STEAM-APPROACH IN THE CONTENT OF THE HOBBY GROUP WORK TECHNICAL CREATIVITY

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Summary

STEAM is actively implemented in the modern educational space of Ukraine. This is due to the fact that one of the important tasks of education is the comprehensive development of the growing generation, their acquisition of the necessary competencies and successful realization in the future. Therefore, the required condition is the formation of an integral (coherent) approach to the content of education and the formation of the educational environment.

Analysis of theory and practice shows that the STEAM-approach contributes to the improvement of the learning process in the educational institutions, including after-school education, based on the use of five components: **S**cience, **T**echnology, **E**ngineering, **A**rts, **M**athematics

It has been established that steam aims to expand opportunities and areas of work, promoting not only the development of the subject competencies in the field of natural sciences, technologies, engineering, art and mathematics, but also the key competencies that are set to ensure effective child socialization and actively interact with each other.

At the heart of large-scale multi-year research, such scientists as N. Balyk, G. Shmyger, Ya. Bykovskyi, N. Polihun, J. Bilyk, V. Zhukova, V. Pikalova, A. David, etc., came to the unanimous conclusion that these components are of great importance in the development of science and society in the future. They are also called disciplines of the 21st century. In the future, they may become the basis for such professions as: chemical engineers, software developers, petroleum engineers, computer systems analysts, mechanical engineers, civil engineers, robotics mechanics, nuclear medicine engineers, architects of underwater structures and aerospace engineers.

Special attention in the article is focused on the question of STEAM -approach in the content of the hobby group work on technical creativity.

Keywords: STEAM-approach; technical creativity; hobby group work; after-school education; educational process.

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1. Introduction

Scientific and pedagogical researches show that the urgent need in education is to shift the emphasis on the performance of routine mechanical tasks, that are typical for traditional programs on technical creativity for junior pupils, to the formation of skills of the 21st century: effective cooperation in the team, creative solution of tasks, determination and achievement of goals, making important decisions, managing project activity, self-education and development of their talents. In this context, STEM-education is one of the progressive pedagogical innovations of the 21st century beginning.

2. Presentation of the main material

The ideas of the STEM-approach in the field of children's education are being developed in many educational systems around the world, including Ukraine. The reform of general secondary education called the "New Ukrainian School" includes nine components, which are among the targets of the STEM-approach to learning. According to the Concept of the new Ukrainian school, the graduate student must be an integral person, a patriot and an innovator, that means, to be able to positively change the surrounding world, develop the economy of the country, compete on the labour market and gain knowledge during life.

N.Polihun points out that STEM-education is based on solving the real problem or the complex issue for which the necessary knowledge of several disciplines is needed. On the one hand, this approach results in improvement of efficiency and quality of natural and scientific education in conditions of formal education (preschool and school), and on the other – STEM-education provokes to go out of standard school education, including establishment and development of partnership relations between staff school teachers, tutors of the hobby groups, researchers and specialists in the sphere of production for realization of joint projects *(Polichun, 2019: 80)*.

N. Balyk and G. Shmiger, considering the educational value of STEM-approach to development of content and methods of education of children and youth, summed up its main advantages and promising opportunities, among them:

– possibility of scientific and technical knowledge application in practice – in the process of implementation of STEM-project students apply scientific and technical knowledge in real life;

– development of critical, flexible thinking and skills of problem solving – children, working on creation of different products, face the need to solve problems which they face by their own efforts, reaching the specified;

– active communication in the team – at the stage of discussion for children free atmosphere is formed, which works towards discussion and expression of the team members opinions;

– increasing the recognition interest in technical disciplines – classes that are realized within STEM-approach are exciting and dynamic, it provides active cognitive activity of pupils *(Balyk, Shmyger, 2017: 26-30)*.

The main goal of STEM-education is to improve the learning process in educational institutions on the basis of research and engineering activity, and the object is to develop the intellectual-cognitive and creative abilities of the child, the level of which gives a competitive ability during further educational activity and employment according to the requirements of the 21st century *(Bilyk, Postova, 2017: 22–25)*.

Integration as a key principle of STEM-education will allow to realize the methodological basis and content modernization of the elementary-technical profile hobby groups educational activity, ensuring quality improvement of natural-mathematical training of the elementary school pupils and forming:

– skills of complex practical tasks solving;

– ability to evaluate the problems and make decisions;

– skills of practical and creative application of acquired knowledge;

– critical and divergent thinking, creative qualities, organizational and communication abilities;

– readiness for conscious choice and education;

– financial literacy;

– comprehensive scientific worldview, values, cultural, mathematical, technological, communicative and social competence;

– skills of mastering by means of cognitive, research and practical activity *(Polichun, Slipuhyna, Chernetsky, 2017: 5-9)*.

Modern approach to the content and methods of the elementary-technical profile of after-school education, based on STEM-approach, is proposed on this particular challenges and public needs.

In 2010, the active transformation of STEM into STEAM began. Leading educational institutions of Europe and the United States started to Defend the need to incorporate art and design into the STEM system to create an integral educational model that could prepare a growing generation to the conditions for the development of an innovative economy in the future. Since then, STEAM has been actively developing around the world and has been widely used by educational institutions and leading corporations in their activities to enhance the value of art and humanities *(Sousa, 2013: 280)*.

Thus, taking into account modern scientific researches, it is necessary to note that for junior school age children a new approach STEAM is proposed. To establish the key foundations of this approach, research was conducted in scientific sources on the prerequisites of the STEAM-approach in the context of the worldwide STEM trend, its principles and key aspects of pedagogical implementation.

One of the initial stages of STEAM became the study of the pedagogical university John Hopkins (2009), who proved that during the study of artistic disciplines pupils improve their cognitive skills, memory and attention develops more dynamic, the range of educational and life skills expands. Thus, STEAM-approach to the organization of educational process covers the sphere of development of the personal creative potential, combining technical creativity, research and art activities and ensuring formation of horizontal links between different branches of knowledge. The actual directions of STEAM-education V.Zhukova considers web, audio and video design, interior and industrial design, animation, architecture, industrial esthetics, beauty and fashion industry, etc. *(Zhukova 2018)*.

STEAM implements the principle of education through hands, which enables students to understand the reasons and consequences of their work, as well as its impact on the world around them. The main purpose of such training is to acquire self-education skills, to form adaptive features of character, to learn to perceive technologies and globalization process as modern conditions of mankind existence, to form conscious citizens of the world and their country. That is why the implementation of this approach requires the involvement of children in this type of activity from the preschool, which will create conditions for the full development of the child's personality and its preparation for further successful adaptation in rapidly changing conditions.

It should be noted that according to our opinion, the key importance in the forming of creative and technical competencies of the junior school age pupils in STEAM-approach should play not only modern information and communication technologies offered in many manuals, but mostly creativity and research activity. In the system of STEAM-education at classes for junior school age children on the first place is development of their abilities, creative thinking and freedom in research and creation. Therefore, when developing the content of the classes, it is necessary to take into account that the most effective is using of simple toys, constructors, cubes, etc.

Based on the study of V. Pikalova the main parameters for development of the content of the elementary-technical profile after-school class were established on the basis of

STEAM-approach, taking into account the key aspects of realization of this approach in the educational process, in particular:

– integration in the content of after-school education and teaching methodology of natural sciences, modern technologies (including information), engineering design and mathematical knowledge;

– development of the programmes on the interdisciplinary ground;

– integration of scientific knowledge within the framework of topics, not separate sections;

– using true technical, technological, economic and social problems in the educational process;

– concentration on the system formation of critical and engineering thinking *(Pikalova, 2020: 95-103)*.

Studying pedagogical experience, it was established that introduction of educational STEAM-approach in after-school education requires changes to the traditional content of teaching in the hobby groups of the elementary- technical profile, by moving away from strict frameworks and taking into account psychological requirements to the content of teaching pupils of junior school age: flexibility of content, which provides the possibility of its saturation and transformation; distribution of topics and problems for studying by content modules, which have generalized character and occur the basis for further filling of educational material, which will correspond to age and individual needs; interdisciplinary approach to the specification of the studying content in a hobby group that meets the cognitive children needs of the preschool age, their creative possibilities and world-view development; integration of problems within one theme for establishing internal relations between scientific knowledge; high level of educational material problem, which corresponds to level of children development; fullness of content – it provides a high level of cognitive activity of pupils and intellectual loading *(Polihun, Postova, Slipukhina, Onopchenko, 2019: 80)*.

At the same time, the development content of the educational program on technical creativity should take into account the basic spheres of the personality of the pupil. These spheres allow to outline different aspects of the hobby group program content of the elementary-technical profile, namely:

– development of the cognitive sphere: gradual complication of content due to greater abstraction and generalization; parity of tasks on divergent and convergent thinking; predominating of developing educational content over information load; development of productive thinking based on skills of practical use of knowledge;

– development of active brain-work and creativity: the predominance of research tasks over reproductive; the focus on revealing intellectual initiative of the pupil; the rejection of conformism;

– effective development: profound elaboration of the problem being investigated; support of independent educational activity; parity of criticality and loyalty in estimation of the pupils' ideas; orientation on competition and collective responsibility; actualization of pupils' leadership qualities.

The program of the hobby STEAM group opens up the current change of the elementary-technical profile of the science and technology directly, it is for the junior children of age 6–10 years. Its aim is the development of individual creative features of the pupils, working towards competencies in natural sciences, technology, engineering, science and mathematics.

STEAM-approach in the hobby groups of elementary-technical profile provides organization of game, research and project activity of pupils taking into account the following components:

– science of general knowledge in astronomy, chemistry, physics, biology, geography, etc.);

– technologies (general knowledge about production, production process, types of materials, human professions, stages of realization of the child creative ideas (projects); safety rules at work, with tools, etc.);

– engineering (general knowledge about modelling, design and scheming etc.);

– art (general knowledge about drawing, basic design, graphic drawing, architecture, culture and crafts, etc.);

– mathematics (general knowledge about mathematics, quantitative ratio, logic, calculation, measurements, logic and mathematical thinking, etc.).

The developing process of the hobby group content for children of the junior school age from the elementary-technical profile on the principles of STEAM-approach.

The objectives of the program of the hobby group STEAM are the development of competencies:

1) cognitive – formation of skills and experience of self-learning new knowledge in the process of technical-creative and research activity, development of cognitive activity during mastering of the personal new vectors of the project activity;

2) practical – formation and development of the pupils' choosing ability of means and technologies of technical design, methods of research activity and skills of solving practical tasks in the process of designing in accordance with specificity of technical-technological, natural-research and art activity;

3) creative – formation of pupils' ability to generate creative and research ideas, elimination of hypotheses, fantasy, determination of creative and technical contradictions, transfer of existing knowledge and skills into new situations, overcoming of the thinking inactivity, independence of judgments, critical thinking;

4) social – development of the experience of team cooperation, establishment of relationships in groups, constructive conflict resolution and fulfilment of different roles in collective; formation of skills to plan, develop and implement joint socially significant projects; development of skills to support mutual relations and solve problems in different cases.

4. Conclusions

Summing up, we can say that the development of modern content of the program STEAM for the primary school children provides an opportunity to go beyond technical activities and promotes the comprehensive development of children's creative and technical thinking, which are extremely important at this age. The topic-educational plan of the hobby group is constructed in such a way as to cover all directions, which are important for education and development of dialectical thinking, and each component of STEAM plays an important role in realization of projects on sections and themes.

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