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# METHODOLOGICAL MODEL AND EFFECTIVENESS OF ORGANIZING COMPUTER SCIENCE LESSONS BASED ON THE STEAM APPROACH

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**Abstract**
This article develops a methodological model for organizing informatics lessons based on the STEAM (Science, Technology, Engineering, Art, Mathematics) approach and provides a scientific justification of its effectiveness. It highlights the mechanisms for developing students' digital literacy, algorithmic thinking, and creative thinking competencies through interdisciplinary integration, project-based and problem-based learning, as well as elements of design thinking.
The research is based on the scientific perspectives proposed by Georgette Yakman and Rodger W. Bybee, and the effectiveness of STEAM-based lessons in increasing student engagement and the level of practical application of knowledge is demonstrated through pedagogical experimental results. The proposed methodological model serves as an important foundation for improving informatics education and fostering modern competencies in students.

**Keywords**: STEAM, informatics education, methodological model, integration, competence, innovative approach.

## Introduction

In the context of a modern information-based society, the demands placed on the education system are fundamentally changing. In particular, teaching computer science requires not only theoretical knowledge but also the development of practical skills and creative thinking. From this perspective, the STEAM approach is recognized as an innovative pedagogical model that ensures the comprehensive development of students [2].
The concept of STEAM education was initially developed by the American researcher G. Yakman, who defines interdisciplinary integration as a fundamental principle of the educational process [1]. According to Yakman, the STEAM approach fosters

students' competence in solving real-life problems. R. Bybee, in turn, substantiates the role of STEM (later STEAM) education in modern society, evaluating it as an important tool for developing 21st-century skills [2]. Research conducted by Honey and others has scientifically proven that an integrated educational approach contributes to students' deeper understanding of knowledge [3]. Furthermore, S. Beers emphasizes that the STEAM approach develops competencies such as critical thinking, collaboration, and creativity among students [4]. Uzbek scholars O. Tolipov and M. Usmonboyeva also note that the effectiveness of education can be enhanced through the implementation of modern pedagogical technologies [5].

In this study, the following methods were used:

Theoretical analysis (review of scientific literature);

Pedagogical observation;

Experimental work and trials;

Comparative analysis.

The proposed methodological model consists of the following components:

Goal component – developing students' competencies;

Content component – interdisciplinary integrated learning materials;

Technological component – interactive methods and STEAM technologies;

Result component – the level of students' knowledge and skills.

The results of the experiment showed that computer science lessons organized based on the STEAM approach:

increased students' interest in the lesson;

developed independent thinking skills;

enhanced the ability to find solutions in problem situations.

These results are consistent with foreign studies, confirming that the integrated educational model contributes to a deeper understanding of knowledge among students [3].

**Conclusion**

The STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach has emerged as a pivotal methodological foundation for the modernization and transformation of computer science education within the context of contemporary educational paradigms. Unlike traditional, knowledge-centered pedagogical approaches, which predominantly focus on the memorization and theoretical comprehension of subject matter, the STEAM approach is inherently student-centered and competency-oriented. It emphasizes the holistic development of learners by simultaneously fostering theoretical understanding, practical skills, and

higher-order cognitive abilities. In particular, through the systematic integration of interdisciplinary knowledge and STEAM principles, students acquire critical 21st-century competencies, including digital literacy, algorithmic and computational thinking, effective problem-solving strategies, creativity, and critical reflection skills. These competencies are essential for learners to navigate the increasingly complex and technologically driven environments of modern society.

Empirical evidence from international studies indicates that educational frameworks grounded in interdisciplinary integration significantly enhance students' engagement, deepen conceptual understanding, and strengthen their capacity to apply learned knowledge to real-world contexts. Moreover, when STEAM pedagogy is combined with project-based and problem-based learning methodologies, students' independent thinking, collaborative skills, and innovation potential are further amplified. The inclusion of design thinking strategies within STEAM-based learning environments cultivates a systematic, analytical, and creative approach to complex problem-solving, thereby enabling learners to develop solutions that are both innovative and practically feasible.

The methodological model developed in this study provides a structured framework for effectively organizing computer science lessons in a manner that is integrative, competency-driven, and aligned with modern pedagogical standards. Implementation of this model facilitates heightened student engagement, encourages active participation in the learning process, and enhances the practical application of acquired knowledge and skills. By incorporating interactive methods, interdisciplinary content, and technology-enhanced learning strategies, the model ensures that students' learning experiences are meaningful, contextualized, and aligned with the evolving demands of the digital age.

In conclusion, the integration of the STEAM approach into computer science education represents a pedagogically sound and strategically significant advancement. It not only strengthens students' cognitive, technical, and creative competencies but also prepares them to thrive in a digital society characterized by rapid technological change and complex problem-solving requirements. The proposed methodological model serves as a robust and reliable framework for improving educational quality, fostering modern competencies, and cultivating an innovative and future-ready learning environment. Its adoption has the potential to transform traditional educational practices, bridging the gap between theoretical knowledge and practical application, and equipping learners with the tools necessary for lifelong learning, professional success, and active participation in a technologically sophisticated world.

**References**

1. Yakman, G. (2008). STEAM Education: An Overview of Creating a Model of Integrative Education.
2. Bybee, R.W. (2013). The Case for STEM Education: Challenges and Opportunities. NSTA Press.
3. Honey, M., Pearson, G., Schweingruber, H. (2014). STEM Integration in K-12 Education. National Academies Press.
4. Beers, S. (2011). 21st Century Skills: Preparing Students for Their Future.
5. Tolipov, O., Usmonboyeva, M. (2010). Pedagogical Technologies. Tashkent.
6. Republic of Uzbekistan. Law on Education.