



IMPROVING MECHANISMS FOR DEVELOPING 4C (4K) COMPETENCIES IN A DIGITAL EDUCATIONAL ENVIRONMENT

Ismoilova Gulnoza Olimboy qizi

Urgench State Pedagogical Institute

Lecturer at the Department of Pedagogy and Psychology

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Abstract: This article provides a scientific and pedagogical analysis of improving the systemic and organizational mechanisms for developing 4C (4K) competencies — critical thinking, creativity, communication, and collaboration — among learners within a digital educational environment. Unlike individual digital tools and methods, the current state of systemic mechanisms that ensure sustainable and large-scale development of these competencies — curriculum integration mechanisms, assessment and monitoring mechanisms, teacher preparation mechanisms, and infrastructure provision mechanisms — is examined, and their limitations and directions for improvement are substantiated from a scientific and practical perspective.

Keywords: 4C competencies, digital educational environment, systemic mechanism, curriculum integration, assessment mechanism, teacher preparation, monitoring, 21st-century skills, digital infrastructure, education management.

Introduction. In recent years, various digital tools and methods (online fact-checking exercises, digital storytelling, cloud collaboration platforms, etc.) aimed at developing 4K competencies - critical thinking, creativity, communication, and cooperation - have been actively used in the digital educational environment[1]. However, practice shows that the successful use of a specific digital tool or method does not guarantee the sustainable and systematic development of these competencies in all students and in all educational institutions. To ensure such stability and publicity, in addition to individual methods, broader, systemic and organizational mechanisms supporting them will be required.

The concept of a mechanism here refers not to a single method or tool, but to a holistic, interconnected systemic process consisting of integration into the curriculum, assessment and monitoring, teacher training, and the provision of the necessary infrastructure[2]. If one of these mechanisms is insufficiently formed, even the most advanced digital method may not be sufficient for the sustainable and equitable development of 4K competencies. For example, a teacher who wants to use advanced digital methods but does not have the opportunity to improve their qualifications, or an educational institution working in conditions where the necessary assessment criteria are absent, will not be able to fully benefit from such methods.

From this perspective, analyzing the status of existing systemic mechanisms serving the development of 4K competencies in the digital educational environment, identifying their limitations, and defining directions for the scientifically grounded improvement of these mechanisms determines the relevance of this article [3].

The level of study of the problem. The theoretical foundations of the concept of 4K (4C) competencies are detailed in the relevant documents of the Partnership for 21st Century Learning (P21) organization in the USA, as well as in the research of B. Trilling and C. Fadel. Although these works substantiate the components of competencies and the principles of their

integration into educational programs, they focus more on methodological and didactic aspects and less on the systemic and institutional aspects of the mechanisms.

The conceptual document of the Organization for Economic Cooperation and Development (OECD) "Learning Compass 2030"[3] pays special attention to systemic, multi-level mechanisms for the development of competencies (curriculum, assessment, teacher training), which serves as an important methodological basis for this study. In domestic pedagogical science, the works of scholars such as F. Yuldashev[4] and Z. Tolipov[5] highlight the general pedagogical mechanisms for the systematic implementation of the competency-based approach into the education system.

Nevertheless, an analysis of the conducted scientific research shows that specifically the systemic mechanisms (integration, assessment, teacher training, infrastructure, monitoring) serving the development of 4K competencies in a digital educational environment are not yet sufficiently studied in domestic pedagogical science to analyze them as a single system, identify the existing shortcomings in each of them, and propose directions for comprehensive improvement. Filling this gap determines the scientific and practical significance of this research.

Discussion. When analyzing the concept of "mechanism" from a pedagogical and organizational perspective, it is necessary to understand it as a systemic, institutional, and repetitive process, distinguishing it from a separate method or tool. While a method is a specific method used to solve a specific pedagogical task, a mechanism is an organizational-institutional system that ensures the regular, stable, and mass application of this method. From the perspective of developing 4K competencies, four main mechanisms can be identified: the integration mechanism into the curriculum, the assessment and monitoring mechanism, the teacher training mechanism, and the infrastructure and resource provision mechanism.

Analysis of the mechanism for integrating 4K competencies into the curriculum shows that today, elements related to 4K competencies are often found fragmentedly in certain disciplines based on the personal initiative of individual educators. In this case, the development of competencies is not systematic, but occasional in nature. To improve this mechanism, it is necessary to develop an integration map (matrix) in each subject program, indicating which topics and tasks specifically target the development of 4K competencies, while preventing interdisciplinary duplication and gaps.

Analysis of the assessment and monitoring mechanism shows that traditional forms of testing and written control, which primarily verify factual knowledge, still predominate in the education system; standardized criteria (rubrics) designed to measure 4K competencies have not been sufficiently developed or are used haphazardly. The way to improve this mechanism is to develop clear, step-by-step descriptive rubrics for each K component and implement a digital portfolio system that allows for tracking the dynamics of a student's development over time. Such a formative assessment system allows for the documentation of not only the final result but also the development process itself.

The teacher training mechanism is the most important, but often the weakest link in the development of 4K competencies[4]. Observations show that the level and methodology of educators' use of digital tools differ significantly between them, and this difference remains largely dependent on the personal initiative and interest of the educator, as systemic professional development programs covering all educators have not been sufficiently

organized. To improve this mechanism, it is advisable to establish a system of gradual training for educators through short-term, practice-oriented micro-educational (microlearning) modules instead of long-term general courses, without disconnecting them from their work process.

The infrastructure and resource provision mechanism is also one of the important conditions for the development of 4K competencies. The uneven distribution of digital tools and high-quality internet connectivity between educational institutions, particularly in urban and rural areas, hinders ensuring equal digital opportunities for all students. To overcome this problem, it is necessary to establish the minimum required digital infrastructure standard and develop a plan for its phased, priority provision to all educational institutions. Finally, to continuously monitor and improve the effectiveness of all these mechanisms, it is necessary to implement a centralized, data-driven monitoring and feedback system—a system that analyzes data collected through a digital dashboard and allows for the continuous improvement of programs and methodologies.

Results. The current state of the five main systemic mechanisms serving the development of 4K competencies in the digital educational environment, the identified shortcomings, ways of improvement, and expected results are analyzed and summarized in the table below:

1-table

Nº	Mechanism type	Current state	Defect detected	Path of improvement	Expected result
1	Mechanism for integration into the curriculum	Elements related to 4K competencies are found sporadically and randomly in some disciplines.	The absence of an interdisciplinary, targeted, and consistent integration scheme, and the separation of competencies from the content of the subject and their consideration as "additional."	Development of an integration map indicating which topics and through which digital tasks 4K competencies are developed in each subject program	The consistent and non-duplicating development of 4K competencies across all subjects
2	Evaluation and monitoring mechanism	Assessment is mainly carried out in the form of traditional, factual knowledge testing, and	Lack or haphazard use of formal, standardized criteria (rubrics) designed to measure 4K competencies	Implementation of a formative assessment system based on clear, step-by-step descriptive rubrics and a digital portfolio for each K component	Creating the opportunity to observe and objectively evaluate student development dynamics over time

Nº	Mechanism type	Current state	Defect detected	Path of improvement	Expected result
		written control.			
3	Mechanism of teacher training	The level of use of digital tools by educators varies, often depending on personal initiative.	Systematic methodology for developing 4K competencies through digital tools	Gradual training of educators through short-term, practice-oriented micro-educational modules	Stable and uniform increase in the level of digital and methodological training of educators
4	Monitoring and feedback mechanism	There is practically no centralized, periodic monitoring system for the development of 4K competencies.	Lack of a mechanism to analyze the collected assessment data and use it to improve the program and methodology	Implementation of a monitoring system that collects, analyzes data through a digital control panel and regularly transmits the results to software developers	Continuous, data-driven improvement of the mechanism

The analysis presented in Table 1 shows that a common trend is observed in all five mechanisms - the existing practice is more random, depends on the initiative of an individual or institution, and a systemic, inclusive institutional solution has not yet been sufficiently formed. This leads to a significant difference in the quality of development of 4K competencies from educational institution to educational institution, and even from teacher to teacher within the same institution.

Also, the results of the analysis showed that these five mechanisms are closely interconnected, and improving only one of them will not yield sufficient results - for example, improving the teacher training mechanism will not yield the expected effect if there is no appropriate infrastructure or evaluation criteria. Therefore, it is necessary to improve these mechanisms in parallel, comprehensively, as a single, complementary system. In addition, the importance of the monitoring and feedback mechanism should be emphasized, as it is through this mechanism that the effectiveness of the other four mechanisms can be continuously monitored and necessary adjustments can be made.

Conclusion

Improving the mechanisms for developing 4K competencies in the digital educational environment requires not only the introduction of new digital tools and methods but also the creation of a systemic and institutional framework that ensures their sustainable, mass, and high-quality application. The results of the study showed that each of the mechanisms for integration into the curriculum, assessment and monitoring, teacher training, infrastructure

support, and monitoring and feedback have certain shortcomings that require comprehensive and interconnected improvement.

Improving these five mechanisms as a complementary integrated system will ensure the sustainable, equitable, and high-quality development of 4K competencies among all students and students across all educational institutions. Such a systematic approach guarantees the long-term sustainability of modern educational reforms. In future research, it is advisable to conduct a more in-depth study of the results of the practical implementation of the proposed mechanisms, as well as their specific characteristics for various stages of education (preschool, general secondary, higher education).

References:

1. Partnership for 21st Century Learning (P21). Framework for 21st Century Learning. – Washington, D.C.: P21, 2019. – 32 p.
2. Trilling B., Fadel C. 21st Century Skills: Learning for Life in Our Times. – San Francisco: Jossey-Bass, 2009. – 256 p.
3. OECD. OECD Learning Compass 2030: A Series of Concept Notes. – Paris: OECD Publishing, 2019. – 30 p.
4. Yo'ldoshev J.G'. Ta'lim texnologiyalari va kompetensiyaviy yondashuv. – Toshkent: O'qituvchi, 2011. – 216 b.
5. Tolipov Z.T. Kompetensiyaviy yondashuv asosida ta'lim jarayonini takomillashtirish. – Toshkent: Fan, 2013. – 184 b.
6. Griffin P., Care E. Assessment and Teaching of 21st Century Skills: Methods and Approach. – Dordrecht: Springer, 2015. – 344 p.
7. Ishmuhamedov N., Abduqodirov A. Raqamli ta'lim texnologiyalari. – Toshkent: Iste'dod, 2019. – 176 b.
8. Ismoilova, G. (2025). Development Of Social Competence Through The Use Of Educational Technologies Based On Domestic Tourism. B International Conference On Arts, Society & Humanities (T. 1, Выпуск 1, сс. 48–52). Zenodo. <https://doi.org/10.5281/zenodo.17426910>
9. Ismoilova, G.. (2025). Bo'lajak o'qituvchilarning ijtimoiy kompetentligini ichki turizm vositasida rivojlantirish mexanizmlari. Педагогика и психология в современном мире: теоретические и практические исследования, 4(18), 56–60. извлечено от <https://in-academy.uz/index.php/zdpp/article/view/62996>