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METHODS OF DEVELOPING "CREATIVE THINKING" SKILLS IN TEACHING PHYSICS

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ABSTRACT

The article discusses the psychological state of adolescents and opportunities for developing «creative thinking" skills in them. For indirect knowledge that is important for the natural sciences, including physics: - The role of idealization, modelling and scientific experimentation is great. These experiments deal with physical quantities. The values of the physical quantities are determined in units. The article presents an intellectual map of the International System of Units.

KEYWORDS: *Methods, Developing, Interest, Opportunity, Imagination, Mind, Law, Quantity, Unit, System, Direct, Indirect, Measre, Skill, «Full Thinking».*

INTRODUCTION

In this paper, we conseive modern methods of developing students' "creative thinking" in teaching physics to secondary school students.

10th and 11th form of pupils (teenagers) are more familiar with scientific concepts and can use them to solve some mathematical problems. This shows that theoretical and logical thinking skills have been developed in them.They have "adult" motives that require in-depth reflection on the goals and objectives of future activities. In other words, the "games" that were once the leader will begin to disappear and move to the next place. Activities such as education, communication and work will continue to grow. General intellectual abilities, especially comprehension and thinking, are formed.

As a result, jumping and sexual growth in psychological and physical development occur serious changes in the body. They become physically stronger, their abilities increase, their mental development continues, their identity develops, and their interests expand.

At this age, a new self-reliant development factor develops in children. As a result, the contradiction between his objective position and his inner world increases. They have a sense of their own ideas, proving their point, showing their growth. [1]The manifestation of creativity is curiosity. It serves as an incentive to explore the unknown world. Focusing on the unknown events provides a link between the outside and the inside. Involvement in the creative process helps to increase the activity of each person in all areas, to develop his creativity. Increased mental and physical activity during adolescence has a more positive effect on student activity. Now they are more interested in mind-numbing games and exercises that require effort and independence. This allows them to develop their mental abilities, ie "creative thinking" skills. At the same time, the "teaching methods" used in the educational process play an important role in the formation and development of "creative thinking". These styles should encourage students to think freely and increase their independence. Allowing students to enjoy their success will allow them to discover their creative talents and gain strength and confidence. This requires solving problems that require increasing levels of difficulty, a creative approach, discussing and analyzing problem situations, and so on[2]. Solving such problems allows students to assess their own creative potential, to activate their inner potential, that is, to understand themselves. The environment and science teachers in the educational institution will play an important role in the success of these processes.

The following elements should be considered in order to form a creative personality in the educational process:

- Believing that every student is gifted with creativity;

- to achieve a wide range of student development;

- increasing creative work in education;

- being the creative approach of the teacher.

Developing students' "imagination" and "creative thinking" skills in teaching physics

Given the fact that adolescents' brains are well-formed, that is, they can analyze data well, and now they are taught foreign languages, natural subjects such as physics, chemistry, biology, English, German, Russian, etc. Applying existing knowledge in one subject to another gives good results[3]. In teaching most subjects in the natural sciences, including physics, have to rely on students' "imagination." Because they can only be studied indirectly, that is, by results or by some means.Indirect knowledge is knowledge gained by enhancing or facilitating the observation of human senses. An example of this is the knowledge gained through experimentation or modeling. At the same time, to analyze this knowledge, man is endowed with the ability to "think" and reason. These abilities do not mean that man is physiologically limited, and with his help man was able to look from a distance into space to the bottom of a nucleus 10-15 m in size. There are many ways to acquire indirect knowledge.These are:

- idealization - an ideal object is created with some limitations, and with its help the properties of a real object are studied. For example, the concepts of material point, ideal gas, absolute solid.

- modeling-analogy-based method. In this case, the object that is difficult to study is replaced by another object that is similar to it, but easier to study.

- The knowledge gained from studying the model is applied to the initial object. This method is used to study objects that are difficult to study directly. For example, the micro and macro worlds, which are difficult to see.

- Experiment (a scientific experiment) - a method of studying an object that is difficult to know directly. in this situation, human uses devices that enhance the human senses or make it easier to observe. This method transformed man from an observer of nature to a researcher. For example, Rutherford's experiment to determine the structure of the atom.

Imagination is proof that the human brain is the most advanced computer. The computer brain has "electronic literature" about many events. It is not surprising if these "electronic publications" are written in our computer brains through some genes. Our life experiences and knowledge awaken and activate these "e-books" that are "dormant". When we call this "electronic data", events unfold before our eyes.An inner voice describes events, and we can only write down what we hear and see on a piece of white paper.

Each artist depicts a scene differently. This is due to the fact that the landscape made a different impression on them. Similarly, the "electronic description" of a process in the brains of different individuals varies. This is due to the knowledge, experience and previously activated "electronic data" of the "computer brain" owner. Thinking hard about a problem, looking for something new, can activate new "information" that was previously unknown to anyone. This is called "creative thinking." These data can be proven in experiments and turned into "scientific discoveries". Einstein and Bohr's famous intellectual experiments are a good example of this. These experiments were performed in a "computer brain", their "electronic versions" were activated and only then tested in practice. Then it goes into a long memory and becomes "knowledge". As a result, this information creates a template in the brain. Subsequent information is compared with this template, and similarities and differences are noted and converted into new knowledge. The imagination divides and reconstructs the object until it finds the necessary "electronic information", which predicts the result of creation. In other words, it allows things and events that did not exist before to occur.

In addition to acquiring new knowledge using existing knowledge, imagination also helps a person to transfer knowledge from one field to another and use its conclusions to solve new problems. The elements of thought in imagination and imagination in thought complement each other.

According to A. Einstein, imagination is more important than knowledge. Knowledge is limited, “imagination" pervades the whole universe, creating development.

There is a close connection between 'creative thinking' and 'imagination'. Therefore, to improve 'creative thinking', it is recommended to practice painting, imagine the studying process, and draw a picture.

Physics is the study of the simplest and most important laws of natural phenomena, the properties of matter, its structure, and the laws of its motion.

The questions of why, why not, are the basic questions of physics.

Like all-natural sciences, the main goal of physics is to study the laws of the material world around us, the laws of nature.

What are the laws of nature?

It turns out that everything in the material world is closely intertwined. The most important of these connections are the laws of nature. The law shows exactly how changes in nature happen. For example, day alternates with night, summer with autumn, winter with spring. Why is that? It turns out that the reason for the change of day and night is that the Earth revolves around its own axis, and the reason for the change of seasons is that the Earth revolves around the sun. We know that the laws of physics are manifested by looking closely at natural phenomena.

Any physical body changes. For example, a tortoise moves, water evaporates or freezes. Such changes were noticed in ancient times: "It is impossible to enter the same river twice", - said Heraclius 544-583 BC.

The changes that take place with physical objects are called events.

When the composition of a substance changes as a result of a change, such a change is called a chemical event.

If the changes do not change the composition of the substance, such changes are called physical phenomena.

How to understand the meaning of physical phenomena. What methods do physicists use. The basic method of physics is the scientific method of investigation.

Physics, not only in physics, but in all-natural sciences, has the function of a "window to the world" - to see, hear, feel (touch), feel, feel and taste.

Because our senses are imperfect, the information we receive from them can be deceptive. One thinks about what one sees and hears and makes hypotheses. In other words, observation encourages thinking. How do you know if the Hypothesis is right for sure? To do this, special experiments are conducted, and as a result of these experiments, certain knowledge is gained.

Thus, not only physics, but also other natural sciences move along the chain of observation - thinking - experience - knowledge.

Visualization of processes in the teaching of natural sciences, including physics, to students is important in the educational process. Because visual information is recognized and recovered faster. The human brain analyzes visual information sixty thousand times faster than verbal information. Even when people were shown more than two and a half thousand images in 10 seconds, their image recognition rate was no less than 90 per cent. After a year, the figure was 63 per cent. If the information is given orally, after 72 hours, people will remember only 10% of it. If the text is presented in the form of an image, this figure increases to 65%. The colour, location, size, and movement of the image are striking. Therefore, it is advisable to use animations in the

lessons. Therefore, it is advisable to use information technology to increase the productivity of education [4].

One of the most effective ways to visualize information and develop 'creative thinking' skills in education is through the 'Mind Map', which is widely used in education today. [5-7]

Teaching topics in all subjects using Mind Maps helps students to explore topics independently and develop their 'creative thinking' skills. The use of "intelligence maps" in activities activates the right hemisphere of children's brains, and they learn to work in the process of "full thinking". [8-9]

Results. System of international units of physical quantities

Mind map "System of units".

As noted, the main method of verification in physics is experiment. Scientific theories are created in order to explain and justify the results of experiments. All this leads to the study of objective laws that exist in nature and, as a result, to the creation of physical laws related to them. The laws of physics are expressed through certain relationships between physical quantities.

Physical size is a quantity that is quantitatively specific to each physical object, but qualitatively common to many objects and represents one of their properties. [10]

A quantity that fully expresses a physical quantity, both quantitatively and qualitatively, is called its true value.

The values of physical quantities are determined by constantly improving experiments, and their comparison requires the introduction of agreed units (system of units).

The system of physical quantities consists of basic and derivative quantities. There are seven basic physical quantities, three of which represent the basic properties of the material world: length, mass, and time. The other four: current, thermodynamic temperature, amount of matter, and luminosity are derived from a branch of physics.

The value of a physical quantity indicates its magnitude and depends on the unit selected.

A unit of physical quantity is a physical quantity that is used to quantify each physical quantity, conditionally denoted by a numerical value equal to one.

Typically, the unit is denoted by the size symbol: [s] = 1m; [m] = 1 kg and so on. The set of basic and derivative units of physical quantities forms a system of units.

The International System of Units (SI) was adopted at the General Conference on Weights and Measures in 1960 and consists of seven basic units - meters, kilograms, seconds, amperes, kelvins, moles, candelas, and two -the unit is composed of radians and steradians:

meter (m) - the length of the path of light in the space at 1/299792 458 s;

kilogram (kg) is the value of the kilogram determined using the Planck constant. [11]

second (s) is the time equal to 9192631770 of the radiation periods corresponding to the transition between the two ultra-thin surfaces of the basic state of the caesium-133 atom;

Kelvin (K) - a unit of temperature equal to one part of the thermodynamic temperature of the tertiary point of water from 273.15;

ampere (A) is the interaction force of 2 · 10-7 N per meter of length between these thin, infinitely long conductors located parallel to each other in space at a distance of 1 meter is the alternating current that generates;

mol (mol) - the amount of matter in the system, the components of which are equal to the components present in 12C nucleate with a mass of 0.012 kg;

Candela (cd) - light intensity in the direction of a source of monochromatic radiation with a frequency of 540 · 1012 Hz, energy intensity 1/683 W / sr;

radian (rad) - an angle between two radii and the length of the opposite arc is equal to the radius of the circle;

steradian (sr) is the spatial angle at the centre of a sphere, separating the surface from the surface of a sphere equal to the surface of a square whose side is the radius of a sphere.

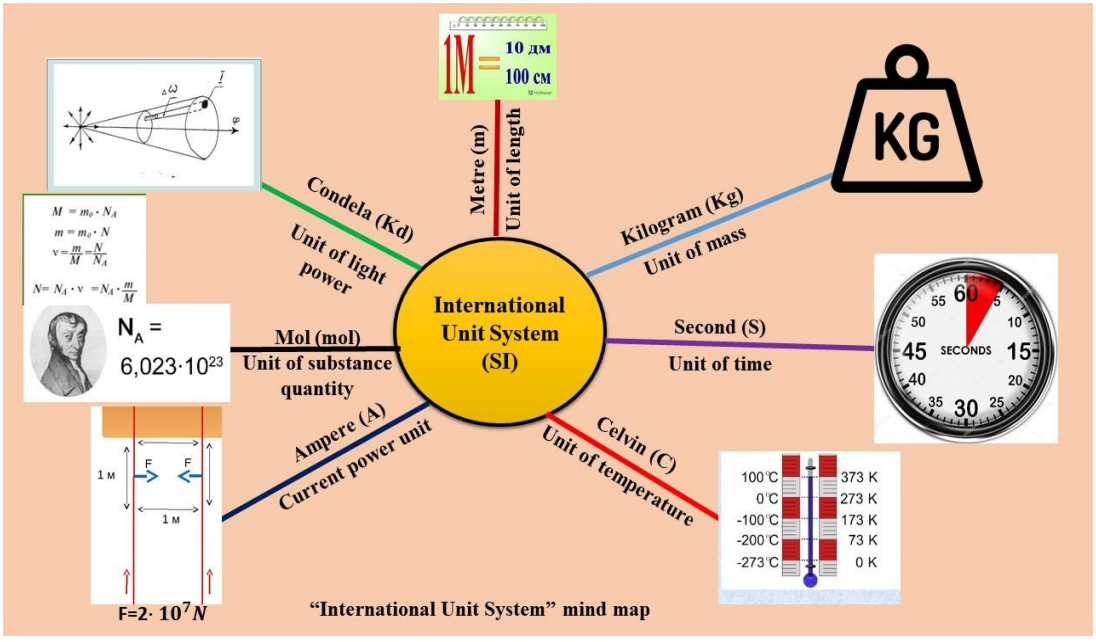
Derivative units are determined according to the laws of physics.

There are two types of measurements:

- Indirect - the numerical values of physical quantities are determined directly using measuring instruments.

- Indirect - numerical values of physical quantities are calculated using the results of measurements of numerical values of other physical quantities.

Using a mind map to teach physics without putting a lot of information together can help students not only develop their “imagination” and “creative thinking” skills, but also their “full thinking” skills. [12-15]



CONCLUSION

The mental states of the 10th and 11th forms were discussed and their sense of greatness, self-demand, and interest in learning about the world.

- Given their interests, it is expedient to use indirect methods of learning, which are important in the teaching of physics, to develop the skills of "creative thinking".
- It is based on the importance of improving the "imagination" and visualizing information to improve the skills of "creative thinking".
- The main method of physics is experiments, in which the values of physical quantities are clarified. The International System of Units (SI) is used to determine the relationships between physical processes.
- The article provides a mind map of physical quantities "International System of Units". Instead of concentrating information on basic physical quantities on a mind map, it allows students to develop their “imagination,” “creative thinking,” and therefore “full thinking” skills.
- It is advisable to use the "mind map" to improve the methods of developing "creative thinking" skills in students.

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