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THE IMPACT OF MODERN DIGITAL EDUCATIONAL TOOLS ON EDUCATIONAL EFFICIENCY

Khudoyberdiev Shodiyor Mamatillayevich
Kattakurgan State Pedagogical Institute, teacher
Samarkand, Uzbekistan
shodiyorkhudoyberdiyev743@gmail.com
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Abstract. In recent years, the process of digitization of the education system in the Republic of Uzbekistan has been accelerating, and modern digital teaching aids are being widely introduced into educational practice. The use of electronic textbooks, distance learning platforms, online assessment systems, and interactive digital resources is becoming an important component of the educational process. However, it is observed that the real impact of digital technologies on educational efficiency is not always stable and does not always produce the expected results. This study aims to empirically determine the impact of modern digital teaching aids on educational efficiency in the conditions of the Uzbek education system. The study substantiated that the impact of digital aids is manifested not directly, but through pedagogical integration mechanisms. The results of the study, conducted on the basis of a quasi-experimental design, showed that pedagogically based digital teaching aids significantly increase educational efficiency. The results of the study serve to develop scientific and methodological recommendations for the development of digital education.

Keywords: digital learning tools, educational effectiveness, digital pedagogy, didactic design.

Introduction. In recent years, the introduction of digital technologies in the process of modernization of the education system in Uzbekistan has become a strategic direction. The issues of expanding digital infrastructure, using information systems to manage the educational process, creating digital educational platforms and integrating them into the educational process are supported at the level of state policy. In particular, the tasks of increasing the efficiency of education in the context of digital transformation are interpreted in an inextricable link with the "Digital Uzbekistan-2030" strategy and regulatory legal documents on the development of education until 2030. However, as digital tools (LMS, adaptive platforms, electronic resources, test analytics, simulation, AR/VR elements, artificial intelligence-based auxiliary systems) enter education, it is becoming clear that **the presence of technology** alone does not automatically guarantee an increase in the quality of education. Practice shows that educational effectiveness is formed in conjunction with factors such as the didactic design of a digital tool, teacher competence, content quality, transparency of assessment, student motivation, and availability of Internet and device resources. In scientific and technical approaches to the creation and implementation of national digital platforms in Uzbekistan, such areas as pedagogical design, measurement of motivation and mastery, and personalization are emphasized. Therefore, this article analyzes the impact of modern digital teaching tools on educational effectiveness based

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on scientific sources, and the problem formulation and solution mechanisms in the educational environment of Uzbekistan are based on a conceptual model.

In particular, Mayer R.E. — Multimedia Instructional Design (Cognitive Approach) Mayer argues that the combination of "word + image" in multimedia instruction can increase learning outcomes, but this only happens when design principles that control cognitive load (coherence, signaling, segmentation, redundancy reduction, etc.) are correctly applied. He also provides systematic principles based on the results of numerous experimental studies on multimedia design. This shows that in Uzbekistan, when creating electronic textbooks, videos, and interactive content, the focus should be not on "beautiful" appearance, but on the learner's cognitive mechanism [1]. Garrison, Anderson, Archer — Community of Inquiry (CoI) model The CoI model explains the effectiveness of online/blended learning through three components: cognitive presence, social presence, and teacher presence. According to this approach, the digital platform is not just a content delivery channel; It should build a "learning community" through discussion, feedback, collaboration, and reflection. In expanding distance and blended learning in Uzbekistan, it is precisely the "presence" components that can be used as an evaluation indicator [2]. Means, B., Toyama, Y., Murphy, R., Bakia, M. — Meta-analysis of Online Learning (U.S. Department of Education) The meta-analysis selected studies from 1996–2008, compared "online vs. traditional" conditions, and extracted effect sizes that could be used to calculate learning outcomes. This approach suggests that the effectiveness of digital tools should be assessed through measurable learning outcomes, rather than "subjective opinions" [3]. Tamim et al. — A second-order meta-analysis of 40 years of research Tamim et al. summarize the impact of technology on learning through a "second-order meta-analysis" and show a moderate positive effect size (moderate effect size). Importantly, the outcome is more sensitive to the model of its application and contextual factors than to the "technology" itself. This means that in Uzbekistan, too, the question of "what didactic scenario?" is more important than "which platform?" [4]. Mishra and Koehler — TPACK (technological-pedagogical-content knowledge) The TPACK model shows that a teacher's effective use of digital tools is formed at the intersection of three areas of knowledge: content, pedagogy, technology. Thus, for educational effectiveness, it is not enough to simply "teach a teacher to click on the platform"; he or she must be able to combine technology with the content and methodology of the subject [5]. Fayziyeva M.R. — Creation and implementation of a national digital educational platform (DSc abstract) The study describes the scientific and pedagogical foundations of creating an educational platform in the context of digital transformation in Uzbekistan: platform stages, pedagogical design requirements, motivation and mastery indicators, implementation methodology. The abstract clearly shows the connection to national strategies and education policies. This work scientifically substantiates the fact that in Uzbekistan it is not a "platform = IT product", but a pedagogical system [6]. Kayumova M.Sh. — Adaptation of education using artificial intelligence and digital technologies (empirical research) The article demonstrates the effectiveness of the adaptive/AI approach on the basis of experimental testing: on the example of TSUU with 200 students, experimental and control groups are compared, and the group that received personalized education based on AI has higher test results and increased motivation (percentage indicators are given). This reinforces with practical evidence that AI tools can have a measurable impact on educational effectiveness in Uzbekistan [7]. Karimova N.B. discusses the pedagogical conditions, infrastructure and methodological support for the introduction of digital

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educational tools; the main emphasis is on the fact that digital tools should serve to individualize education and automate control, but this process should be accompanied by updating the methodology [8]. Sodiqova N.N. The research studies analyze the impact of digital tools on the effectiveness of the lesson, feedback, support for independent learning, and simplification of the assessment process. The main conclusion: effectiveness depends on the teaching strategy and student activity in conjunction with the digital tool [9]. Zaripov N.N. — Digital technologies as a necessary component of the educational system The author justifies digital technologies with such advantages as visualizing the lesson, modeling complex processes, saving time, simplifying assessment, and establishing flexible education. This approach systematizes the functions of "digital tools" in education and explains the mechanisms for increasing efficiency at a conceptual level [10].

Problem statement. In recent years, the process of introducing modern digital learning tools in the education system of Uzbekistan has become significantly more active. The use of electronic textbooks, distance learning platforms, online testing systems, digital educational resources and interactive learning materials in educational institutions is increasingly widespread. However, it can be observed that the impact of these tools on educational effectiveness does not always give the expected result in practice. The conducted analyzes and observations in the educational process show that in many cases, digital learning tools are introduced into the educational process not with a deep pedagogical basis, but as a technical opportunity. As a result, digital tools do not sufficiently serve the deep assimilation of knowledge by students, the development of independent and critical thinking skills, and the increase in learning motivation. The problem is also further complicated by the fact that teachers have varying levels of training in digital pedagogy, the varying didactic quality of digital learning materials, and the lack of sufficiently developed mechanisms for assessing the effectiveness of using digital tools in the educational process. Often, the effectiveness of using digital learning tools is based on subjective assessments and not based on clearly measurable indicators.

Approaches and proposals for solving the problem. To eliminate the problems described above and increase the educational effectiveness of modern digital teaching tools, the author puts forward the following comprehensive approaches and practical proposals. Prioritizing the pedagogical-didactic approach - When introducing digital teaching tools, pedagogical goals should take precedence over technological capabilities. Each digital teaching tool should perform a specific didactic task, be developed inextricably linked to educational goals, learning outcomes, and assessment criteria. To this end:

• Be based on the principles of cognitive load and multimedia teaching when developing digital teaching materials;

• It is recommended to design a “digital lesson scenario” integrated with the content and methodology of the subject.

Developing digital pedagogical competence of teachers - Educational effectiveness largely depends on the teacher's ability to use digital tools pedagogically correctly. Therefore:

• introducing regular in-service training courses for teachers in digital pedagogy, didactic design, and educational analytics;

• organizing trainings (based on TPACK) aimed at integrating teachers' technological, pedagogical, and subject content knowledge. Introduction of person-centered and adaptive

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learning – One of the main advantages of digital learning tools is the ability to form individual learning trajectories. Therefore:

• introduction of adaptive tasks that take into account the level of knowledge and pace of learning of students;

• systematic use of digital resources that support independent learning activities is proposed.

Improvement of the assessment and feedback system

To increase the effectiveness of the use of digital learning tools, the assessment process should be based on transparent, accurate and measurable indicators. In this regard:

• widespread introduction of automated tests, diagnostic assessment and formative assessment mechanisms;

• the use of digital assessment tools that provide quick and individual feedback is recommended.

Creation of a system for monitoring and analyzing educational effectiveness – To determine the real impact of digital learning tools, systematic monitoring of the educational process is necessary. To this end:

• introduction of learning analytics tools that reflect student activity, level of mastery, and independent learning indicators;

• it is proposed to develop a system of clear indicators and criteria for assessing the effectiveness of digital education.

Integrated introduction of digital learning tools - Digital learning tools should be introduced into the educational process not as a separate element, but as a component of a single pedagogical system. Therefore:

• harmonization of digital tools with subject content, teaching methods, and assessment system;

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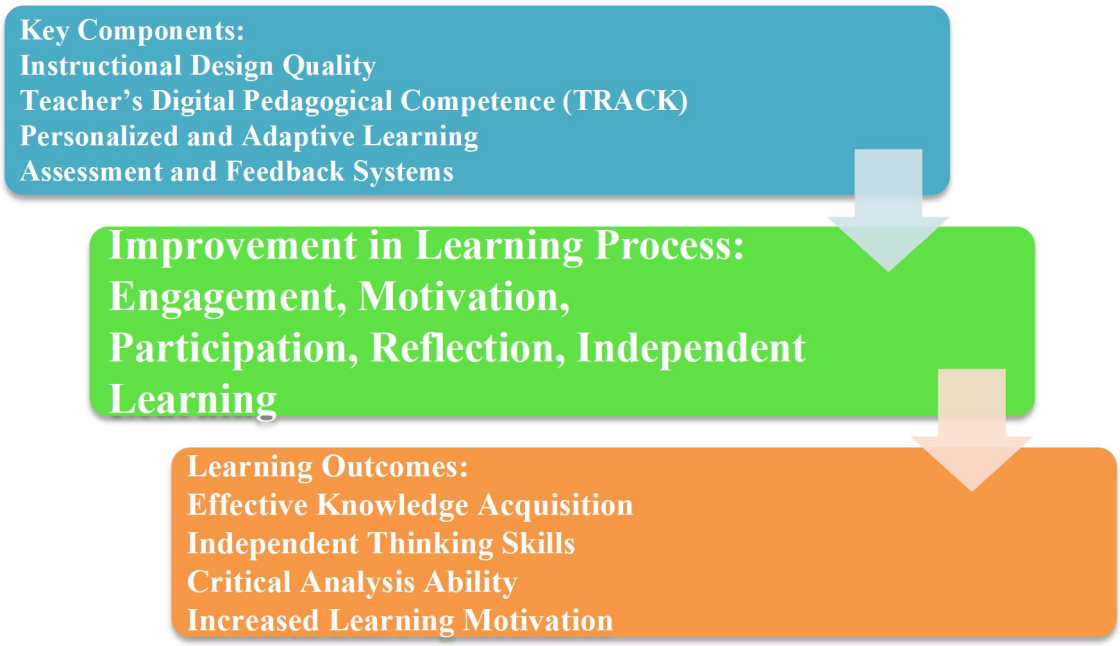
(e-learning courses, LMS, online assessments, interactive and adaptive resources)



This conceptual model argues that the impact of modern digital learning tools on educational effectiveness is not direct, but rather occurs through a number of mediating

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pedagogical factors. The model is appropriate for the educational environment of Uzbekistan and considers digital technologies as a pedagogical system.

Conclusion. This study was aimed at scientifically analyzing the impact of modern digital teaching aids on educational effectiveness in the educational environment of Uzbekistan. The results of the study showed that the impact of digital teaching aids on educational effectiveness is not direct, but depends on how correctly they are pedagogically designed and used in an integrated manner in the educational process.

It was found that the pedagogical and didactic approaches proposed to solve the problem, in particular, the development of digital educational materials based on cognitive and didactic principles, the development of digital pedagogical competence of teachers, the introduction of person-centered and adaptive education, as well as the improvement of the assessment and feedback system, are important factors in increasing the effectiveness of digital tools.

The conceptual model developed during the study scientifically substantiated that modern digital teaching aids affect educational effectiveness only through pedagogical integration mechanisms. According to the model, the quality of didactic design, the digital pedagogical competence of the teacher (TPACK), person-centered learning, assessment and monitoring systems were identified as mediating factors that improve the quality of the educational process. It is through these factors that students' activity, motivation and independent learning skills are developed, and a sustainable increase in educational effectiveness is ensured.

It was also confirmed on the basis of empirical research methodology that the systematic use of digital teaching tools can serve to increase the level of students' knowledge acquisition, form independent and critical thinking skills, and strengthen learning motivation. This indicates the need to consider digital technologies in the educational process not only as technical innovations, but also as pedagogical innovations. Increasing the effectiveness of modern digital teaching tools in the education system of Uzbekistan is ensured by combining digital technologies with pedagogical goals, introducing them on the basis of systematic monitoring and evaluation, and continuously developing teachers' digital pedagogical competence. The results of this study are important in developing scientific and methodological recommendations for the development of digital education and improving educational practice.

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