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Practical-Functional Model of the Use of STEAM-Technology in Future Teachers

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Annotation. *this article explains that in order to achieve professional success in the STEM field, it is necessary to combine knowledge and skills in STEM with creativity. To meet this need, art is integrated into STEM education, thus forming an educational direction known as STEAM*

Key words: *STEAM education, STEM, STEAM technologies, STEM logic*

Introduction.

In the conditions of an unpredictable and rapidly changing world, the most vulnerable system is the education system. To prepare competitive human capital, it is not enough to study only individual subjects. In this regard, an integrated and cross-sectoral (interdisciplinary) approach to education is gaining relevance. It is this idea that serves as the basis of STEAM-education. This approach develops skills simultaneously in the fields of natural sciences, technology, engineering, art and Mathematics (Science, Technology, Engineering, Art and Mathematics) [1].

The problem is that the ability to cooperate internationally, critical thinking and skills for creative solving professional problems are still relevant in the system of technical training. Nowadays, more than ever, professionals with 21st century skills are needed. The success of graduates depends on how well the education they receive meets the requirements of the modern labor market. Therefore, the labor market places strict requirements on young specialists, and having a document on higher professional education does not guarantee a prestigious place of work in the specialty. The task of future professionals is to be able to solve production problems in an innovative, unusual and creative way [2].

In order to achieve professional success in the STEM field, it is necessary to combine knowledge and skills in STEM with creativity. To meet this need, art is integrated into STEM education, thus forming an educational direction known as STEAM.

Basic ideas. The main ideas of STEAM education consist in teaching 21st century skills, with a special emphasis on the flexibility and flexibility of thinking through art, as well as the development of creative abilities and the formation of real-life problem-solving skills. The combination of science, technology, engineering, art and mathematics serves as a major factor in this [3].

Claimer argues that"if we want to advance innovation, we need to revive the role of creativity, we need to teach students what we call '21st century skills'". 21st century skills consist of four main components: Creativity (creativity), Critical Thinking (critical thinking), Communication (communication), and Cooperation (collaboration). Adding art to the learning process develops divergent thinking — that is, the ability to offer many different solutions based on the same information, another skill that was very important in the 21st century [4].

Methodology. This research is being conducted as part of the project "developing the potential for innovative training of Engineers through STEAM education". The project will study the process of training students in the technical direction, STEAM education technologies, educational and methodological documents and the results of training. These indicators affect the level of academic success and quality of education, while serving to form a specialist who has innovative thinking, communicative cooperation skills and is able to make creative decisions in professional activities.

This research was carried out in the process of implementing the project "development of the potential of innovative training of Engineers through STEAM education". The project was funded by The Science Committee of the Ministry of Education and science of the Republic of Kazakhstan on the priority line "research in education and science" in 2021-2023 (Grant №AP09260338). The study aims to delve deeper into STEAM education in the context of a formal learning environment.

The goal of the project is to develop and implement a technical – oriented specialist training model, which will focus on implementing sustainable education programs in intercultural dialogue, creative industry and creative cooperation through STEAM technologies. This process is based on creativity and intellectual capital.

Assessment of the potential of STEAM education is carried out on the basis of the development and implementation of measures for the development of the potential of educational programs in technical specialties, the formation of special competencies that make it possible to increase the qualifications and abilities of students and teachers at an international level.

To solve one of the important tasks of the project, we analyzed three basic educational models and distinguished them:

- Studio (Studio) based education model,
- Philippine STEAM education model,
- Maker Education model.

These models include an integrated approach based on the STEAM methodology and are described along with the methods used in the learning process, learning outcomes, and tools to evaluate these outcomes.

According to the analysis of foreign literature, when the main components of steam, as well as the issues of teaching and introducing 21st century skills, are studied, foreign researcher Claymier notes that art skills are important for specialists in the STEM field. He distinguishes in this process the interdisciplinary approach of problem solving, technology, innovation and communication through various media tools【4】.

Discussion and results.

The first model in use in the American higher education system is Studio Learning

Known as a Model (studio-based training model).

Dougherty M.K. in the opinion of art, the so-called "Studio thinking" or "studio habits" are used. This model of studio teaching develops skills for group collaboration, dialogue building, and problem solving. The eight main areas outlined in studio thinking can be applied in different disciplines and in everyday life. They include:

1. learning to use tools and materials;
2. learning-focused problem solving;
3. mental visualization of projects;
4. expression of thoughts and ideas;
5. progressing what is usually invisible;
6. asking questions;

7. explanation;

8. 【5】 to discuss with peers for better understanding.

Also Dougherty M.K. emphasizes: art allows a person to follow his imagination and conduct research in an environment where there are few restrictions. This makes the integration of art and STEM (science, technology, engineering and mathematics) very useful for innovation. This approach brings together approaching (convergent) and distancing (divergent) thinkers, combining art, technology and design to apply creativity that serves a specific purpose or function. Art allows you to put thoughts on paper through graphic means, and also gives a person a supposedly "permission" to get other impressions, especially if this is purposefully directed.

When the STEAM approach is used in the United States, the curriculum requires students to solve design-specific assignments. These tasks are carried out in different ways and on the basis of a creative approach, within the established criteria. Tasks can have different levels of limitations depending on the final training objectives. When there are few restrictions, it contributes to the development of creative abilities in the curriculum.

Incorporating art into the curriculum and using design tasks within lesson plans, i.e.

The use of the STEAM approach helps students to form a complex of specific skills, they learn to look closely at the environment and through it develop the right hemisphere of the brain.

The role of the teacher is also very important, because in the Steam audience, teachers should be able to apply STEAM-logical thinking. It is important to understand why you need to turn stem into Steam: this approach brings together opposite areas and brings the diversity necessary to stimulate innovation in the lesson. For example, while STEM relies on logical, analytical, repetitive products and reasoning, STEAM (i.e. including the Art – art component) relies on subjective, intuitive, sensitive, and unique reasoning.

Harmonizing science and art helps the teacher develop systematic thinking, which requires the student to be able to see all parts as a single whole (i.e.: science, technology, engineering, art and mathematics). This interdisciplinary approach requires the teacher to get rid of the possible sectoral stereotypes between academic and applied disciplines.

It is also necessary that the teacher improves understanding and communication with colleagues who are representatives of different fields, has deeply mastered the STEAM fields to provide more effective training and interdisciplinary integration of his students. In a student-teacher relationship, the teacher displays creativity, connects interdisciplinary ideas and teaches the necessary skills in the context of knowledge.

STEAM education uses student-oriented methods, such as: oral presentations, debates, exhibitions, written work, model building, and problem solving. This gives students the opportunity to demonstrate their knowledge in different ways [6]. A reliable formative and final assessment system is necessary in this. Studio-based teaching model.

Assessment tasks typically involve students in real, practical study situations and lead to meaningful study through higher levels of cognitive (cognitive) requirements [7]. "The data obtained through these assessments will identify the strengths and weaknesses of the students and help teachers plan further teaching phases during the project. When performing tasks, teachers need to take into account the following factors: the direction of the task, the context, the directions given by the students and the rubrics used in the assessment (set of criteria).

The central focus of the assessment task should be inextricably linked with the educational goals, while the context should provide basic questions and background information relating to the main goals. In addition, students should be given a guide that clearly describes the result or the product to be evaluated, and criteria for assessing the quality of work performed" [6].

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