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SCIENTIFIC AND PEDAGOGICAL FOUNDATIONS OF THE FORMATION OF ENVIRONMENTAL COMPETENCE IN STUDENTS BASED ON THE STEM EDUCATION CONCEPT

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Abstract. The article analyzes the scientific and pedagogical foundations of the formation of environmental competence in students based on the STEM education concept. Methodological approaches in the process of mastering environmental knowledge through the integration of science, technology, engineering and mathematics are highlighted. The advantages of introducing the STEM approach in the teacher training system and areas of application in practice are also shown.

Keywords: STEM education, environmental competence, integration of sciences, ecological culture, scientific thinking, pedagogical innovations.

In the 21st century, the harmonious development of scientific thinking, technology and ecological culture has become a priority in the education system.

Innovative educational models are needed to scientifically analyze the environmental problems arising in the relationship between nature and society and prepare a generation capable of solving them. One of such approaches is the STEM education concept (Science, Technology, Engineering, Mathematics), which involves connecting interdisciplinary knowledge with real-life practice. STEM education is an effective methodological basis for developing not only technical skills, but also ecological competence. Because knowledge in the field of natural sciences and engineering plays an important role in solving practical ecological problems. Ecological competence is a system of knowledge, skills, values and activities that determine a person's conscious relationship with nature.

It includes:

1. Cognitive (knowledge) component: knowledge about the structure of ecosystems, the impact of human activity;

2. Activity (practical) component: practical skills in solving environmental problems;

3. Axiological (value) component: responsible attitude to nature and confidence in the ideas of sustainable development.

In modern education, an integrative and project-based STEM approach is widely used as an effective method for forming this competency.

“STEAM - educational technology based on elements of science and technology, engineering and mathematics, mixed with art,” as defined by Georgette Yakman. Modern children live in an era of informatization and computerization. In a rapidly changing life, a person is required not only to possess knowledge, but, first of all, to thoroughly understand this knowledge, work on practical experience and projects, and the ability to think independently and creatively.

Any technological innovations are actively used not only by adults, but also by preschool children. Every child is a potential inventor. Thanks to the STEAM approach, students learn the logic of events, understand their interrelationships, systematically study the world and develop curiosity, an engineering style of thinking, the ability to get out of difficult situations, and teamwork skills, which differs from traditional education and has many advantages.

At the current stage of the development of school education, the main attention is paid to the comprehensive development of the personality of students, namely; curiosity, purposefulness, independence, responsibility, creativity, ensuring the successful socialization of children, increasing the competitiveness of the individual and, as a result, society and the state.

STEAM - educational technology develops creativity, perseverance, curiosity and, most importantly, problem-solving skills in children. “STEAM thinking” begins in childhood. Even before a child can walk, he or she can understand the connections, sequences and probabilities of processes. These characteristics require comprehensive encouragement from adults, timely provision of the necessary knowledge, skills, competencies and values. STEAM is an interdisciplinary integrated approach that studies STEM subjects through research, creative thinking and liberal arts problem-solving methods. Thus, although STEAM projects are based on science, they leave room for curiosity, imagination and artistic expression. As an approach, STEAM education aims to stimulate children's creativity and self-expression, as well as develop their statistical and numerical abilities, as well as problem-solving and critical thinking skills. STEAM educational technology aims to create interconnected and integrated curricula designed to support innovation throughout the learning process.

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Mechanisms for the formation of ecological competence in STEM education

1. Development of ecological thinking through the integration of disciplines. STEM educational models involve the joint study of biology, chemistry, physics, computer science and mathematics. This integration develops the ability of students to think scientifically and find creative solutions.

2. Establishing project and research activities. In the process of preparing an "ecological project", students formulate scientific hypotheses, conduct experiments and analyze the results. Through this process, the practical part of ecological competence is formed.

3. Using information technologies and the digital environment. Interactive simulations, virtual laboratories, digital maps and mobile applications allow modeling ecological processes. This increases the information and communication potential of STEM education and deepens ecological awareness.

The use of STEM educational technologies is of great importance for improving students' ecological competence. In this regard, it is necessary to pay attention to the following areas:

- mastering the methodology of teaching environmental topics based on interdisciplinary integration;
- learning to use modern laboratory and digital devices;
- developing scientific research skills in organizing environmental projects. In this process, the innovative activity and creative thinking of students determine the effectiveness of environmental education.

STEM education, as an educational model aimed at solving ecosystem problems scientifically and practically, plays an important role in the formation of environmental competence. Integration of sciences, research activities, digital

technologies and project work methods form a responsible attitude towards nature in young people. Introducing the STEM approach in biology education processes is a modern mechanism for the sustainable development of environmental competence. It is worth noting that the role of the education system in accelerating the comprehensive development of our country and ensuring its economic security is incomparable. Among the global trends taking place in the world's education system, such as the internationalization of education, international mobility of students, and rapid change in the educational program, the issue of ensuring the quality of education is gaining particular importance. Modern socio-economic conditions and high demands on the spiritual, moral, intellectual and professional potential of the devotees of the education system set educational institutions the task of educating students who can meet international requirements.

In order to fulfill these tasks, it is necessary to use innovative approaches in education. However, modern trends in the education system, especially modern experiences in reforming innovative technologies used in the education system of developed foreign countries, are being absorbed relatively slowly. At this point, it is worth noting that developing students' ecological culture based on innovative approaches is also of great importance today.

Today, in our country, which is moving along the path of independent development, special attention is paid to the modernization of the education system, achieving high quality and efficiency of education, and providing educational institutions with specialists with a high level of professional qualifications, skills, and pedagogical experience. The urgency of these issues can be seen in a number of reforms and legal and regulatory documents adopted by our government.

Ecological problems have become one of the most important priority areas of our country's policy, so in recent years, special attention has been paid to environmental protection, conservation of natural resources, a rational attitude to natural resources, increasing the ecological culture of the population, and environmental education and upbringing among young people.

The relevance of environmental education is determined by the need to protect the nature, ecosystems, and environment of our country from instability and degradation, to increase the ecological culture of the population, and to involve all segments of the population, especially young people, in these extremely serious and vital issues. In this regard, the further development of the environmental education system through the successful implementation of the Concept for the Development of Environmental Education in the Republic of Uzbekistan, which provides for specific goals, objectives, and directions, is of particular importance. This Concept stipulates the implementation of environmental education at all stages of continuous education.

In particular, a number of tasks have been set for the implementation of environmental education. In this regard, it is determined that knowledge, skills and qualifications that serve to form an ecological culture in students should be widely incorporated into the content of education, that environmental knowledge should be organized on the basis of differentiation at the level of classes, taking into account the age, physical capabilities and psychological characteristics of students, that the provision of knowledge should be based on pedagogical principles such as “from simple to complex”, “organicity and continuity”, that the combination of theoretical and practical knowledge should become a targeted system that ensures the gradual formation of ecological culture and education in students, that knowledge related to

the theoretical foundations of ecology and knowledge, skills and qualifications aimed at forming an ecological culture should be provided on a consistent basis in the content of existing academic subjects and expressed in a comprehensive way.

As a result, it is emphasized that a person who graduates from an educational institution should have at least a minimum level of knowledge about ecological concepts and rules of behavior (ecological culture). It is worth noting that it is necessary to develop the ecological worldview of students in higher educational institutions not only among future biology teachers, but also among students studying in all areas.

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