USE THE TRIZ METHOD TO TEACH MECHANICAL ENGINEERING

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Abstract: ***The systematization of teachers' knowledge in the field of pedagogy, which is to teach educators to understand the unity and contradictions of the world around them and to give concrete practical education to creative individuals who are able to solve any of their problems.***

Keywords: ***Creativity, problem solving, imagination, thinking, inventive problem theory (TSIP).***

Today, the development of science, engineering and technology, the growing needs of society have a significant and positive impact on the educational process, that is, the demand for technical programs and tools to update educational programs, to apply theoretical knowledge in practice leads to the development of creative approach skills. To improve the quality of training in Uzbekistan, to create the necessary conditions for the training of highly educated and qualified specialists on the basis of international standards, to establish close cooperation between each higher education institution and higher education institutions with high international rankings; Wide introduction of advanced pedagogical technologies, curricula and teaching materials based on educational standards, development of creative competencies of students, scientific and pedagogical staff as part of their professional competence, effective use of interactive methods in education, higher education in accordance with the priorities of the Action Strategy identified as the main tasks of quality improvement and radical improvement [1].

After the independence of the Republic of Uzbekistan, the modernization of educational and methodological literature, material and technical base, all structures in all types of educational institutions, including higher education, began. Changes in the socio-economic life of society require modern knowledge and skills. This requirement will lead to the use of new methods of teaching students in higher education. In this regard, it is considered to be important to use the method of TSIP (theory of solution of inventive problems). The purpose of this method is to cultivate a strong mindset and a creative person who is ready to solve complex problems in different areas of society. The TSIP method was invented and developed about 50 years ago by Soviet engineer-technologist Henrikh Saulovich Altshuller [2].

What is the TSIP method? Inventive Problem Theory (TSIP) is a set of algorithms and methods developed by the Soviet inventor Henrikh Saulovich Altshuller and his followers to improve the creative process of scientists.

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TSIP - Although there are recommendations for improving the creative process, Altshuller's theory is aimed at solving so-called "inventor" problems. The task of an invention is a complex one, the solution of which is to identify and resolve the contradictions that lie within the task identify the root cause (the root of the problem) and eliminate the cause. This requires special skills and technology.

Originally designed to help solve technical problems, it helped develop thinking, flexibility, coherence, logical construction, and originality. The main task of this method is to teach students to think and understand themselves.

Applying the TSIP method

The main task of TSIP, according to the author of this theory, is to help inventors find quick solutions to creative problems in various fields of knowledge. TSIP allows the user to solve many creative problems. According to users of Altshuller's theory, knowledge of TSIP provides the following advantages (according to the book "Fundamentals of TSIP") [3]:

• Ability to determine the nature of the task;

• Ability to correctly identify the main directions of the search, not to miss the many points that usually pass;

• Know how to systematize information retrieval to select problems and find solutions.

• Learn how to move away from traditional solutions;

• Ability to think logically, logically and systematically;

• Significantly increase the efficiency of creative work;

• Reducing decision-making time;

• A fresh look at things and events;

• TSIP promotes inventive activity;

• TSIP expands a person’s worldview.

Some people argue that inventive problem-solving theory can only be useful in certain sciences. This is partly true: but the theory has been developed and defined for use in specific technical areas. However, knowledge of TSIP undoubtedly contributes to the application of the TSIP methodology to the humanities and business, due to the universality of the TSIP methodology for any creative task.

Students who master this technique will have the ability to creatively solve problems that arise in a particular situation in life (creativity). The skillful use of TSIP techniques and methods (inventive problem-solving theory) helps the student develop inventiveness, creative imagination, and dialectical thinking. The purpose of TSIP is not only to develop students' imagination, but also to teach them to constantly understand and think about ongoing processes, to provide a clear practical training of creative personality traits capable of understanding the unity and contrast of the world around them and to solve their small problems.

"TSIP is a controlled process of creating something new that combines precision, logic, and intuition, as the founder of the theory, GS Altshuller, and his followers believe. materials - field resources identified [3].

The use of the TSIP methodology dramatically speeds up the search for innovative solutions, significantly increases the likelihood of finding solutions to complex problems and allows anyone who has mastered its tools to find solutions to such problems.

Over the years, the following scientists have made significant contributions to the study of this method. They are V.N.Drujinin, S.L.Rubinstein, E.L.Soldatova, as well as J.P.Gilford, E.P.Torrance, A.Maslow and others. The works of GS Altshuller, MM Zinovkina and others are devoted to the conscious formation and management of creative activity.

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There are a number of studies on the development of creativity based on TSIP technology. For example, the research of EA Fedorova on "Development of creative activity of students through TSIP-pedagogy." In this study, TSIP tools (techniques, analog tasks, database, system operator, etc.) are adapted to solve creative problems in computer science. Presentation of the main material. In his opinion, first of all, you need to understand the popular term “creativity”. In describing a creator, we usually mean an artist who thinks from the outside and in his own way. The term "creativity" is derived from the Latin word "creation," which means creation, and is considered in several senses. First, it is a constant feature of a person that determines his ability to perform creative activities of social significance; level of creative ability, creative ability. Second, it is the ability of a person to create a variety of unique ideas in an unregulated environment, the ability to reject stereotyped ways of thinking and bring new things into the experience. Third, they are unique human creative possibilities that can be expressed in thinking, communication, and certain activities. And fourthly, creativity is understood as a creative ability, a level of creative ability, which is a relatively stable characteristic of the personality [4-9].

It is necessary to use modern pedagogical technologies to develop creative thinking. Pedagogical technology is a method of concretizing the methodology, natural pedagogical activity, which implements a scientifically based project of the educational process. We can say that this is a well-thought-out model of pedagogical and educational activities for the design, organization and conduct of the educational process [9].

The following key characteristics can be identified to define creativity:

- Productivity is the ability of a person to perform a certain number of actions over a period of time;
- Flexibility as the ability to move from one idea to another, to find new solutions;
- originality as the ability to create new, unusual ideas that differ from generally accepted ideas;
- interest, increase sensitivity to problems that do not interest others;
- ability to solve complex problems.

Analyze the problem, look for its solution and practical solution.

All components of this creativity can be developed with the help of innovative pedagogical technology TSIP - inventor problem-solving theory. It is the structure of laws, algorithms, and methods that allow us to find non-standard solutions to different situations. TSIP is a creative science that teaches thinking to find the best and most effective solution. Heinrich Saulovich Altshuller, founder of Inventive Problem Solving Theory (TSIP), is an engineer and science fiction writer. Heinrich Altshuller began to study the methods most commonly used by inventors. There were about forty such techniques, and all of them, together with the invention problem-solving algorithm (ARIZ), formed the basis of TSIP. TSIP first appeared as a technical science. However, according to GS Altshuller, the development of all systems is governed by similar laws, so many of TSIP's ideas and mechanisms can be used to construct theories to solve non-technical creative problems [3]. According to him, any technical problem leads to a situation where every inventor finds himself: there is a moment in which there is no solution and there are many options around ... The method of trial and error is a very shaky and energy-intensive method, but also exemplary and effective. does not guarantee the result.

Modern TSIP pedagogy is a pedagogical system aimed at developing the child's creative thinking to effectively solve the problem. TSIP-pedagogy is based on the theory of solving inventive problems. The content of modern TSIP pedagogy can be described as the interdependence of such areas as the development of creative thinking, the development of creativity, the development of the

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creative personality. TSIP pedagogy is aimed at forming a strong mindset and cultivating a creative personality, prepared to solve complex problems in various areas of activity [3]. Other innovative systems of modern education often address a number of issues that need to be addressed separately. The success of TSIP training is that students who have to solve any difficult problem become more eager to acquire new knowledge. The use of TSIP-pedagogy allows to reveal the creative potential of the child by solving various problems (not only engineering, but also domestic). The basic principle of this method is "Solve the problem yourself". The teacher only suggests the direction of thought, but the child thinks independently. Every age has its own TSIP method ... Small school-age children invent riddles, proverbs, games, puzzles. With age, tasks become more difficult. Let's take a brief look at modern TSIP methods. Problem-solving exercises that develop students' system-logical thinking skills have a special place in the implementation of TSIP technology:

Brainstorming is the process of inventing an invention and finding ways to solve it by listing resources and choosing the ideal solution. It is the process of finding ideas, forming insights, developing creativity in thinking.

The focus object method is a situation in which the properties and characteristics of other, unrelated, spontaneous objects are applied to a variable object. It focuses on developing analytical skills, imagination and creative imagination.

Modern TSIP pedagogy is designed for children and adults of all ages. There are courses available for both preschoolers and students. TSIP-pedagogy teaches us not only to solve creative problems, but also to manage our time consciously. All these qualities, which are formed in a person using TSIP technology, are a key component of creativity. Thus, we can conclude that TSIP technology helps to develop the ability to find new solutions and make effective use of existing resources, as well as to quickly change their minds depending on the situation; ability to come up with new, unusual ideas; develop the ability to solve complex problems. These are all components of creativity.

With the help of TSIP technology, a style of thinking is formed, which is focused not on the acquisition of ready-made knowledge, but on its independent generation; ability to see, set and solve problems in their field of activity; the ability to identify hidden records, to perceive life as a dynamic space of open tasks, to cultivate a worldview attitude. The modern task of education is to cultivate a competitive artist.

Thus, the inventor's problem-solving theory allows the student to engage in creativity based on his or her interests, broadening his or her horizons, developing his or her creative needs, and teaching him or her how to solve creative problems. TSIP forms creative thinking conditioned by a high level of student imagination, which includes: critical thinking, the ability to identify contradictions, predict the possible direction of development, create an algorithm of actions, analyze, synthesize, compare and establish causal relationships. There is an exchange of decision results, one child's decision activates the other's opinion, expands the scope of imagination, stimulates his development. TSIP technology is based on the principles of collaborative pedagogy, puts students and teachers in the position of partners, encourages students to create a climate of success, and thus supports their confidence in their own strengths and abilities, their interest in learning about the world around them.

Creative orientation in teaching leads to the introduction of creative use of acquired knowledge, the achievement of new results in their work, the development of the ability to bring to life experiences, the creation of unique ideas in non-standard settings.

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Due to creativity, a person is always in a state of research and activity, prone to any changes in the reality around him. The development of creative thinking, as a key component of the creative process, is the key to a person's successful creative self-awareness.

The two main ideas of TSIP. First, the development of systems takes place through the intensification and resolution of conflicts. TSIP covers all the ways and means of resolving conflicts that arise during the development of these systems. Second, technical systems evolve according to objective laws that can be studied and used.

In the process of creating the classic TSIP, G.S. Altshuller has trained and educated many followers who are independently developing specific areas of TSIP and spread TSIP around the world.

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