METHODS OF INCREASING THE HEURISTIC ACTIVITY OF STUDENTS IN TEACHING PHYSICS

Toshev Salimjon Nurboboevich
Shakhrisabz State Pedagogical Institute
https://doi.org/10.5281/zenodo.10155108

Abstract. Creativity is the driving force behind the fourth industrial civilization in the world today. If you look around, you will come across incomparable and amazing examples of human creativity everywhere: electronic services, virtual reality, square watermelons, harvesting without soil. All these are products of human imagination and thinking. Books, music, buildings, airplanes, and even lamps, which seem commonplace to us today, were once dreams and imaginations, and later they were created as a result of intelligence.

Examples of creativity that began with the invention of the wheel are roaming the universe today. Innovations create conveniences in our daily life, lighten our burdens, and make our distances closer. In this way, creativity has become an integral part of development. There is a great demand for creative thinking professionals in all fields. Every day, experts from the world-famous software products and mobile phone manufacturers are asked for a new idea. As the demand for creative thinking professionals is increasing in the labor market, it is an urgent task to form and develop the unusual thinking ability of students in the educational process.

Keywords: creativity, interactive simulation, visual communication, games that form creative thinking, visual expression, solving intellectual problems, solving scientific problems.

Introduction. Innovations create conveniences in our daily life, lighten our burdens, and make our distances closer. In this way, creativity has become an integral part of development. There is a great demand for creative thinking professionals in all fields. Every day, experts from the world-famous software products and mobile phone manufacturers are asked for a new idea. As the demand for creative thinking professionals is increasing in the labor market, it is an urgent task to form and develop the unusual thinking ability of students in the educational process. Until now, many approaches and methods in the educational system are not focused on creative thinking, but on interpretation and analysis, that is, on understanding and correctly conveying the given information, and on the other hand, on summarizing several pieces of information and drawing a conclusion.

So how do you teach students to think creatively? What changes in thinking are necessary to create innovation? Imagination is more important than knowledge (is it?) In order to develop the qualities of creativity in a person, it is first necessary to know the content of this concept. Creativity is derived from the English word "create" and means to create. Creativity means a person's creative ability to create new things and solve problems. It is based on originality, practicality, unusualness and freedom. Also, creative thinking means comprehensive thinking about a specific issue, approaching the same point from different angles.

Creativity as a personality-developing category is an integral part of human thinking and spirituality, it is not in the multifaceted nature of the knowledge a person has, but in the pursuit of new ideas, reforming and changing established stereotypes, solving life problems. in the process of making unexpected and unusual decisions. That is, creativity cannot be achieved by repeating

the given knowledge, the emergence of a new thought, a new idea is the main condition in the process of creative thinking.

Analysis of the literature on the topic: The analysis of the literature shows that the creative potential of a person is an independent view of the problem, contradictions, critical thinking; ability to analyze any problems, analytical thinking; the ability to find solutions for them; the possibility of transferring knowledge, skills and teaching methods to a new state; it can be manifested in skills such as the ability to combine previously learned methods with new ones. Flexibility of thinking - realizing that the template directions and principles accepted and traditionally existing in society, which are actually thought to be correct, are not able to respond to modern development, to notice new directions and measures, to use them to be able to think and form, to be able to rebuild one's activity and mobilize oneself in new directions of problem solving. Prognosis, and the ability to predict, is the thinking of understanding in advance the nature of future changes in the development of one's field, the causes of their origin, and the periods of their occurrence through a mental analysis. In the process of developing students' creativity, the interactive learning process is considered important. Interactive education is a system of teaching methods based on "subject-subject" relations, based on the needs of the learner to activate cognitive activity, and the educational process is organized on the basis of mutual cooperation. In this case, interaction is based on the principles of student activation, group experience, and feedback. Therefore, the creation of a free-creative environment in the educational process, joint relations of professors, teachers and students and mutual cooperation is to establish a teaching process based on movement.

Research methodology: Creativity as a personality-developing category is an integral part of human thinking and spirituality. manifests itself in making unexpected and unusual decisions in the process of solving life problems. That is, creativity cannot be achieved by repeating the given knowledge, the emergence of a new thought, a new idea is the main condition in the process of creative thinking. This is exactly what Albert Einstein meant when he said, "Imagination is more important than knowledge." Often, unusual ideas and solutions come to a person's mind unexpectedly. For this, first of all, it is necessary to put an end to the sameness and routine in the process of thinking. We abandon molds. The human brain uses templates and stereotypes to "ease" and "facilitate" its work. For example, in the topic of acceleration of free fall in students, the acceleration of free fall is a vector quantity and is denoted by the letter g. $[g]=1$ m/s2

Acceleration of free fall on the Earth's surface (at the latitude of Paris, at sea level), $g=9.80665$ m/s2 Value in vacuum: (at average latitude) $g=9.81$ m/s2; $g_{qutb}=9.83$ m/s2; $h_{equator}=9.79$ m/s2 The free fall of an object in space is called free fall.

The phenomenon of free fall was first discovered by Galileo Galilei in 1589 based on experiments in the Leaning Tower of Pisa. During the study of the phenomenon of free fall, 2 different laws were established.

1. Any freely falling body moves with uniform acceleration.

2. Any freely falling object falls with the same acceleration. This acceleration is called free fall acceleration. By way of proving this topic, the Universal Law of Gravitation. Gravitational force The law of universal gravitation was discovered by Isaac Newton in 1667. The force that pulls any object to the ground is called gravity.
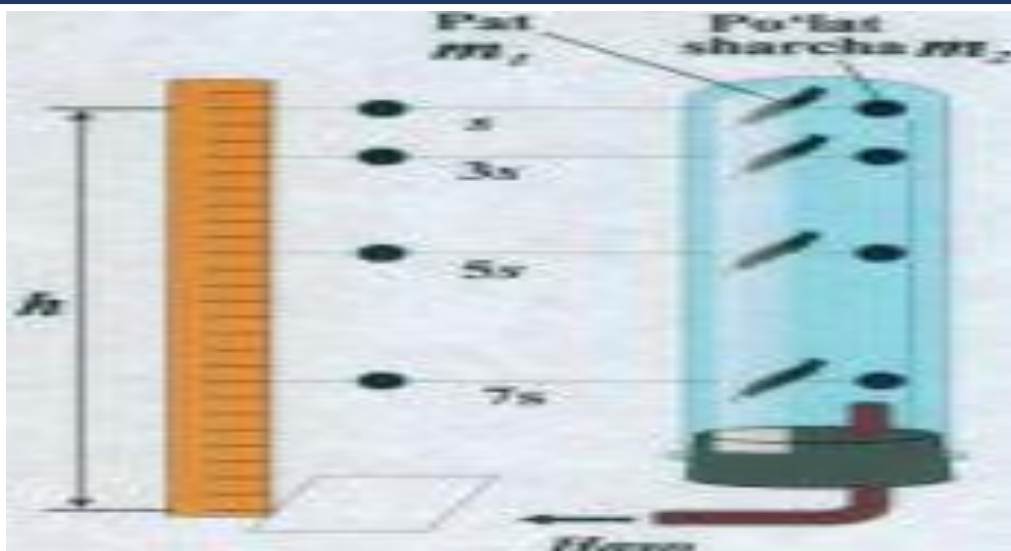
The attraction of objects to each other in the gravitational field is called the law of universal gravitation. Gravitational force acting on an object standing on the surface of the planet equals the force of gravity:

$g_s = G\frac{m}{r^2} = 6.67 * 10^{-11}\frac{N*m^2}{kg^2} * \frac{6*10^{24}kg}{(6,4*10^6)^2} = 9.77\frac{N}{kg} \approx 9.8\frac{N}{kg}$, it will be easier for students to remember.

Everyone agrees that a person should not be separated from the crowd. Moreover, it seems easier to "go with the flow" than to think independently. When thinking through stereotypes, when the human mind is "inquired" about a certain topic, habitual information and judgments arise. For example, when you think of "new year", imagining a full table, carbonated drinks that don't fall off advertising, fir trees, etc., seeing an old man with a cane in his hand and glasses in the image of a grandfather is a form of thinking based on a pattern. Creative thinking people can imagine images that are different from ordinary scenes, notice aspects that no one has seen, and create something new.

The most surprising thing is that the educational process teaches children to think in the same way. It can be seen that the famous inventors and discoverers did not get used to the uniformity of the educational process at school, did not fit into the molds. For example, Albert Einstein was expelled from school or Dmitri Mendeleev got a "three" in chemistry.

Produced by Ken Robinson and has 5 million views on YouTube, Is School Stifling Creativity? This is also mentioned in the video. As a result of children's writing along fixed lines, working through examples when completing assignments, information on how to understand the work in literature lessons, and teachers' evaluation of good performers, children begin to think within the framework of patterns. As a result, many young people ask if there is a role model when given an assignment. This is the result of getting used to working on pre-existing models. In order to eliminate such a situation, it is appropriate to pay attention to education of creative qualities in the educational process. For example, ask students, "If you were given $86,400 in one day, what would you spend it on?" unusual questions like This question develops the student's qualities such as resourcefulness, knowledge, creativity, the ability to look at the issue from different points of view, and reveal hidden aspects. This is because 86,400 represents the number of seconds in a day. The question tells the student that every second is valuable, not to waste it. If the student does not understand the essence of the question, then creative and heuristic qualities are considered low.

There are several forms of thinking based on patterns and stereotypes. For example, polar thinking means accepting everything in two ways - good or bad, seeing the world in black and white. In fact, there is no such thing as good or bad, our thoughts make it so. Each situation and process has positive and negative aspects. One-sided approach, unfounded conclusions are also manifestations of thinking based on stereotypes.

In order to create creativity, it is necessary to recognize the function that limits creativity at the subconscious level of stereotypes, to avoid templates. Following an idol, brand and fashion is an independent thought process. Imitation in dressing, behaving, choosing a profession, even in thinking can limit creative activity. Therefore, giving up the influence that is forcefully inculcated on the human mind through mass media and advertising, as to why I chose this particular dress, why I am buying this drink, is a reason to make an independent decision, to get out of the media environment. Exercises, Thomas Edison said, "Creativity is an involuntary process." But every day many experts feel the need to find unusual solutions to problems. Can they make this involuntary process voluntary? Nature doesn't have a "magic wand" to generate new ideas, but there are many techniques that can help any professional think creatively. For this, it is necessary to devote time to creative thinking, to realize the creative potential. George Bernard Shaw jokingly says, "Most people think twice or three times a year. "The reason I'm famous all over the world is because I think about it once or twice a week." Therefore, it is important not to ignore new thoughts that come to mind, to create an opportunity for thinking.

Limit your creativity. When faced with a challenging problem, set the limits of your creativity. Ask yourself, "What's the simplest solution?" ask. Then imagine an "incredible solution to the problem." Between the simple and the surprising solution, you have a creative space. Now the new idea is not abstract, it has limits. It relieves the psychological pressure in the creative process.

Walt Disney's theory of creative thinking. Walt Disney is a person who created his own industry in the field of entertainment and is known all over the world for his animated cartoons. When creating his world-famous characters, he uses the image of three phases of creativity - a dreamer, a realist, a critic. In the process, he said he heard Bach's "Toccata, fugue re minar". After creating images in his mind, he combines them with reality. How the character moves, how he speaks - he animates and realizes everything as a constructor. After that, the critic reviews the work of the dreamer and the realist. The critic acts as a "filter". Walt Disney's achievement is that he was able to combine the dreamer, the realist and the critic in one person. In normal thinkers, one of them takes precedence.

Do not be indifferent to coincidences. Many inventions were made in emergency and accidental situations. That is, fate itself gives subtle hints to a person. It can be in the form of the apple that fell on Isaac Newton's head, the scientist Alexander Fleming, the scientist who discovered antibiotics, and it was not washed and became moldy.

Connecting the unrelated. By combining the capabilities of a mobile phone and a computer, a tablet, a portable station with an antenna installed on a truck, and a cloth hung on a boat have become sailing ships. The son of J. Dunlop, a Scottish doctor, had difficulty riding a bicycle on a stone road. Dunlop was watering his garden with a hose and noticed its light springy bounce. As a result, he was the first to discover the tire.

It is also important to understand the micro- and macro-signals of creativity, its aspects related to human physiology, that is, to know in what situations new ideas come to a person's mind.

Games that form creative thinking

The "Dreamer, Realist and Critic" method

A role-playing game in which you have to solve a certain problem from three different positions - from the perspective of a dreamer, a realist and a critic. At first, students enter the image of a dreamer and come up with the most extraordinary ideas. In the second, they are pragmatists, they create a clearly integrated plan of action to solve the problem and think it over several times. In the third, students debate, think critically, and find fault with the proposed ideas. The roles can be divided among several people, or each of them can be tried on one student.

"Six hats" method

During the technique, 6 different colored hats must be "put on" by 1 student one by one. In white - the task of carefully and impartially checking all the facts on the topic is carried out, in black - to find flaws, in yellow - to analyze the advantages, in green - to give several ideas and in red - to express an emotional reaction and in blue - it will be necessary to generalize.

Given that there are differences in cultural norms for some forms of creative activity, different values in education, and differences in the way subjects are taught around the world, it can be expected that student outcomes in these areas will vary. When students are assessed in more than one domain, we can make predictions about the strengths and weaknesses of the creative thinking domain at the national level. This data also reveals differences in the extent to which students are encouraged to find their own solutions and ways of expressing their ideas. This is important for how creative thinking in different areas should be taught in school.

WRITTEN EXPRESSION

Writing is a natural means of creative expression both in and out of the school context. Writing plays an important role in improving children's mental and behavioral skills. Fluent writing requires logical consistency. A creative writer invites people to understand and believe in his imagination. This requires the writer to emphasize detail and consistency. For example, even fictional stories about demons and aliens must have an internal logic, meaning within the world the author has created. People who are engaged in writing reflect on the skill and process of writing, determine the expected results of their work, and express creative reactions to the text of others. These steps can open up new areas of intellectual and emotional development for the student, help them better understand themselves and their environment. Moreover, creative writing does not have to be limited to the literary genre, documentary prose can also be creative. In the cognitive test, students must demonstrate their ability to express their imagination in writing. In doing so, they should follow the rules and procedures in such a way that the written communication is understandable and shows its uniqueness for different audiences. A number of test forms have been developed for the field of written expression. Tasks given to students include: open and imaginative written work (there is a size limit as the examiners are human); brainstorming different written formats such as a picture to choose a title for; creative improvement of the written work of others (presented in the test) is required.

VISUAL EXPRESSION

In the domain of visual expression, students express their ideas and experiences through a variety of visual materials and processes (Irish National Teacher Association. Visual expression preparation allows students to analyze pictures with both explicit and implicit content, think about the writing skills and process, and determine the expected outcomes of their work. and react creatively to the text of others. These steps the reader to open up new aspects of intellectual and

emotional development, better themselves and the environment. This type of written creative expression allows students to understand and master the basic rules of effective communication that they will need throughout their lives. Helps you better understand how information, communication and design work. Creative visual expression has grown in importance in recent years: with the proliferation of digital painting and design software, almost everyone will one day engage in visual communication that affects themselves or those around them (for example, think about the importance of visual blindness on a resume you're sending for a job). Test questions for the domain of visual expression require students to: perform an open-ended visual design task using a digital drawing tool; giving a visual design idea based on the proposed scenario (for example, about adding a certain detail, etc.); to give an idea of improving the form of the exhibition presented in the task.

SOCIAL PROBLEM SOLVING

In everyday life, students use creative thinking to solve problems in their various interactions and in society. In this context, creative thinking consists in solving not only the technical aspect of the problem, but also the social aspect, that is, taking into account the needs and perspectives of others, solving global problems in the interpersonal, community and world. Creative thinking in this domain depends on the learner's ability to empathize with others and understand the needs of a particular group, identify connections and provide ideas with emotional value, and propose solutions that are innovative yet workable. Test questions in the domain of social problem solving require the student to perform the following tasks: perform the task of solving an open problem of social importance individually or in a possible group scenario; finding solutions to social problems based on the given scenario; further improvement of the finished solution.

SOLUTION OF A SCIENTIFIC PROBLEM

Creative thinking in science can be reflected in different ways: proposing new ideas that contribute to the advancement of science; design experiments to prove assumptions; development of scientific ideas or inventions applicable to specific areas of practical interest or new planning of scientific/engineering activities. Students can demonstrate creative thinking by experimenting, exploring, and analyzing materials as much as they like during scientific research. Creative thinking in science is very close to the skill of scientific research, but a number of features of this test completely distinguish it from tests in the field of mathematics and science. First, this test emphasizes the generation of new ideas rather than the application of previously taught knowledge. Second, the uniqueness of the student's approach and solutions is evaluated (if the answers are considered valid). A third difference is the use of open-ended questions that do not have a single perfect solution. Finally, this test focuses on a student's creative thinking processes in a scientific context—that is, the student's ability to approach open-ended problem solving rather than the ability to find the "right" or "best" solution. Test questions in the domain of scientific problem solving cover different aspects of creative thinking in different scientific contexts. In general, students are asked to: solve an open-ended problem in a scientific context; based on the presented scenario, give the idea of a solution or hypothesis (hypotheses, assumptions) to problems of a scientific nature; to propose further improvement of the already given solution. In probabilistic tasks, observations about a scientific phenomenon are presented, and the student is asked for a hypothesis to express a different research subject or problem; may also be asked to discover something using a variety of equipment in a laboratory environment. A group of tasks with a more

mathematical focus may require students to develop different methods to represent given properties of data or geometric shapes, or to make as many inferences as possible from a given set of data. can be solved. Also, this task group may present an open engineering problem that requires an innovative solution or a system that needs to be improved. Interactive simulations and games are particularly useful in assessing creative thinking in solving a scientific problem, because in such an environment, the student receives immediate feedback about his choices and actions; Observing how students respond to this feedback provides valuable insight into students' engagement with failure and discovery, which is an integral part of scientific innovation. The importance of content area preparation is undoubtedly an unavoidable problem in most imaginable tasks in this area. Originality without validity has no value, and validity, in turn, requires at least some level of background knowledge or understanding of basic scientific principles.

Conclusions and suggestions In conclusion, we can say that the content of developing students' creative abilities was analyzed based on the requirements of the SES, "creativity", "creative ability", "pedagogical creativity", "interactive teaching", "teaching conditions", "development of creative ability in students" and the essence of the main concepts were revealed.

REFERENCES

1. "Oltita shlyapa" usuli. Texnikani o'tkazishda har xil rangdagi 6 ta bosh kiyimni 1 o'quvchining o'zi birma -bir "kiyishi" kerak. O'quvchi qora rangdagi bosh kiyimni kiyganda qanday fikr bildiriladi?

2. Albert Eynshteynning maktabdan haydalishi yoki Dmitriy Mendeleyevning kimyo fanidan "uch" baho olganini qanday izohlash mumkin?

3. Uolt Disneyning kreativ fikrlash nazariyasi qanday ahamiyatga ega edi?

4. U. Sharifxodjayev, D. Norboyeva. PISA tadqiqotida kreativ fikrlashni baholash doirasi– Toshkent, 2020-yil. 2.A. A. Ismailov va b. Kreativ fikrlashni baholash. Ta'lim inspeksiyasi huzuridagi Ta'lim sifatini baholash bo'yicha xalqaro tadqiqotlarni amalga oshirish milliy markazi. – Toshkent, 2021-yil.

5. A. B. Radjiev va boshq. O'quvchilarning savodxonligining baholash bo'yicha xalqaro tadqiqot dasturi. Qo'llanma. Toshkent, Ta'lim sifatini baholash bo'yicha xalqaro tadqiqotlarni amalga oshirish milliy markazi -2019

6. OECD (2013), PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy, OECD Publishing.

7. Исследование PISA в 2021 году сравнит креативность мышления 15-летних школьников из разных стран http://obrnadzor. gov.ru/ru/press_center/news/index.php?id_4=6958

8. Авдеенко Н. А., Денищева Л. О., Краснянская К. А., Михайлова А. М., Пинская М. А. Креативность для каждого: внедрение развития навыков XXI века в практику российских школ // Вопросы образования. 2018. № 4. С. 282-304.

9. Framework for the Assessment of Creative Thinking in PISA-2021 – Second draft 2019