

Features of developing students' technical competencies through TRIZ technologies

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ABSTRACT

The main aspects of using TRIZ methods are that they are all interesting for students, allow them to form knowledge, master creative thinking operations, develop all types of universal educational activities. They help to find solutions to problem situations, reflect on the studied material, develop creative and logical thinking, and evaluate their own work.

Keywords: TRIZ methods, logical thinking

Today, as time progresses rapidly, talented students are required to strive for even higher goals, to be aware of innovations in science, technology and engineering. The world community has recognized that since ancient times, our great ancestors have been passionate about innovation and have initiated the Renaissance in the East. In particular, the desire to gain knowledge, learn a craft, and become a master of a profession was very strong in our ancestors, and this, in turn, led to the emergence of many scientists who have made a great contribution to the development of world science in our country.

Over the past decade, the use of TRIZ tools in many German industrial enterprises has been recommended in the early stages of the innovation process, following the principles of new innovative design, identifying customer needs, identifying complex problems and identifying ideas, developing and optimizing new concepts.

The main aspects of using TRIZ methods are that they are all interesting for students, allow them to form knowledge, master creative thinking operations, develop all types of universal educational activities. They help to find solutions to problem situations, reflect on the studied material, develop creative and logical thinking, and evaluate their own work.

The "Learning Portfolio" method. This method is used to study educational materials, and the purpose of the method is: the student needs to understand his progress in mastering the material and record the results achieved. Each student places in this portfolio the knowledge, skills and competencies he has acquired on a specific topic or section of educational material.

The "Cause–Evidence–Result" method. This method allows you to determine the cause-and-effect relationship for conducting small studies. This method is effective at the stage of explaining the topic, it allows the student to see the prospects and predict the further course of events, encourages them to complete homework on educational materials. To form a logical chain, only one of its components is recommended. Students select a cause (or causes) for a given situation and determine its consequences or find a result close to reality based on certain reasons.

"Ideal" strategy. This is a strategy for developing critical thinking, which allows you to structure the following learning activities: the ability to

identify a problem; the ability to solve a problem and find a strong solution.

"Good-bad" method. The method is aimed at increasing the mental activity of students in educational activities, forming ideas about how to behave in conflict situations. Forming the ability to analyze information, students consciously, in oral form, independently construct words through speech, are required to establish cause-and-effect relationships, build chains of logical thinking, and identify arguments.

In addition, it forms the ability to find positive and negative sides in any object, situation, and eliminate contradictions.

The "chain of signs" method. It is aimed at updating students' knowledge of the signs of objects present in the work. It is designed to develop cognitive skills (comparison, analysis, and synthesis), organization (drawing up an action plan). Forms: describing the object by the names and values of signs; identifying hidden parts from specific parts of the model; drawing up a work plan.

The "PAMN-formula" method. Students learn to express their thoughts consciously and confidently. This method can be used at the stage of learning new material, as it teaches students to form a point of view. The composition of the PAMN formula includes 4 important parts, which are necessary elements for creating a text.

P–position. You need to express your opinion on a specific problem. To do this, you can use the following words: "I believe ...", "I think this problem is worthy of attention / not worthy of attention", "I agree ...".

A–substitution, explanation of your position. Here the teacher requires the student to justify his opinion. The main question here is why do you think so? The student should begin his explanation with the words "Because ...".

M–examples. At least three facts should be cited to substantiate his point of view. This section develops the ability of students to prove their position. The words "For example ...", "I can prove this with the following ..." are used.

N–result. In this final part, final conclusions are required to be made that confirm the point of view. "Thus ...", "In conclusion ...", "Therefore ...", "Based on the above, I came to the following conclusion ...".

TRIZ pedagogy is a specific system, the purpose of which is to educate a creative personality. The following principles of TRIZ pedagogy should be cited:

1. Technical disciplines should be aimed at training creative students who know everything and can do everything.
2. It is recommended to start education from an early age (5 years) and apply it systematically until the age of 13, 15, 16.
3. Students are guided towards a professional specialty and choose their own specialty.
4. Learning is carried out at maximum speed.
5. The training program should be regularly updated and improved.
6. When dividing students into groups, it is necessary to take into account the individual characteristics of the child.
7. The teacher himself should be a universal creative person.

The TRIZ program appeared in the middle of the 20th century, and at first it was not even related to pedagogy. In 1946, the former Soviet engineer, scientist and science fiction writer Henry Altshuller began to study the methods most often used by inventors. There were about forty such techniques, and all of them, together with the inventive problem-solving algorithm (MHQA), formed the basis of TRIZ. During this time, it acquired new algorithms, and in the early 80s, educators took it as the basis for teaching methods in experimental classes and schools.

The goal of TRIZ pedagogy is to develop flexible thinking and imagination, the ability to skillfully and effectively solve complex problems.

In modern pedagogy, the TRIZ program is an innovative solution for working with students, using unique methods of working with students, unusual teaching techniques, and achieving high results.

TRIZ (theory of inventive problem solving) is a special direction of pedagogy that teaches children to think creatively. Many people have a question. Is TRIZ another new, untested method that has become fashionable? Is it really necessary, useful? Or is it better to engage children in other areas that are more

understandable to us instead of TRIZ? Mathematics develops children's logical, algorithmic thinking. Physical education develops physical skills. It develops grammatical and speech abilities in the Russian language. TRIZ develops creative thinking skills. Creative thinking can be developed not only in children, but also in adults. It is natural that things related to creativity such as sculpture, painting, music, dance, poetry immediately come to mind. In fact, this is not the case. True creativity always comes to the fore when a person does something without instructions. For example, when a child arranges his desk in a convenient way for him in your absence, or when a boss decides how to increase productivity without punishing or intimidating employees, in short, when he finds a solution to any problem, a person is practicing creative thinking.

You might think that if a student studies well, does not deviate from the guidance of his parents and teachers, graduates from universities, starts a business, and retires, then what is the use of TRIZ? True, 30-40 years ago, nothing else was needed, people graduated from universities, got a job, and continued to perform the same activities until retirement. But now, in this rapidly developing life, many tasks are performed by robots and automation. Now, no one needs people who are constantly doing the same work. Now, people who approach their work creatively, who can find optimal ways, change templates, save, develop, and provide creative solutions, are valued. So, an important question is looming before us; "How can children be taught to think creatively? "To do this, problems and issues should be posed to the child, so that they can be solved without instructions. This is where children's creative thinking abilities come into play. For example; in the evening, we are sitting around the family bonfire, chatting and warming up, and at this time it is necessary to fry sausages for dinner. As you know, to fry sausages, you need to turn off the fire and reduce it to a smoldering ember. When the fire goes out, it becomes uncomfortable, dark and cold. The problem arises; what should be done so that the fire does not go out and the sausages are fried well? This is a vital creative problem. There is no instruction to solve it. Just as it is difficult to force an overweight person to run, it is equally useless to force a person with undeveloped creative thinking to solve such problems. Children who are not used to creative thinking also get tired of scratching their heads or offer superficial solutions. For example: “Two bonfires need to be lit.” This is where TRIZ pedagogy comes to the rescue. It is useless to force children to solve such real-life problems. First, they need to be prepared for this with simpler exercises.

At the first stage, we learn to ask questions together with the children. As many questions as possible. For example, we need to come up with as many questions as possible about the bonfire.

1. How long can a bonfire burn if we cover it with a metal can?
2. How high can a bonfire burn at a temperature of at least 40 degrees? There are countless such questions. There are no right or wrong answers. There are only different solutions. This teaches children to think again and again. And they will not be afraid to express their ideas. As a result, their creative thinking gradually develops. There are a lot of such exercises in TRIZ pedagogy. They slowly, day by day, develops ingenuity and creativity in children.

TRIZ develops creative and at the same time productive thinking. Some people always think creatively, come up with new proposals, but their thoughts and ideas do not reach the end. With TRIZ, these ideas reach the end by thinking through dozens of options, as a result, it is possible to achieve wonderful non-standard inventions.

This is the main goal of creative thinking.

In schools, problems are given with instructions for solving. But in life, this does not happen. There is no instruction in solving life problems. Everyone solves it in their own way. In the traditional education system, schools work like a factory system. Because this system was formed during the industrial era. At that time, the goal of education was to instill our culture and traditions in the younger generation and to train workers for factories. In traditional education in schools, students only listen,

memorize and repeat ready-made information. Is there logical, critical thinking here? Of course not. It is possible to graduate from school with honors without being creative, without finding solutions to problems, without thinking hard. This is the biggest problem in education.

TRIZ pedagogy teaches us to perceive life through logical, critical thinking right from school

The 21st century requires completely different competencies. Because we need to teach our children to live in a future that we do not yet know. Previously, we used to tell children that your father and grandfather were accountants, they were not bad, you will also become an accountant. At that time, this was true. But now it is impossible to say that. Because today some professions are completely disappearing, and new ones are emerging. For example, we cannot know what professions will be needed in 10-15 years. This means that children need to be able to think for themselves, see problems for themselves, and find non-standard solutions in non-standard situations. Without such qualities, it is difficult, if not impossible, to live in the new world. That is why there is a huge gap between school and life. Many people lose themselves here and are overwhelmed by the whirlpool of problems. It can be said that TRIZists aimed to build a bridge to cross this gap.

Experience shows that when working with TRIZ, conflicts decrease and motivation increases. Any change must first be initiated by a person himself, that is, teachers must be ready for TRIZ.

Anatoly Gin and Evgenia Gin, during TRIZ seminars throughout Russia, constantly conducted a survey of teachers asking “What should an ideal lesson be like?” and summarized them and created a manual called “Priemi pedagogicheskoy tekhniki”. It answers questions such as how to start a lesson that meets the requirements of an ideal lesson, how to give homework, whether it should have freedom of choice, and the opportunity to act so that the child is not bored. The second part of the book provides a set of exercises that develop creative and logical thinking to awaken inventive competencies.

TRIZ can be effectively used in all subjects, including native language, reading, mathematics, technology, and fine arts.

In TRIZ, problematic issues can be called open, and school issues can be called closed. Because textbook issues do not require thinking or analyzing, but rather taking numbers and putting them into memorized formulas. All students solve problems with the same instructions. But does that happen in life? Not everyone faces this problem, right? Let's say they do, everyone finds a solution to the problem in different ways, approaches it in their own way, and each can come to a successful solution. Because when you face a problem in life, you find dozens of options for a solution. For example, you prepare food for lunch every day in advance, but that day the gas and electricity were out. Is this problem correct? You think of three, four, or dozens of options for solving this problem and solve it. That is, if this way does not work, you find another way.

In school issues, characteristics such as effectiveness, critical thinking, logic, motivation, and cooperation are not enough. We show them the way to the solution and simply check them. The mother or teacher is the controller here, the children do not like this. It only worsens the relationship between the teacher and the student, the parent and the child. In TRIZ, the teacher and the student, the mother and the child are on the same side, they agree with each other, give each other ideas, support each other. This unites the two sides in one position. It improves mutual relations. And in school, all children are given the same problem and are required to come up with a ready-made solution.

So, this education system cannot meet the requirements of the modern world. That is why our President Sh.M. Mirziyoyev emphasized the need to create a National Curriculum (NCC). NCC is aimed at eliminating these shortcomings and preparing the future generation for the 21st century. It is aimed at developing logical and critical thinking. Teachers should arm themselves with TRIZ pedagogy in the process of applying NCC.

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