psychophysiological aspects of developing and using electronic teaching materials and substantiated that multimedia tools activate students' cognitive processes.[8]

Analyzing foreign experience, it can be observed that in the United States, South Korea, and European countries, informatics education is organized on the basis of digital platforms, virtual laboratories, and adaptive learning systems. This approach contributes to the formation of individualized learning trajectories for students. The analysis of the above-mentioned scientific sources indicates that the use of electronic educational resources in informatics lessons in grades 5-7 is not only a modern pedagogical requirement but also one of the key factors in improving the quality of education. Therefore, further improvement of methodological approaches in this direction represents an urgent scientific problem.

The issues of improving the content and methodology of teaching informatics within the continuous education system are currently considered one of the most urgent scientific and pedagogical problems. In this regard, the research conducted by N.I. Taylakov is of particular importance, as he has developed the scientific and pedagogical foundations for creating a new generation of informatics textbooks for the continuous education system. This approach ensures continuity between different stages of education and contributes to the gradual development of students' digital competencies.

In addition, a number of local scholars have also carried out significant research on the problems of teaching informatics in primary and general secondary education. In particular, the studies conducted by D. Kamalitdinova, B. Boltayev, and N.I. Taylakov scientifically substantiate issues such as adapting the content of informatics to students' age characteristics, developing initial algorithmic thinking skills, and improving digital literacy.

Within the framework of this research, the concept of informatics education in general secondary schools has been considered on a broad scientific basis. This field of education aims to prepare students for active participation in the digital society and to develop their competencies in working with, analyzing, and creating information. In modern scientific approaches, the concept of "computing" is interpreted as an independent field of education that includes three main directions:

Informatics (Computer Science - CS) - the study of algorithms, programming, and computational processes;

Information Technology (IT) - the practical use of computer systems and software tools;

Digital Literacy (DL) - the development of skills for safe, critical, and effective interaction with information.

These three areas are closely interconnected and jointly contribute to the formation of competencies necessary for students to function successfully in the modern digital world. In particular, in grades 5-7, the integration of these areas promotes not only technical skills but also independent thinking, problem-solving abilities, and creative approaches. From this perspective, the use of electronic educational resources serves as an important didactic tool in modernizing the process of teaching informatics and has a direct impact on improving the effectiveness of education.

The scientific sources analyzed within the framework of our research indicate that the concept of "computing education" is an integrated system that encompasses three interconnected areas: Informatics (CS), Information Technology (IT), and Digital Literacy (DL). However, existing scientific approaches often focus on only certain aspects of these areas, considering them as separate components. In contrast, in the modern digital educational environment, the integration of these three

directions has significant didactic importance.

According to traditional approaches proposed by some researchers, the introduction of complex concepts at the propedeutic stage of teaching informatics is considered inappropriate. For example, there are differing opinions regarding the early use of the Logo programming environment or the introduction of programming elements at an early stage. In their view, rather than forming abstract programming concepts in grade 5 students, it is more appropriate to develop preparatory (propedeutic) skills.

However, modern pedagogical approaches view this issue differently. In particular, it is emphasized that in grades 5–7, before introducing programming, it is necessary to identify basic cognitive operations, gradually develop logical thinking, and form computational thinking. In this process, designing tasks of varying levels of complexity and teaching them in a sequential manner plays an important role.

Limiting propedeutic education only to the formation of computational thinking is not sufficient. Such an approach covers only one direction of “computing education,” namely the Computer Science (CS) component. However, in today’s digital society, learners are expected not only to master basic programming concepts but also to acquire practical skills in using information technologies and to develop competencies for safe and effective functioning in digital environments. Therefore, an educational model based solely on a propedeutic programming approach is no longer adequate in the current context. It may restrict students’ full adaptation to and active participation in the digital world. In particular, at the stage of grades 5–7, the application of an integrated approach based on electronic educational resources, interactive platforms, and mobile applications enables the formation of broader digital competencies among students.

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