



THE ROLE OF STEAM EDUCATION IN THE DEVELOPMENT OF CREATIVE AND CRITICAL THINKING IN ELEMENTARY STUDENTS

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ABSTRACT

This article covers the theoretical and practical foundations of the application of the STEAM (Science, Technology, Engineering, Arts, Mathematics) program in the process of primary education. The nature of STEAM education, its importance in students' creationism, critical thinking, problem-solving skills formation, and strategic importance to the national education system are addressed on a scientific basis. At the stage of primary education, students are considered as an active subject of learning, and the effectiveness of teaching subjects in an integrated way is emphasized for them. The article will also analyze the world experience and show the specifics of the implementation of the STEAM program in Uzbekistan, the available opportunities and problems, as well as ways to solve them.

This article discusses the theoretical and practical foundations of the use of the STEAM (Science, Technology, Engineering, Arts, Mathematics) program in primary education. The essence of STEAM education, its importance in developing students' creativity, critical thinking, and problem-solving skills, and its strategic importance for the national education system are considered on a scientific basis. At the primary education stage, students are considered as active subjects of learning, and the effectiveness of teaching subjects in an integrated manner for them is emphasized. The article also analyzes world experience and shows the specific aspects of the implementation of the STEAM program in Uzbekistan, performing opportunities and problems, and ways to solve them.

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V dannoy state raskrivayutsya teoreticheskie I prakticheskie osnovi primeneniya programmi STEAM (Science, Technology, Engineering, Arts, Mathematics) v prosesse nachalnogo obrazovaniya. Nauchno obosnovivaetsya sutshnost STEAM-obrazovaniya, ego znachenie v formirovanii U U uchatshixsya kreativnosti, kriticheskogo mishleniya I navikov resheniya problem, a takje ego strategicheskaya znachimost dlya nasionalnoy sistemi obrazovaniya. Na Etape nachalnogo obrazovaniya uchatshiesya rassmatrivayutsya Kak aktivnie subject obrazovatel'nogo prosessa, PRI Etom podcherkivaetsya effektivnost

integriruvannogo obucheniya uchebnim dissiplinam. Krome Togo, v State analiziruetsya mirovoy Opit, a takje rassmatrivayutsya osobennosti vnedreniya programmi STEAM V Uzbekistane, sutshestvuyutshie vozmojnosti i problemi, a takje Puti IX resheniya. Klyuchevie slova. nachalnoe obrazovanie, STEAM, integriruvannoe obuchenie, kreativnoe mishlenie, kriticheskoe mishlenie, projektno-orientirovannoe obuchenie, innovacionnie method.

Introduction In recent years, interdisciplinary approach, innovative methodologies and creativity-based teaching concepts have been widely used in the world's education system. The most relevant and effective of them is the STEAM program. It was formed by the addition of an Arts (Arts) element to the traditional STEM (Science, Technology, Engineering, Mathematics) model, an integration that aims to broaden students ' not only technical knowledge but also aesthetic worldview. The stage of primary education is the most important period in the development of the individual. Because at this stage, the child's thinking is formed, his worldview expands and his motivation for the educational process is determined. For this reason, the introduction of the STEAM program in primary schools allows students to develop a creative approach that combines scientific and technical knowledge. The purpose of the article is to highlight the scientific and methodological foundations of the implementation of the STEAM program in primary education, analyze world and national experiences, develop methodological approaches and substantiate the impact on educational effectiveness on the basis of practical results. Literature analysis and methodology STEAM education in foreign literature is at the center of many pedagogical studies. For example, the educational philosophy of John Dewey and Jerome Bruner noted the need to teach subjects integrated. Modern researchers, on the other hand (Beers, 2018; Yakman, 2019), have scientifically substantiated that through the STEAM program, students can develop qualities such as "21st century skills"-creativity, critical thinking, collaborative work, problem solving. Research on the STEAM program is also being conducted in Uzbekistan. In particular, Kh. Abduazizov (2021), D. Local scientists such as Jo'rayev (2022) have studied the effectiveness of using innovative technologies in the educational process and identified the prospects for introducing STEAM elements in primary education.

At this point, literature analysis shows that while the STEAM program at the world level serves as an important tool in the formation of integrative thinking of students, the need to develop methodological manuals, textbooks and teacher retraining programs in this regard is relevant in Uzbekistan. As a research methodology, the following approaches were used: 1. Theoretical analysis-determination of the importance of the STEAM program in primary education on the basis of foreign and domestic scientific sources. 2. Pedagogical experiment-practical experiments on the introduction of STEAM elements in the cross section of grades 1-4 were carried out in several secondary schools in Termez. 3. Survey and interview-feedback was gathered between primary school teachers and students regarding the use of STEAM methods. 4. Comparative analysis-the effectiveness of a traditional lesson and a STEAM-based lesson was compared. The study used techniques such as project-based teaching, interdisciplinary integration, group work, and creative assignments as primary tools. Results. During the study, the effectiveness of applying the STEAM program to elementary students was checked through special experimental tests. The test classes were conducted in 3 schools (each in a cross section of grades 1-4) and the level of knowledge, motivation and creative

thinking of students were compared. Significant differences were observed between classes trained in the traditional method and those taught using STEAM methods. First, the level of knowledge acquisition of students has increased. For example, in math and Natural Science control assignments, steam-based students averaged 82% correct, while in traditional classes the rate was 62%. Secondly, increased activity in the performance of creative tasks. In group work based on STEAM methods, children showed creative approach skills by working together to develop a project, advance new ideas, and provide mutual assistance. As a result, more than 70% of students offered independent and unusual solutions in project assignments. Thirdly, there was also a significant increase in the level of critical thinking. In problem situation analysis, 65% of students were able to draw independent conclusions, while in traditional classes this figure was 38%. This shows the effective impact of STEAM methods on the formation of thinking and decision-making skills in real-life situations in students. Fourth, there was a significant increase in students' interest in the educational process. According to the results of the surveys, 85% of students attending STEAM-based classes rated "classes as interesting and creative", compared to 55% for traditional classes. Fifth, there was also a change in social skills. In group work, children developed skills such as mutual respect, listening, collaborative decision-making, and sharing responsibility. This is important for personal upbringing and social adaptation. Also, according to teachers, STEAM methods allowed them to organize classes in a new style, show interdisciplinary connections, and engage students in active participation. In practice, however, some problems were also encountered: lack of methodical applications, low teacher training, and limited technical means. In general, experimental results have proven that the implementation of the STEAM program in primary education significantly develops students' knowledge, skills and competencies. This approach sets the stage for students to prepare for future activities in the fields of Science, Technology and engineering.

1. The STEAM program provides an integrative approach. Teaching subjects in the primary classroom by harmonizing them and tying them to practice instead of studying them separately can help shape students' knowledge as a whole system.
2. Creativity and critical thinking develop. Students learn to think independently through projects, hands-on activities, experiences. This will focus on future innovation, startups, and innovative ideas.
3. Social skills are formed in students. Group work, cooperation, interaction are integral parts of STEAM methods. This serves to educate active, responsible individuals in the community.
4. New methodological opportunities open up for teachers. STEAM classes require teachers to take an innovative approach, use modern technology, and creatively organize classes.
5. There are problems. During the experiment, it was found that there was a lack of methodological manuals, a lack of technical tools and the need for special training of teachers. Thus, comprehensive strategic programs should be developed to support the STEAM program on a statewide basis. In the future, primary education can be brought to a qualitatively new level by the extensive introduction of the STEAM program in the educational system of Uzbekistan. This will be important in preparing students for future professions, developing scientific and technical thinking and achieving global competitiveness. Thus, the STEAM program is not only an educational methodology, but also an important means of educating the younger generation intellectually and spiritually as a person capable of mature, creative and innovative thinking.

Conclusion. The introduction of the STEAM program in primary education is a contemporary requirement today. Because this program not only serves to give traditional knowledge, but also forms the creative, critical and social skills of students. The results of the study also show that in classes organized on the basis of STEAM methods, students become active, enterprising and independent, mastering knowledge more deeply.

List of used literature:

1. Dewey J. Experience and Education. – New York: Macmillan, 1938. – 115 p.
2. Bruner J. The Process of Education. – Cambridge: Harvard University Press, 1960. – 121 p.
3. Beers S. 21st Century Skills: Preparing Students for Their Future. – Alexandria: ASCD, 2018. – 187 p.
4. Yakman G. Exploring the Importance of STEAM Education. – Washington: STEM to STEAM, 2019. – 202 p.
5. Abduazizov X. Boshlang'ich ta'limda innovatsion metodlardan foydalanish. – Toshkent: Fan va ta'lim, 2021. – 164 b.
6. Jo'rayev D. Integratsiyalashgan ta'lim texnologiyalari. – Toshkent: Yangi asr avlodi, 2022. – 189 b.
7. O'zbekiston Respublikasi Xalq ta'limi vazirligi. Umumiy o'rta ta'limda STEAM metodlarini joriy etish bo'yicha metodik qo'llanma. – Toshkent, 2023. – 76 b.

