# USING TRIZ TECHNOLOGY TECHNIQUES IN PRIMARY SCHOOL

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***Abstract.*** *The process of understanding, clarifying and formulating a given contradiction, according to TRIZ, is actually the process of formulating a task request, and the process of overcoming a contradiction is the process of solving a problem. Initially, TRIZ was presented by its author Heinrich Altshuller as a Theory for Solving Engineering Problems, i.e. as a theory for overcoming technical contradictions. However, later it began to be understood much more broadly - as the Theory of Solving Inventive Problems. Note that recently, many TRIZ followers have begun to classify inventive problems as problems whose solution is associated with overcoming contradictions, not necessarily technical, but, say, pedagogical, economic or managerial, focused on overcoming contradictions such as "profitability and sustainability", "quality", etc. and price", "leader and follower", etc. Therefore, increasingly, many researchers are offering a broader interpretation of this theory.*

***Keywords:*** *TRIZ - the theory of solving inventive problems, mathematics, primary school, education, training.*

TRIZ - the theory of solving inventive problems - a new domestic technology of creativity, currently known in many countries: the USA, Sweden, France, Japan, Korea, Israel, Vietnam, Spain, Finland, Canada and others. TRIZ began to be created in the fifties by the scientist, engineer, inventor, organizer and teacher Genrikh Saulovich Altshuller. This is a relatively young but rapidly developing science. It was created to solve inventive problems in technology, but nowadays it has found many applications in pedagogy, science, business, psychology and other fields of knowledge. An independent direction has emerged - TRIZ pedagogy, which has adopted all the basic ideas of classical TRIZ.

TRIZ pedagogy is based on:

1) techniques and technologies that promote the development of creative imagination (CTI);

2) a methodology for solving problems based on the laws of development of systems, general principles for resolving contradictions and mechanisms for applying them to solving specific creative problems (OTSM - the general theory of strong thinking);

3) an educational system built on the theory of creative personality development (TRTL).

The main goals of TRIZ education are:

1) development of creative abilities;

2) activation of creative thinking for productive cognitive, research and inventive activities;

3) formation of the qualities of a creative personality.

In the process of working with TRIZ technology, the following competencies are formed:

1. Educational: independently solve educational problems, use individual parts of knowledge and connect them together.

2. Social-personal: see connections between present and past events, enter into discussion and develop your own opinion, cope with uncertainty and complexity.

3. Communicative: listen and take into account the views of other people, defend your point of view, speak in public.

4. Collaboration: make decisions, collaborate and work as a team.

5. Personally adaptive: use new information, come up with new non-standard solutions, show flexibility, be prepared for self-education and self-realization.

Thus, TRIZ technology provides great opportunities for the formation of UUD.

In primary school, mainly RTV techniques and methods are used using TRIZ elements, aimed at the intensive development of students' intellectual abilities.

TRIZ technology techniques can be used at different stages of the lesson.

1. Start of the lesson

NON-STANDARD ENTRANCE TO THE LESSON. A universal TRIZ technique aimed at involving students in active mental activity from the first minutes of the lesson.

The teacher begins the lesson with a controversial fact that is difficult to explain based on existing knowledge.

DELAYED GUESS.A universal TRIZ technique aimed at activating the mental activity of students in the classroom.

1 reception option. At the beginning of the lesson, the teacher gives a riddle (an amazing fact), the answer to which (the key to understanding) will be discovered during the lesson when working on new material.

Reception option 2. Give a riddle (amazing fact) at the end of the lesson to start the next lesson with.

Example.

At the beginning of the lesson, I announced that our conversation would be about poetry, but the children would have to guess the name of the author themselves. The students were offered four poems, printed on a separate sheet of paper, naturally, without indicating the name of the poet.

FANTASTIC GUESS. A universal technique aimed at attracting interest in the topic of the lesson. The technique involves transferring the learning situation to unusual conditions or environments. You can be transported to a fantasy planet; change the value of some parameter that usually remains unchanged; come up with a fantastic animal or plant; transfer a literary hero to modern times; consider a familiar situation from an unusual point of view.

2. Updating knowledge

I TAKE YOU WITH ME. A universal TRIZ technique aimed at updating students' knowledge, facilitating the accumulation of information about the characteristics of objects.

The teacher thinks of a sign by which many objects are collected and names the first object. Students try to guess this feature and take turns naming objects that, in their opinion, have the same meaning of the feature. The teacher answers whether he takes this object or not. The game continues until one of the children determines on what basis the set is collected. Can be used as a warm-up in class.

Example.

U: I'm getting ready to go on a trip. I pack my suitcase and take with me objects that are somewhat similar. Guess on what basis I collect objects. To do this, offer me objects that are

somewhat similar to mine, and I will tell you if I can take them with me. So, I take carrots with me. What do you have?
D: I take cabbage with me.
U: I'm not taking you with me.
D: I take an orange.
U: I'm not taking you with me.
D: I'll take the jellyfish.
U: I'm taking you with me.
D: And I take woodlice with me.
U: I'm taking you with me.
D: Do you take all items whose names begin with the letter “M”?
U: Yes! So, by what feature name did we collect objects? What question do they all answer the same way?
D: Does it start with the letter "M"? U: Who else will pose the question so that it can be answered: “begins with the letter “M””?
D: What letter does it start with?
U: I agree. So, the name of the feature here is the first letter of the word denoting our subject.

FALSE ALTERNATIVE.Universal TRIZ technique. The listener's attention is diverted by the alternative "either-or", expressed completely arbitrarily. None of the suggested answers are correct.

The teacher randomly offers regular riddles and false riddles; children must guess them and indicate their type. For example:
• What is 8 and 4: 11 or 12?
• What grows on a birch tree - apples or pears?
• Is the word “hours” spelled “chesy” or “chisy”?
• Who swims faster - a duckling or a chicken?
• The capital of Russia - Moscow or Minsk?
• What animals live in Africa - mammoths or dinosaurs?
• How many seconds are there in a minute - 10 or 100?

CATCH THE MISTAKE.The teacher offers students information containing an unknown number of errors. Students look for a mistake in a group or individually, argue, and confer. Having reached a certain opinion, the group chooses a speaker. The speaker conveys the results to the teacher or announces the task and the result of its solution in front of the whole class. To prevent the discussion from dragging on, set a time for it in advance.

Russian language. The teacher gives several grammatical (syntax or other) rules. One or more of them are incorrect. Find and prove it wrong.
- The hedgehog rolled into a ball.
- I've already been on a plane.
- We were preparing to meet feathered birds.
- The river is frozen with ice.
- My dad woke me up.

SYSTEM ELEVATOR.The technique is used to consider parts of the object being studied and the object as part of another larger object (the world around us, the Russian language).

“Classroom → first floor → school → Krasnaya street → Michurinsk city → Tambov region → Russian Federation → mainland Eurasia → Northern Hemisphere → planet Earth → Solar system → Milky Way galaxy → Universe”

4. Discussion and problem solving

GOOD BAD. A universal TRIZ technique aimed at activating students’ mental activity in the classroom, forming an idea of how a contradiction works.

Option 1

The teacher sets an object or situation. Students (groups) take turns calling out “pros” and “cons.”

Option 2

The teacher sets the object (situation). The student describes a situation for which this is useful. The next student looks for why this last situation is harmful, etc.

Option 3

Students are divided into three groups: “prosecutors”, “lawyers”, “judges”. The first accuse (look for minuses), the second defend (look for pluses), the third try to resolve the contradiction (leave the “plus” and remove the “minus”).

Example

The class is divided into two teams. The first will find “pros” in the proposed object or situation, the second will find “cons”. We answer one by one, until the first stop.

T: It’s raining today. This is good. Why?
D: Because the mushrooms will grow faster.
U: It’s bad that mushrooms grow quickly, why?
D: Because people won’t have time to collect them, they will become wormy.
U: It’s good that the mushrooms will become wormy. Why?
D: This is good for the worms, they will be able to raise more offspring, etc.

5. Solving educational problems

YES-NO.A universal technique of TRIZ technology: it can captivate both children and adults; puts students in an active position.

The teacher thinks of something (a word, phrase, sentence), the student tries to find the answer by asking questions to which the answerer can only say “yes” and “no” or “both yes and no.”

Example

During the lesson, the syntactical analysis of a sentence was carried out. The wind was noisy all night. As an additional task, the children are asked to guess the word chosen by the teacher from a given sentence in order to repeat information from different sections of the language. I get asked questions:

-Does this word have two syllables? (Yes)
-Is this a functional part of speech? (No)
-Is this word conjugated? (no), etc.

and, based on the teacher's answers, the students eventually find a solution to the problem.

CONNECTIONS. The teacher sets (or the students choose) two objects that, at first glance, are in no way related to each other (alternatively, objects are selected randomly, for example, using a cube). Children build a chain of objects and interactions between them so that the first interaction begins with one of the original objects, and the last one ends with the second object.

Example

U: We will play the game “connections in nature.” For this we need two cubes. On each face is written the name of some natural object: sun, air, soil, etc. We throw the dice. Children throw cubes, soil falls out on one, and a bird falls on the other.

U: Your task is to find connections between these natural objects. Whoever finds it gets the move.

D: Caterpillars develop in the ground, and birds peck at them.

U: Accepted. Roll the dice...etc.

TRIZ RIDDLES. To develop interest in learning the Russian language, I resort to students composing TRIZ riddles, the answers to which are different linguistic units. Most often I use TRIZ riddles of two types: by characteristics and by actions. To make the kids’ work easier, I suggest using algorithms for composing riddles. Usually such work takes place lively; You can compose TRIZ riddles both in class and offer them to children as homework.

Technique “Making riddles” (false riddle). The listener's attention is diverted by the alternative "either-or", expressed completely arbitrarily. None of the suggested answers are correct.

- Is the word “SPOT” spelled “PITNO” or “PETNO”?

Technique “Making riddles” (similar parts).

These riddles differ in that they indicate what each part of the riddle object looks like.

Riddle about glasses. We remove the first column in the table (for example, erase it with an eraser), we get: “2 jellyfish on two hooks, one letter “B”.

CREATE A PASSPORT.The technique is used to systematize and generalize the acquired knowledge; to highlight essential and non-essential features of the phenomenon being studied; creating a brief description of the concept being studied, comparing it with other similar concepts (Russian language, mathematics, the world around us, literature). This is a universal technique for compiling a generalized description of the phenomenon being studied according to a specific plan. Can be used to create characteristics:

during literary reading – heroes of literary works;

We create a passport of a literary hero. Key words for the passport are chosen by the students themselves.

Passport

• Name – Scarecrow the Wise
• Creator – A. Volkov
• Registration – fairy tale “The Wizard of the Emerald City”
• Appearance – straw effigy, painted face, worn blue caftan, worn hat, old blue boots
• Where it is first found – a pole at the blue hedge
• Personal qualities – funny, good-natured, curious, a little stupid
• My deepest desire is brains, because I wanted to be smart

o on the surrounding world – passport of minerals, plants, animals, parts of plants, body systems;
o in mathematics – passport of geometric figures, mathematical quantities;
o in Russian – passport of parts of speech, members of sentences, parts of words, linguistic terms

ELEMENT - FEATURE NAME - FEATURE VALUE.The technique is used to consider the components of the phenomenon being studied and their meanings (the world around us, computer science, the Russian language (composing the lexical meaning of a word)).

For example: school, desk, textbook. To do this, students are asked to answer the questions:

• What class of objects does it belong to?
• What material is the “object” made of?
• What is it used for?”

The students wrote down: “School is a building made of brick, wood, concrete, a place where they study,” “A desk is a piece of furniture, made of wood, people sit at it at school,” “Textbook is a book used to study at school.” The obtained characteristics of the objects are compared with the lexical meaning of the word in the explanatory dictionary. You can also offer the lexical meaning of the word, compiled from the same questions, and students need to guess the word.

PLAN/STORYBOARD.The technique is used to draw up a simple and detailed plan of the read work. Each frame is a schematic representation of the events happening to the characters. A change of frame means a change in the scene of action, a change in the situation for the hero.

6. Knowledge control, feedback, reflection

BACKPACK.-I learned how to plan a text
-I understood such and such a topic
-I finally remembered how a preposition differs from a prefix, etc.

The use of TRIZ technology makes the pedagogical process effective, forms systemic-dialectical thinking, independence of students and deepens their subject knowledge.

Such systems can actually help a person achieve better concentration on the task at hand and carry out various kinds of experiments faster. Thus, they help increase a person’s creative abilities and accelerate the development of new skills. It should be noted that the number of assisted creativity projects is growing rapidly. Two trends have clearly emerged here: 1) Systems aimed at increasing a person’s accessibility to creative skills; 2) Collaborative platforms, facilitating the process of acquiring new creative skills. It is expected that the development of these trends will make creativity more accessible to people and will provide people with the opportunity to seek and create new forms of creative expression. It is generally accepted that the greatest contribution to the development of assisted creativity currently comes from research on machine and deep learning and human-computer interaction. However, I would like to draw the reader’s attention to another possibility and, thereby, another trajectory of the formation and development of assisted creativity, associated with an original approach to solving creative problems, called TRIZ (Theory of Inventive Problem Solving).

First of all, it should be noted that TRIZ is perhaps the only fairly holistic section of knowledge completely devoted to how creative problems should be solved (mainly using the example of technical requests), using a huge range of different empirical and heuristic techniques, including original ones, created within the framework of this theory. Another important advantage of TRIZ is that this theory gives a clear answer to the question – where do problems come from and what causes them to arise. Note that knowing the true reason for the appearance of problems allows you to clearly, effectively and correctly answer such contextual questions “why do we need to solve this particular problem?” and “why do we need to solve this particular problem?” And finally, an important distinctive feature and advantage of TRIZ is that this theory was able to formulate a clear guideline (ideality criterion), which can be considered simultaneously both as a certain criterion for the direction of searching for ideas for solving a problem, and as a criterion for choosing the most effective idea from many competing ideas. At the same time, with regard to technical, and in a more general case, inventive problems, TRIZ has built an original system of

guidelines, techniques and tips (often of a metaphorical nature; let us pay attention to this circumstance - metaphor, as a conscious and very effective way of searching for ideas for solving problems occupies a very significant and well-founded place in TRIZ), how and where one should look for the necessary answers.

Thus, according to TRIZ, it is contradictions that are the real source of problems. Note that this thesis, which clearly answers the question “where do problems come from?”, distinguishes TRIZ from other areas of human knowledge and largely explains the exceptional success of this theory in practice, as well as its popularity among engineers and the world's largest manufacturers. Moreover, from this thesis it follows that the meaning of the request of any task lies in the need (!) to overcome the identified contradiction between the desired result and the available capabilities. The process of understanding, clarifying and formulating a given contradiction, according to TRIZ, is actually the process of formulating a task request, and the process of overcoming a contradiction is the process of solving a problem. Initially, TRIZ was presented by its author Heinrich Altshuller as a Theory for Solving Engineering Problems, i.e. as a theory for overcoming technical contradictions. However, later it began to be understood much more broadly - as the Theory of Solving Inventive Problems. Note that recently, many TRIZ followers have begun to classify inventive problems as problems whose solution is associated with overcoming contradictions, not necessarily technical, but, say, pedagogical, economic or managerial, focused on overcoming contradictions such as “profitability and sustainability”, “quality”, etc. and price”, “leader and follower”, etc. Therefore, increasingly, many researchers are offering a broader interpretation of this theory.

Unfortunately, to date, there has not been a general and unified understanding of the laws of development of systems, including technical ones. All works devoted to this topic describe only specific and some general points. On the other hand, there is clearly a need and need for further research on the development of TRIZ, understood as a general theory for solving creative and innovative problems. First of all, this applies to the tasks that arise during the development of high technology systems, where there are undoubtedly their own patterns. This is especially true for microelectronics, computers, information technology and programming, and artificial intelligence systems, where there are likely to be patterns that have not yet been identified and that could form the basis for their further development. In conclusion, we note that many methodological provisions of semantic modeling echo the TRIZ ideology.

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