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DEVELOPING STUDENTS' CREATIVE THINKING BASED ON STEM APPROACH IN TECHNOLOGY EDUCATION

Aliyeva Mukhlisakhon Ilhomjon kizi
1st-year Master's student in the field of Technological Education at Kokand State University
e-mail:azamovamuxlisa103@gmail.com

Annotation: This article analyzes the issues of developing students' creative thinking based on the STEM approach in the process of technological education. The reforms being carried out in the education system of Uzbekistan are highlighted, based on international experience and practical examples, the effectiveness of STEAM. Project-based education, business situations are shown through innovative approaches.
Keywords: STEAM, technological education, creative thinking, integration, project-based education, innovative approach.

In our country, great attention is being paid to raising the quality of school education to a new level, developing in students a healthy, strong, and effective motivation for learning, teaching them to independently plan their professional growth, and nurturing their ability to master modern professions in the conditions of the digital economy.
In order to effectively organize the educational process in educational institutions, the development of practical scientific research aimed at studying and scientifically substantiating new, including alternative approaches, and the expansion of the use of modern educational technologies that ensure the broadening of students' competence in mastering knowledge without changing the duration of study, have been identified as priorities.
Improving teaching methods and gradually implementing the principles of individualization in the educational process are also defined as key directions1
In today's rapidly developing era, one of the most important tasks facing education is the development of students' independent, creative, and critical thinking skills. Transitioning to an innovative educational process, studying new methods of teaching and ICT in light of the growing demand for modern professionals, and building a knowledge base necessary for mastering the fundamentals of STEAM pedagogy and acquiring new professional competencies have become essential goals.
Technological education stands out not only for providing theoretical knowledge but also for developing practical skills. From this point of view, the application of the STEAM approach in technological education is considered an effective tool for fostering creative thinking.

When looking at the history of STEAM educational technology, it is natural to consider who its founder is. The founder is Georgetta Yakman, who developed STEAM education technology at the Massachusetts Institute of Technology (MIT) in the United States—a famous institute whose motto is "Mind and Hand." In 2006, she developed STEAM education technology at a design-oriented school and in 2007 introduced it as an engineering and technology teacher. The approach is widely used in the education systems of Australia, the United Kingdom, Canada, China, Singapore, and the USA.
The goal of STEAM education is to develop learners' creative thinking and teach them how to effectively use natural sciences, technology, engineering, mathematics, and arts through project-based learning.
Characteristics of STEAM education include:

- STEAM education relies on binary lessons, projects, and educational research.
- STEAM education provides an environment where knowledge is memorized in context.

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The essence of the STEM approach, expanded to STEAM (Science, Technology, Engineering, Art, Mathematics), is an educational concept based on the integration of these disciplines. This approach aims to develop students' ability to apply theoretical knowledge in real-life situations, independently solve problems, and engage in creative activities that generate new ideas and products.

Today, interest and attention towards increasing the effectiveness of education through innovative pedagogy and the use of information technology in the educational process are steadily growing.

Practical lessons enriched with modern technologies are aimed at encouraging students to engage in independent research, creative thinking, and the development of their intellectual potential. In this process, the teacher facilitates the formation of the child's personality and the student community, creating opportunities for acquiring knowledge and upbringing, while simultaneously performing the roles of observer, manager, and guide. Additionally, technology classes involve students in practical activities. Lessons organized based on STEM provide students with the following opportunities:

Learning through integration: applying knowledge from mathematics, physics, and computer science to technological processes. The term "integration" originates from Latin, meaning "to restore, complete, or make whole." Integration itself is divided into two principles:

1. Studying the interconnectedness of parts and functions of a system or organism and the processes leading to such a state.
2. Studying the convergence and communication between sciences.

Problem-based thinking: Questions such as "How can we use environmentally friendly energy sources?" encourage students to engage in creative exploration.

Project-based learning: Students create projects based on their ideas, such as robotics, 3D modeling, and renewable energy devices.

Teamwork: Group activities promote the discussion and development of creative ideas collectively.

Mechanisms for developing creative thinking within the STEM approach include:

- **Project tasks** — enabling students to create new products based on their own ideas;
- **Experiments** — conducting practical experiments to reach scientifically grounded conclusions;
- **Innovative approaches** — learning to solve existing problems in novel ways;
- **Creative environment** — providing opportunities for free exchange of ideas and independent decision-making.

For example, during a project on "Using Solar Energy," students:

- Learn about solar energy and electric current circulation laws in physics,
- Perform calculations in mathematics,
- Apply programming skills in informatics,
- Coordinate device manufacturing processes in technology.

As a result, students not only create a practical project but also develop their creative thinking skills.

The core essence of STEM educational technology lies in the fact that each subject has its own unique technology for creation and development. Pedagogical technology in the educational process is a holistic sequence of actions designed to achieve a goal based on students' needs, carefully planned in advance and guaranteed to yield results.

To clarify the concept of "technology": this term entered science in 1872 in connection with technical progress and derives from two Greek words—"technos" (art, skill, craft) and "logos" (science)—meaning "the science of craft." However, this term always implies that modern technological processes are carried out in a sequence of operations using necessary tools and conditions. As science and technology evolve, technology is also continuously updated and

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modified. The development of technology in any field requires systematic technological processes, standardized procedures, and the use of equipment.

STEAM educational technologies are also widely applied in schools and preschool education. STEAM education is not only a method of teaching but also a way of thinking. In STEAM education, children acquire knowledge and learn how to use it. Therefore, when the growing generation faces real-life problems, such as environmental pollution and global climate change, they understand that these issues can be addressed by relying on various fields of knowledge.

Thus, it is evident that during the STEAM educational process, the activities performed by preschool children are explained through the development of creative thinking

The STEAM approach in technological education is a modern pedagogical method that develops students' creative thinking, problem-solving abilities, and independent decision-making skills. Through this system, students gain a deep understanding of the interconnectedness of subjects rather than seeing them as separate disciplines, and they have the opportunity to bring their ideas into practical form.

This makes education more meaningful, engaging, and closely connected with real life. Teachers, in turn, are able to foster creative thinking, innovative ideas, technological literacy, and a scientific worldview in their students through such an approach.

In the future, it is essential to further study the STEAM approach in technological education, fully integrate it into the national education system, and adapt it to local conditions. In this way, the STEAM approach will serve as a vital factor in improving the quality of Uzbek education and shaping the younger generation as creative, initiative-taking, and technologically-minded individuals.

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