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PEDAGOGICAL CLUSTER OF EDUCATION IN STEAM SCIECE TEACHING

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Abstract
The purpose of this article is to identify and describe the elements, principles of teaching an innovative cluster approach that contribute to the development of S-competence (i.e. the necessary knowledge, skills, attitudes and values) related to the core subjects of STEAM, and potential approaches to STEAM teaching that need to be taken into account for the effective implementation of STEAM in the curriculum. The article extensively covers the implementation of the Steam methodology based on the cluster approach.

Keywords: teaching methodology, curriculum, cluster of education, critical thinking, STEAM of education, the principle of "Heard-saw-done".

Introduction

The United Nations 2030 Agenda for Sustainable Development, entitled "Transforming Our World", set out 17 Sustainable Development Goals (SDGs) to address global challenges such as poverty, climate change, food shortages, protecting the planet; and to ensure that all people enjoy peace, prosperity and quality of life [3]. Education in the field of science, technology, Engineering, Mathematics and Arts (**STEAM),** plays a crucial role in the modern educational system.

The time has come for the education sector to rethink the traditional boundaries of curricula in which knowledge and skills are distributed across subjects. IBE has held discussions to identify and concretize competencies beyond areas of expertise, with the aim of assisting Member States in developing competency-based curricula that prepare young people with the necessary competencies for sustainable, fulfilling and healthy lives in the rapidly changing world of the 21st century.

METHODS AND MATERIALS

Currently, there is limited research on the necessary knowledge, skills, attitudes, values and experiences that are an essential part of the competency-based curriculum, as well as limited consideration of the challenges faced by teachers in effectively implementing a competency-based curriculum. This is especially true for education in science, technology, engineering, mathematics, and the arts (STEAM), because the concept of STEAM as an interconnected and potentially integrated field of learning is relatively new. Accordingly,

there is a growing need for an integrated STEAM system that will help teachers, instructors and curriculum developers meet the requirements of effective STEAM education.

What should be understood by the terminology of STEAM - education? It is a branch of science integrated and aimed at developing and providing innovative solutions to global problems, in particular those directly related to the 2030 Sustainable Development Goals.

As the Industrial Revolution gains momentum and affects every aspect of our daily lives, the boundaries between STEAM disciplines (science, technology, engineering, mathematics, arts) as well as between non-STEAM fields are becoming increasingly blurred. The global development of the world of science in the world of technology is forcing us to rethink how we educate students in both STEAM and other fields.

STEAM (Science, Technology, Engineering, Arts, Mathematics and Art) schools in Uzbekistan are educational institutions that actively use an integrated approach to learning. In these schools, students receive an education that includes not only traditional subjects, but also science, technology, engineering, art, and mathematics. These schools are designed to develop the skills and abilities of students that are necessary for a successful career in the modern world.

In Uzbekistan, STEAM schools have become popular in recent years. They teach students the latest technologies and techniques, such as robotics, 3D printing, programming, data analysis, and others. They also help students develop creative thinking and problem-solving in real-world situations.

There are several schools in Uzbekistan that specialize in STEAM education. One of these schools is the Presidential School, which is located in all regions of the Republic of Uzbekistan. In this school, students receive education in the field of mathematics, physics, chemistry, biology, computer science and other scientific subjects, as well as learn programming and robotics according to the national program and jointly studying the program of the world's leading universities in the field of natural science.

Another example is the IT-Park Kids school in Tashkent, which provides education in the field of information technology, programming, robotics and other STEAM areas for children from 7 to 17 years old [2].

There are also a number of projects and initiatives in Uzbekistan aimed at the development of STEAM education. For example, in 2020, the STEM Town project was launched in Namangan, which is a center for the development of scientific and technical culture and education, which includes research laboratories, workshops and other educational facilities.

Thus, STEAM schools and projects in Uzbekistan demonstrate a commitment to the development of a modern education system that will provide students with the skills and knowledge necessary for a successful career in the modern world.

The main feature of STEM is the use of scientific, mathematical, technical, engineering and artificial knowledge to solve everyday or societal problems, which makes the study of science, technology, engineering and mathematics more meaningful and contextual. STEM - literacy was defined as:

- Knowledge, attitudes, skills and values for identifying issues and problems in life situations;

- Understanding the characteristic features of STEM disciplines as forms of human knowledge, research and design;
- Awareness of how STEM disciplines shape our material, intellectual and cultural environment; and
- Willingness to deal with issues related to STEM, relying on the ideas of science, technology, engineering, mathematics and art, as a constructive, interested and reflective citizen.

The cluster approach to teaching STEAM involves bringing together teachers, scientists, engineers, technicians and other experts in the fields of science, technology, engineering, art and mathematics to jointly develop and implement educational programs [6]. The STEAM approach is based on the idea, individual and differential teaching of biology and includes many different components, such as courses, lectures, workshops, projects, research, scientific and technical exhibitions, etc.

Training to the Steam methodology (Science, Technology, Engineering, Arts and Mathematics) in Uzbekistan is being actively introduced into the educational system. It aims to develop students' critical thinking, problem-solving, teamwork and technological literacy skills.

As part of this methodology, laboratories are created in schools and colleges where students can practice programming, robotics, 3D modeling, as well as develop their creativity in the field of art and design.

Uzbekistan also hosts various competitions and Olympiads in STEAM areas, which allow pupils and students to show their knowledge and skills in this area.

Thus, the STEAM methodology is becoming more and more popular in education in Uzbekistan and contributes to the development of the technological and creative potential of young people.

The methodology for teaching STEAM in biology may include the following steps:

1. Defining the goals and objectives of the lesson. It is necessary to determine what specific skill or knowledge will be studied in the lesson. For example, the lesson may be devoted to learning the basics of genetics and mutations.
2. Selection of materials. It is necessary to choose materials that will help students better understand the topic. These can be videos, presentations, interactive assignments and tests.
3. Use of new technologies. The STEAM approach involves the use of new technologies and tools. For example, you can use computer programs as visual learning tools.

The teaching methodology of STEAM (Science, Technology, Engineering, Arts, Mathematics) in biology, as in other subjects, aims to integrate various fields of knowledge and skills in order to stimulate creative thinking and awaken students' interest in science.

OUTCOMES

The innovative cluster of teacher education is being introduced for the first time at Chirchik State Pedagogical University and performs the following functions:

- training of teachers with modern knowledge and skills for educational institutions in the region;

- effective use of innovative pedagogical technologies to improve the quality of education;
- consistent implementation of scientific activities in the field of pedagogy;
- basic (textbook) and auxiliary (dictionaries, electronic resources, etc.) means of education.) to ensure continuity and continuity in the context of the educational stages of the content-essence of the means;
- organize short-term training courses in cooperation with the regional in order to fill the gaps in the level of knowledge of teachers of educational institutions in the region;
- Eliminate problems related to the teaching of subjects in secondary schools;
- to organize scientific and practical seminars in cooperation with the regional one in order to increase the scientific potential of professors and teaching staff of the institute, to strengthen scientific cooperation with scientific centers and basic higher educational institutions;
- involvement in research work of teachers who are able to conduct research in secondary schools; - implementation of internships in leading foreign universities in order to master advanced foreign experience in the field of pedagogy [5].

As a result of the practical implementation of the model, the "innovative cluster of teacher education" provides a solution to the issues of eliminating the disunity between the types of education that make up the system of continuing education, uniting them around a common goal, finding a solution to continuity and continuity, creating an environment of mutual competition and control, creating a system that ensures effective continuity in the pedagogical sphere [9].

The innovative cluster of teacher education is a set of all types of education in the system of continuing education, centers of research institutes, practice bases, scientific and scientific-methodological structures, the joint distributed activities of which make it possible to qualitatively raise the system of teacher education to a new level [11].

For example, R.Kh. Khasanov gives the following definition of a cluster: an open educational system, in which, as a result of end-to-end vertical integration of the stages of continuing education and horizontal coordination of structures, a high level of organizational unification of the activities of the subjects of the pedagogical process is ensured [10].

T.V. Fadina considers the educational cluster from the standpoint of the competence approach as a set of interrelated institutions of higher professional education, as well as organizations related to their activities: employers, suppliers, institutions of secondary and general education, organizations of the research sector, uniting in order to create a competent graduate that meets the needs of all stakeholders [1].

Below are a few approaches that can be used in the educational process when teaching STEAM:

1. The use of technologies and digital tools for the study of biological phenomena. For example, the use of microscopes with the ability to record video so that students can observe the processes occurring in the cells.

2. Integration of art into the educational process. For example, creating drawings or models that will help visualize biological processes. This can be especially useful for visual learners.
3. Use of project methodology. Students can work in groups and realize their creative creative skills in biology lessons.

DISCUSSION

But we will apply the cluster approach in teaching STEAM sciences. The pedagogical cluster of education in the teaching of STEAM includes several key elements:
1. Bringing together experts from various fields. The Pedagogy Cluster brings together experts in science, technology, engineering, arts, and mathematics to provide full coverage of all aspects of STEAM and create comprehensive educational programs.
2. Development of educational programs. The Educators Cluster develops educational programs that integrate science, technology, engineering, art, and mathematics to ensure the fullest possible coverage of all aspects of STEAM.
3. Support and exchange of experience. The Pedagogical Cluster provides support and exchange of experience between teachers, scientists, engineers, technicians and other experts in the field of STEAM in order to provide the highest quality of instruction for students.
4. Use of new technologies and teaching methods. The Pedagogical Cluster uses new technologies and teaching methods, such as online courses, virtual laboratories, interactive textbooks, games and simulations, to make learning more interesting and effective.
5. Development of projects and research.

The STEAM Teaching Education Pedagogical Cluster is a collection of teachers and specialists in the field of STEAM education (science, technology, engineering and mathematics) who work together to develop and implement innovative teaching methods in the educational process.

The Education Innovation Cluster in Teaching includes teachers, researchers, engineers, programmers, designers, and other professionals who work together to create a strong culture of science and technology education in schools and universities.

The main goal of the pedagogical cluster of education in teaching STEAM is to help students develop the skills and abilities necessary to solve complex problems and create innovative products in the future [7].

The Pedagogical Cluster helps students develop projects and conduct research in various areas of STEAM to help them put their knowledge into practice and develop their skills.

The methodology of teaching STEM (science, technology, engineering and mathematics) in biology includes the use of innovative methods and technologies, as well as modern approaches to teaching.

The methodology for the development of STEAM education in the cluster system, based on the principle of "Hear-See-Do", can be an effective way to develop creative thinking and competencies in the field of science, technology, engineering, art and mathematics among students [8].

Step 1: Heard

In this phase, students are introduced to a new topic or problem that they will be exploring. A teacher or facilitator presents students with interesting and relevant tasks or projects related to a specific STEAM area.

Step 2: Saw

At this stage, students get the opportunity to observe and investigate a subject or phenomenon related to the chosen topic. They can conduct experiments, study scientific articles or resources, make trips to enterprises or museums, where they can observe and participate in real processes.

Step 3: Done

At this stage, students apply the knowledge and experience gained to solve specific problems or create their own projects. They can design and build models, conduct research, create designs and prototypes based on the knowledge and observations gained.

The entire methodology for the development of STEAM education in the cluster system is based on the active and practical participation of students in the educational process. They can work in groups or teams, collaborating and sharing ideas and knowledge, as well as developing communication and collaboration skills.

The cluster system can be organized at the level of a school or educational institution, combining various subject areas in order to develop STEAM education. This may include collaboration between teachers of different subjects, joint projects and activities, and access to specialized educational resources and equipment.

The methodology for teaching STEAM (Science, Technology, Engineering, Art, Mathematics) in biology may include the following steps:

1. Study of theory: the teacher should provide students with information about scientific and engineering technologies that are used in biology.
2. Practical exercises: students should be able to apply the knowledge and skills gained in the theoretical part in practice. For example, they can conduct experiments, create models, work with data analysis software, etc.
3. Use of technology: The teacher should show students how to use modern technologies such as computer modeling, 3D printing, microscopy to solve problems in biology.
4. Teamwork: Students should learn to work in a team to develop collaboration and problem-solving skills.
5. Application of art: Students should learn to apply art in biology, such as creating animations, illustrations, designs, etc.
6. Solving real-world problems: Students should work on real-world problems in biology to understand how their knowledge and skills can be applied in practice.
7. Evaluation of results: The teacher should evaluate the results of students' work and give them feedback so that they can improve their skills and knowledge.

FINDINGS

The use of the cluster approach in teaching STEAM allows you to create a multi-system education that combines various areas of knowledge and expertise to ensure the most

complete coverage of all aspects of STEAM. This helps students to better understand the material, develop their skills and abilities, and learn how to apply their knowledge in practice.

The "Hear-See-Do" principle allows students to actively participate in their education, develop independent and exploratory learning skills, and apply the knowledge and skills gained in practice. It promotes the development of creative thinking, problem thinking and innovation, which are key competencies in the modern world.

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