# TECHNOLOGY FOR THE DEVELOPMENT OF TECHNOLOGICAL COMPETENCE OF FUTURE PRIMARY SCHOOL TEACHERS ON THE BASIS OF STEAM EDUCATION

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***Abstract.*** *The article highlights the theoretical and practical importance of the development of technological competence of future primary school teachers on the basis of STEAM education. The essence of the content of technologies for preparing future primary school teachers to teach natural sciences (Science) based on the "STEAM education" approach is revealed.*

***Keywords:*** *STEAM, natural sciences, technological competencies, future competencies, interdisciplinary integrative approach, integrity, practicality, hierarchy, creativity.*

Education is a mirror of the country's future. It is known that improving the quality and efficiency of the educational process is the basis of our further progress.

In the decree of the President of the Republic of Uzbekistan "On approval of the Concept of development of the public education system of the Republic of Uzbekistan until 2030" dated April 29, 2019, "special attention is paid to the development of competencies and competencies of Students in the field of science and critical thinking, independent search and analysis of information, the introduction of general education programs and new state educational standards that meet the requirements of modern innovative economy"[1] priority is defined as a task.

As a result, in the system of continuing education operating in the territory of the Republic of Uzbekistan, the work on the exchange of experience, competition, continuous interaction with world education is developing significantly today on the example of the experience of the education system of developed European states. Including dual training, inclusive education, external training, distance learning and forms of Steam training are vivid examples of our thinking. These forms of education are widely used today and achieve high results.

Currently, the younger generation wants to take advantage of the achievements of the world of digital technologies. The number of young people interested in designing, modeling, robotics and programming is growing every day.

The most famous example of the Steam approach is the Massachusetts Institute of Technology (MIT)[3]. The motto of this famous university is "mind and hand" – "mind and hand". The Massachusetts Institute of Technology has developed Steam courses, and even Steam training centers have been established in some educational institutions.

Research on the introduction of educational elements of STEAM is carried out in many countries: the USA, Australia, South Korea, Canada, Thailand and others [2]. The ability to enter the "Art" element, the indicator of which is included in the STEAM abbreviation. Studying the experience of implementing STEAM Education shows that their diversity is sufficient, and they expand as students progress through the main stages of learning. Since 2011, Chicago scientists have been supporting the SFT initiative[4]. The SFT initiative is designed to use a Steam-based curriculum and is a collaboration between higher education institutions, extracurricular

organizations and non-formal education providers. The initiative will be implemented in all districts during the school year. Abroad, teachers of higher educational institutions and general education schools are trained in the use of interdisciplinary strategies in their activities. We believe that Steam teachers can implement project-based learning programs, while the project method is considered as the basis of Steam learning.

Steam is an integrated learning system by subject, not by subject. Education on Steam gives an icon of the real application of scientific and technical knowledge through practical exercises. This educational technology is widely used in the education system of Canada and the UK.

STEAM-recuires an integrative approach to education with concepts of research and development, technological progress of everyday life. The purpose of this approach is to promote scientific literacy, competitiveness, and the involvement of schools and the public in ensuring the sustainable development of world development and the economy through education.

STEAM-consists of six stages: question or problem, discussion, planning, structuring, testing, development. These stages are the basis of the project. In turn, students should use all opportunities as a team, act together, use them as a basis for creativity and innovation.

Advantages of STEAM education:

1. Integrate teaching not by academic subjects, but by “subjects". This provides training for professions related to engineering;
2. Application of scientific and technical knowledge in real life;
3. Developing critical thinking and problem solving skills;
4. Increased sense of self-confidence;
5. Active communication and teamwork;
6. Develop an interest in natural and technical sciences;
7. A bridge between education and career;
8. Creative and innovative approach to projects.

Future Competencies (4K)

The competencies of the XXI century are a separate area that is now being actively discussed at different levels. The essence of the concept is as follows: in the industrial era, the main skills determining literacy were reading, writing and arithmetic.

In the XXI century, the focus is on the ability to think critically, the ability to interact and collaborate, and a creative approach to work. Steam Training forms the key competencies of the future 4K:

Communication –Collaboration –Critical thinking –Creativity

These skills cannot be acquired only in laboratories or by knowing certain mathematical algorithms. That is why professionals have to study Steam Sciences more and more often.

Contribution to the development of students:

collaboration of teachers of different disciplines to develop projects;

activities that use data to solve real-world problems;

knowledge of ways to develop students' higher-level thinking skills;

improvement of teaching and diversity of teaching methods;

providing students with opportunities for development and innovation.

Advanced foreign experience: today this term is common in many countries claiming to be the best in the field of education: Australia, Canada, Great Britain, China, Hong Kong, Singapore, Turkey and others.

Special funds have been created to support STEM areas, public funds have been allocated, and public and private STEM training centers have been opened.

In the USA, depending on the state, there is a specialty of STEM education, for example, in California, aerospace programs are supported the most, and in Colorado, there are the most programs in geology.

Often, the sponsors of the development of any field of STEM education are specialized organizations, large private companies or government organizations that need to develop science in a particular field. For example, this is the US National Aerospace Service, which creates special funds to support students in this direction.

In some countries [4] STEAM has an academic focus, and organizations are more likely to improve the quality of education in STEM fields than to increase the number of students, for example, the Middle East or Turkey, who work in this way.

The USA, Canada, Australia, Hong Kong, Finland, Germany, Great Britain, Sweden[5] are the countries most actively promoting Stem. In these countries there are special state bodies that are engaged in the development of STEAM education. STEM is the most common in Finland in terms of relative selection among undergraduate students, accounting for more than 30% of graduates.

What should a STEM education teacher be like?

If the teacher is good, he pays attention to the interests of the student and gives practical examples, finds an opportunity for project work. A teacher who transfers knowledge from top to bottom should become a teacher-mentor, mentor and facilitator, organizing an educational environment in which learning and development takes place. This is a very interesting and challenging role.

Recommendations for the successful implementation of STEM learning: STEAM pedagogy should also be implemented in pedagogical universities for future teachers of natural sciences.

In order to avoid disagreements and misunderstandings between stakeholders, it is necessary to develop unified STEM learning concepts. There is no single definition, but it is necessary to develop or choose a general, local definition within the country's education system.

Having developed a plan for the implementation of STEM education for a period of at least five years, it is necessary to include the following stages in it:

Development of a common STEAM learning model;

Teacher training and professional assistance;

Development of uniform qualification requirements for STEAM teachers;

Creating an effective community of STEAM teachers;

Promote and educate all strata of society in STEM education.

In our study, when Steam educational technology is used in the educational field of Natural sciences (Science) for elementary grades, children gain knowledge in the educational environment of Steam and immediately learn to use it.

The development of technological competence of future junior schoolchildren based on STEAM Education allows them to experiment, create models, independently create music and films, translate their ideas into reality and prepare for the creation of the final product.

STEAM Education helps to develop the following skills in elementary school students.

Thoughtful risk;

Become persistent problem solvers;

Creativity, systematic and logical thinking;

Work through the creative process.

The task of STEAM education in primary education is to develop students' interest in natural and technical sciences. Falling in love with what he does is the basis for the development of his interests.

STEAM requires an integrative approach to education with the concepts of scientific research and technological progress of everyday life. The purpose of this approach is to promote scientific literacy, competitiveness, and the involvement of schools and the public in ensuring the sustainable development of world development and the economy through education.

On the basis of STEAM education, the technological competence of the future primary school teacher will be developed mainly on the basis of methodological, general pedagogical and didactic requirements of the subject of natural sciences (Science).

As a result, the future primary school teacher develops such abilities as mobility and flexibility, creativity, imagination, initiative, willingness to innovate, deductive and inductive thinking, as well as critical thinking.

Natural sciences (science) - forms the skills of description, forecasting, understanding, decision-making, research of natural phenomena based on observations and experiments, evidence. The task of natural sciences is the study of the laws of nature, as well as their rational use in the interests of man and the promotion of nature conservation. Natural science knowledge arises as a result of observation, experiments, and the promotion of ideas in human practice. The STEAM approach teaches you to skillfully apply the acquired knowledge in real life. To do this, STEAM develops a common learning model and uniform qualification requirements for students; it is advisable to create an effective student community.

The organizing factor of the methodological system in our study is the formation of technological competence in the process of teaching natural sciences (natural sciences)among the future primary school teachers of pedagogical universities based on STEAM education.

It should be noted that the methodological system developed by us has common features for all systems:

1) integrity (pedagogically, the “strength” of components within the system is higher than the strength of the connection of system elements with external systems or elements of the environment);

2) practicality (the capabilities of the system exceed the capabilities of its components);

3) hierarchy (each element of the system can be considered as a system, as well as the system itself can be considered as an element of some suprasystem).

The formation of technological competence of future specialists is understood as a purposefully organized pedagogical process of interaction between the subjects of the educational process (students and teachers), characterized by a focus on the development of new qualitative and technological competence among students.

Summing up, we can say that the technological competence of the future primary school teacher based on STEAM education encourages experiments based on development, creation of design models, independent creation of music and cinema, the embodiment of their own ideas into reality and the creation of the final product. This approach to learning allows future teachers to effectively combine theoretical and practical skills and facilitates learning in higher education.

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