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THE INTERDISCIPLINARY APPROACH TO DEVELOPING ECO-STEAM EDUCATIONAL COMPETENCIES

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Abstract
This article discusses environmental education for students, Eco-STEAM education, interdisciplinary and practical orientation of students, physical education, biology, geography, computer science, technology, visual arts, engineering thinking, imagination, collaboration, creative abilities, and the formation of interdisciplinary ecological culture through extracurricular independent learning.

Keywords: Eco-STEAM, environment, environment, students, ecology, education, technology, didactics, literacy, practical, approach, Eco-education program, S-science, T-technology, E-engineering, A-art, M-mathematics, project, integration.

EKO-STEAM TA'LIM KOMPETENSIYALARNI RIVOJLANTIRISHDA FANLARARO YONDASHUV

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Аннотация:
Ushbu maqolada o'quvchilarga ekologik ta'lim berish, Eko-STEAM ta'limi fanlararo va o'quvchilarni amaliyotga yo'naltirish Fizika, Biologiya, Geografiya, Informatika, Texnologiya, Tasviriy san'at hamda muhandislik tafakkuri, tasavvur, hamkorlik, ijodiy qobiliyatlarni namoyon qilish, sinfdan tashqari mustaqil ta'lim orqali fanlararo ekologik madaniyatini shakllantirish haqida fikr yuritilgan.

Kalit so'zlar: Eko-STEAM, atrof, muhit, o'quvchilar, ekologiya, ta'lim, texnologiya, didaktika, savodxonlik, amaliy, yondashuv, Eko-ta'lim dasturi, S–fan, T–texnologiya, E–muhandislik, A–san'at, M–matematika, loyiha, integratsiya.

Introduction

In modern environmental education institutions around the world, special attention is paid to shaping a person's true relationship with nature, identifying the specific social and natural aspects of nature that ensure the most guaranteed development of the individual, and mastering the norms of behavior. Science and technology play a significant role in the development of society, and

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the importance of education increases. The problems facing the scientific and technological community are complex problems that cannot be solved only by science and technology, and must be solved using modern knowledge. Convergent (approaching) education is needed to solve this problem. Research is being conducted on convergent approaches that reveal important concepts or fundamental principles of interdisciplinary integrated knowledge.

Today, in developing countries around the world, environmental education, as an interdisciplinary subject, develops aesthetic attitudes towards nature and practical skills in students through three main concepts - systemic, ideological, and prospective.

In recent decades, many countries around the world have been paying significant attention to the problem of shaping the ecological culture of the younger generation. New scientific concepts are being developed and regulatory documents are being adopted in various educational institutions, reflecting the importance of environmental education, upbringing, and enlightenment, as well as the need to ensure the continuity of this process.

In New Uzbekistan, integrated learning in modern educational institutions, the orientation of the student's cognitive activity and independence in thinking and educational practice will help achieve new results as education. The concept of environmental protection, outlined in the concept of environmental protection, is defined in the concept of environmental education and upbringing of New Uzbekistan as "enhancing the environmental culture of the population, increasing the level of transparency of state bodies in the field of environmental protection, and strengthening the role of civil society." In this regard, Uzbekistan has developed and adopted a National Action Plan for the Implementation of the Paris Agreement on Climate Change, Strategies for the Transition to a "Green" Economy for 2019-2030, 2030 and a National Action Plan for the Formation of New Public Administration.

Caring for the environment is part of state policy, and a sense of environmental responsibility is emerging in industrial enterprises. Therefore, in the future, environmental professions will be in demand in all spheres of human life, from mining and agriculture to tourism and the fashion industry.

STEM was first emerged in the 1990s by the American National Organization. STEM is recommended to be a key part of U.S. public education (science, mathematics, engineering, and technology) and has begun to be used in education.

STEM education Australia, Canada, and Singapore, and subsequently France, the United Kingdom, Australia, Israel, China, Canada, and Turkey, implemented elements of a STEM approach to the development of the robotics high-tech industry in preschool and school education within the framework of STEM education.

In the Decree of the President of the Republic of Uzbekistan dated November 6, 2020 No. DP-6108 "On measures to develop the spheres of education, upbringing and science in the new period of development of Uzbekistan":

Resolution No. PP-4963 "On Measures to Support Scientific Research Activities and Introduce a System of Continuous Professional Development in the Field of Public Education."

Despite many advantages of STEAM education, it faces an educational challenge: it is difficult to implement and continue STEAM education in primary education, and there is no meaningful interdisciplinary integration, for several reasons:

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First, there is a high demand for qualified teachers for STEAM education. In primary education, many are science-based, only specialists in their field of study do not have a complete understanding of the knowledge necessary for STEAM education. It is necessary to improve students' experience in STEAM education, as well as the effectiveness of teaching.

Secondly, the implementation of STEAM education depends heavily on researchers. Most of the current STEAM education has been developed by researchers and also implements practical training and completes the STEAM education research project. After the project is completed, teachers will not be able to learn to implement STEAM education and continue.

Thirdly, STEAM education is generally available in the form of comprehensive practice-style education and post-school extension education and is not included in the school's official curriculum. This leads to inattention from teachers and lack of enthusiasm from students, which leads to difficulties in implementing STEAM education.

Analysis of school textbooks.

STEAM education emphasizes convergence and integration across science, technology, engineering, and mathematics (STEM). However, this can increase the workload among teachers and weaken the coherence of the curriculum.

- While studying STEAM education, most studies focus on students' attitudes towards choosing a STEM profession, ignoring the "art" component.

The study of teachers' perceptions and practices of STEAM education based on their background characteristics is very limited research.

- Based on a recent survey of teachers in STEAM model schools, it examines teachers' perceptions and practices of STEAM education.
- Teachers identify the difficulties they face in completing STEAM lessons.

STEAM has important political implications for successful implementation of education.

STEAM education, aimed at encouraging self-directed learning and inspiring enjoyment of learning, as well as bringing the foundations and motivation of learning closer by linking content to individuals' learning experiences, emphasizes three components: (a) creative design, (b) emotional touch, and (c) convergence and integration of content.

Here, creative design refers to a comprehensive process that demonstrates the student's creative abilities, effectiveness, and economic and aesthetic feelings in order to find the optimal solution to the problem.

STEAM education encompasses engineering concepts that imply technological design and the ability to solve creative problems for humanity's shared values.

As R. Descartes and G. Yakman, one of the first major educational philosophers who gave impetus to the birth and development of STEAM educational ideas, noted in their publications and related to their methodology of science, "all disciplines are so interconnected that it is easier to study them simultaneously than to separate them from others." Therefore, if anyone wants to seriously check the truth of something, he should not choose a separate science: after all, they are all connected and dependent on each other."

This study, based on a survey of teachers in Eco-STEAM model schools, examined teachers' perceptions and practices in science, technology, engineering, art, and mathematics (STEAM) education in elementary education. The results showed that most teachers, especially experienced teachers, have a positive opinion about the role of STEAM education. At the same

time, teachers noted various difficulties in implementing STEAM education, such as finding time to conduct STEAM lessons, increasing workload, and a lack of administrative and financial support. Our findings suggest that further development of STEAM education requires adequate government support, a restructuring of national curricula, and significant changes to the national assessment system.

It encourages students' creative approaches and involves a process of reflection. The combined nature of this process allows for the development of communication and attention among students through practical and collaborative activities.

Creative design also includes providing educational opportunities for students to experience the process of self-management until the final learning product is put into practice. In doing so, students experience interest, confidence, intellectual satisfaction, and a sense of success, as they find motivation, enthusiasm, flow, and personal meaning in learning. Emotional touch also involves the formation of a clear and authentic relationship between the reader and the subject, in which the reader perceives the topic as a personal goal. This emotional touch refers to elements that are often overlooked in education.

Factors influencing learning develop more than intellectual characteristics and are prone to change through learning. This means that the reason for academic performance is more influential than intellectual abilities. The increase in the number of studies shows that it is necessary to consider the impressive characteristics of students as an important factor in learning. Creativity and values are manifested through the process of collaboration and competitiveness in groups based on positive self-image. Therefore, cognitive and affective development should be organically linked in the learning process, based on the experience of emotional touch and positive cycles. Finally, the integration and convergence of content is aimed at connecting the content of education from a holistic perspective to real life.

Creative design is the process by which students, individually or as a group, acquire experience in solving problematic situations independently and creatively. Students experience a sense of success through the experience of solving self-managed problems, while also gaining an emotional experience that evokes courage and confidence in solving future problems. The foundation of STEAM education is to develop one's own thoughts and try to understand the trends of others through different learning situations. STEAM education goes beyond the concept of convergence, as it has been detailed in the content of the topic so far. Scheduling lessons to give students an innate reward through creative design, emotional touch, convergence and integration of content is an important factor in STEAM education.

Conclusion Using data from STEAM model school teachers, we investigated how teachers taught STEAM lessons and how they perceived STEAM education and its potential impact on students' learning. We will also explore the challenges faced by teachers in implementing STEAM education. Given insufficient scientific attention to the role of teachers as key policy enforcement agents, this study will generate and summarize new information that can broaden our knowledge of STEAM education.

The research findings suggest that collaborative learning can be an effective way to address these challenges. In this study, we propose teaching the Eco-STEAM educational model based on the concept of collaborative learning. To simplify the model's name, we introduced the term Eco-STEAM.

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To address global environmental challenges in interdisciplinary learning, we used the term "Eco" in STEAM education and called it Eco-STEAM. Eco-STEAM education is a pressing pedagogical problem, the subject of which awaits its solution. In our research, the technologies of an interdisciplinary approach to the development of Eco-Steam educational competencies of future teachers were revealed.

Co-education means that two or more teachers are jointly responsible for teaching students. Teachers develop an educational plan together, engage in constant communication and feedback during the learning process, and jointly assess student performance. In collaborative teaching of Eco-Eco-STEAM education, it is necessary to practically improve the principles of effective educational design.

The goal of Eco-STEAM education is to improve the interdisciplinary methodological support of students through physics, biology, geography, computer science, technology, visual arts, and engineering thinking, imagination, collaboration, creative abilities, and independent extracurricular learning through modern media in the development of Eco-STEAM educational competencies for future teachers.

The goal is to enhance professional competence in the topic "Eco-STEAM - Technologies in Primary Education." Creating a model of a stimulating educational environment using Eco-STEAM is a technology for developing students' intellectual abilities in the process of cognitive activity and engaging them in scientific and technical creativity at all stages of primary education.

Objectives: 1. The study of STEAM technology training modules.

2. Creating an environment for pedagogical, scientific, and creative development in education.

3. Engaging parents in collaborative cognitive research creativity between parents and students.

4. The formation and development of research skills, collaboration and interaction with other participants, and the student's self-awareness.

5. The phased implementation of Eco-STEAM technology in educational activities.

The relevance of the project: In the modern era of change, the state needs personnel capable of making non-standard decisions, thinking creatively, implementing their ideas, and benefiting society. It is necessary to change the teaching system and gradually develop Eco-STEAM educational technologies in the minds of students.

To develop the education system in Uzbekistan: to create a mechanism for its sustainable development, ensuring its compliance with the demands of the 21st century, the demands of innovative development of the economy, and the modern needs of society and every citizen.

The primary mechanism of primary education is the development of innovations and searches that contribute to qualitative changes in primary education.

Eco-STEAM education inspires our students to explore the next generation of inventors, innovators, and leaders like scientists, to model like technologists, to design like engineers, to create like artists, to think like mathematicians, and to play like students.

Modern education poses complex tasks, preparing students for life in a future society, which requires special intellectual abilities. The development of skills in receiving, processing, and practical application of received data is the foundation of Eco-STEAM technology.

The introduction of Eco-STEAM technology in primary education helps students quickly manage information flows and learn how to apply their knowledge in practice. Elementary school

students acquire additional practical skills and abilities in life. Lessons allow for the realization of students' creative potential. Learners learn to see the interconnectedness of events, begin to better understand the principles of logic, and discover new and unique things in the process of creating their own models. An integrated approach helps them develop their interest and involvement in the learning process.

Innovation: includes the study and implementation of the new Eco-STEAM in the educational process of primary education - technology, initiative and the ability to make non-standard decisions, which ensures the development of the primary school student's interest in science, technology, education, culture, the formation of creative thinking.

Eco-STEAM educational module. The Eco-STEAM module is aimed at solving specific problems that ensure the achievement of educational goals when combined: developing intellectual abilities in the process of cognitive research activities and engaging elementary school students in scientific and technical creativity.

The "Didactic System of Eco-Education" training module:

- Experiment with objects from the surrounding world
- mastering the mathematical truth through movements with geometric objects and figures
- Mastering spatial relationships
- Construction at different angles and projections

"Interdisciplinary Connection of Environmental Education":

- the ability to conduct practical and mental experiments, generalize, plan speech, and interpret the process and results of one's work;
- fluent native language (elementary ideas about vocabulary, grammatical structure of speech, phonetic system, semantic structure);
- the ability to create new images, fantasize, and use analogy.

The "Mathematical Development" training module:

- a comprehensive solution to problems of mathematical development, taking into account the age and individual characteristics of the student: size, form, space, time, quantity, and calculation.

The "Robotics" training module:

- development of logical and algorithmic thinking;
- Formation of the programming framework;
- development of planning, modeling skills;
- data processing;
- developing the ability to find abstraction and patterns

The "Creating a Green Space" training module "Virtual Learning, Multi-Study":

- Development of ICT (information and communication technologies) and digital technologies;
- development of media technologies;
- organization of production activities based on the synthesis of artistic and technical creativity.

The training module "Experiment with Living and Non-living Nature" includes:

- the formation of an understanding of the surrounding world during experimental work;
- understanding the unity of all living beings in the process of visual-sensory perception;
- formation of environmental awareness.

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As a result, the Eco-STEAM educational competencies of future teachers, primary school teachers, activated students' interest in practice-oriented mathematics, natural sciences, technology, robotics, the field of design, and developed creative, communicative abilities.

Eco-STEAM educational competencies have been improved for elementary school teachers to orient students towards practice, interdisciplinary modern media tools in physics, biology, geography, computer science, technology, fine arts, and extracurricular activities.

The main content of Eco-STEAM technologies in the system of additional education

In addition, the designed models and devices can be combined with measurement systems.

Within the framework of developing eco-STEAM competencies, students actively participate in competitive robotics practice, final work professions championships in high-tech industries, small Olympiads, and similar educational programs. Engineering and robotic devices, measurement complex systems in the design, manufacture and further development of various aspects of digital production and creative abilities.[5]

The formation of eco-STEAM education begins with the development of design, understanding the relationships of structural elements, principles of action, and allows for the realization of the student's creative potential, while also providing an opportunity to acquire technical skills and familiarize themselves with engineering principles. The use of elements made of wood, plastics, magnets, and metals from various materials allows for the study of the properties of materials and areas of their application.

Various materials are also used - soft and hard plastics, magnets, and wood. The solution range includes special sets for studying the fundamentals of mathematics, outdoor activities, and engineering projects.

One of the key elements in creating the "Software" prototype of the Eco-STEAM educational software for students.

In the process of acquiring eco-STEAM educational competencies, special knowledge and skills, the student must create their own devices, gadgets, prototyping mechanisms, and systems within the framework of educational projects. At the same time, it is very important not to limit the maximum exposure of the learner's engineering and creative potential, but to place it before the need to use standard components and ready-made electronic modules.[1] Prototypes include electronics and circuits, mechatronics, the use of various materials processing technologies, industrial design and Eco-STEAM to solve design problems, and the study of software and design skills.

Eco-STEAM is an interdisciplinary approach to teaching subjects, in which elementary school students are given practice-oriented assignments to find solutions and develop a project to solve real environmental problems.

The Eco-STEAM approach is an effective means of encouraging elementary school students, as learning takes place in a local natural and sociocultural environment as a context for elementary school students' learning experience. The eco-STEAM approach can serve as an element of motivating students to study the laws of nature and the relationship between it and society. Research skills in the process of implementing environmental experimental projects.

The Eco-STEAM approach is based on the use of:

- collective projects of environmental content;
- Eco-STEAM extracurricular activities in the natural environment;

- environmental and experimental projects;
- social design of the ecological composition;
- experiments using digital laboratories in the field of the environment.

Eco-STEAM education requires understanding that humanity may face technological and environmental disasters in the near future, new creative approaches to problem solving, and many people with scientific and technical knowledge.

Learning in the Eco-STEAM classroom is always an attempt to solve some real problems. Students work in teams, discover, experiment, invent designs, promote their products on social media, create websites and cartoons.

The game teaches students how to take care of the environment. Learners know that what's been around for the rest of their lives can be recycled to preserve the planet's natural resources. To do this, students playfully study a separate collection of various waste solutions.

Play contributes to communicative development, the manifestation of initiative and independence, and the ability to work in a team.

The development of Eco-STEAM competencies involves conducting experimental work with future elementary school students, elementary school teachers and students in general education schools, from theoretical to practical aspects of Eco-STEAM education.

By applying Eco-STEAM technologies, it is possible to look at the process of studying the world around us from a new perspective and master the psychological mechanisms of personality formation, achieving good results.[2]

To enhance the effectiveness of the educational process in natural science lessons, the following educational technologies are used, taking into account the age characteristics of students.

The technology of communicative education, oriented towards the student's personality, is studied based on the individual characteristics of each student. Prioritizing the problem-research and creative activities of elementary school students, various forms of work, such as paired, group, project work, are used in lessons using communicative educational technologies.[3]

The technologies of an interdisciplinary approach to the development of eco-STEAM educational competencies develop in students the phenomena occurring in nature and the relationship between them, the method of engineering thinking, the ability to exit critical situations, and teamwork. Students demonstrate skills in various spheres of life. In addition to connecting objects to real life, the Eco-STEAM approach opens up opportunities for students' creativity.

The eco-STEAM approach sets a number of tasks that elementary school students need in their design. Thanks to such tasks, the student not only generates interesting ideas, but also immediately realizes them. He learns to design based on available resources, which is of course a practical aid in real life.

The primary school should keep students' attention focused on the learning material through the use of technical means. It stimulates students' interest, and the creation of a favorable emotional and psychological microclimate in classroom and extracurricular activities also plays an important role.

There are many positive aspects to teaching collaborative technology, working in a group, and working in pairs. This contributes to the realization of educational goals, fosters responsibility, mutual assistance, increases students' effectiveness, fosters cognitive activity, independence, and

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expands students' interpersonal relationships. It can be used both for studying new material and for consolidating, repeating, and summarizing lessons learned.

Based on this, it can be said that serious attention should be paid to the training of interdisciplinary teachers who are able to implement the Eco-STEAM approach in school.

Eco-STEAM is the result of preparation for learning, diligence, and willingness to learn from mistakes.

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