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Developing Students' 'Creative Thinking' Skills In The Course Of 'Law Of Conservation'

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ABSTRACT

This article discusses the opportunities for 10th and 11th graduators in developing "imagination" and "creative thinking" skills. In the teaching of the natural sciences, especially physics, students are required to "indirectly imagine" physical processes. This, in turn, helps students develop 'imagination' and 'creative thinking' skills. The biggest problem in explaining physical processes is the processes that take place in the micro and macrocosm, and the difficulties in visualizing the quantities that characterize them. This problem can be solved with the help of "Mind Map", which serves to visualize the data. For the first time, the article presents the "Laws of Conservation" and the "Law of Conservation and Circulation of Energy" mind maps. They not only help students understand the topics, but also help them develop their "imagination" and "creative thinking" skills.

KEYWORDS

Imagination, creative thinking, comparison, perception, indirect, laws of conservation, energy, impulse, momentum. Homogeneous, isotropic, intelligence map, matter, explosion, combustion.

INTRODUCTION

Improving people's livelihoods will lead to labor productivity, which in turn will lead to the introduction of new areas of science and technology into production and the need for

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professionals who can solve the problems that arise. Those who meet such requirements are called "creative thinkers" [1].

The teaching of "creative thinking" is carried out in the educational process. The teaching of "creative thinking" is carried out in the educational process.

“Creative thinking” is thinking that aims to create something new to find a solution to a problem. Creative thinking in education is a way of thinking that focuses on understanding the meaning of a topic and encourages students to develop their imagination and 'creative thinking'.

People have different thinking abilities. What is the reason for this? Genetics (human biological nature) or environment and upbringing?

In general, the genetic code passed down from generation to generation plays an important role in the formation of the human intellect [2]. DNA is irreversible and unique, and only the first steps are being taken to change it. The 2020 Nobel Prize in Chemistry was awarded to E. Sherpante and Dj Dudna for their discoveries in modifying the DNA of living things and plants by editing the genome [3]. At the same time, scholars acknowledge the unique role of education in the formation of the individual. According to them, the use of innovative teaching methods can improve students' thinking skills and improve their memory dozens of times. This means that although the role of genetics in a person's intellectual potential is significant, the influence of the environment in which he or she grows up is also significant [4].

What changes take place in the human brain during education? Neurobiologist and biochemist Erek Kandel (winner of the 2006 Nobel Prize) has shown that the "transmitter" (neuron) of the human brain changes during education. Even the smallest detail can lead to changes in the structure of the neuron [5].

The cerebral cortex covers the right and left hemispheres of the brain. They control certain human activities. American neurophysiologist Sperry Roger won the semi-Nobel Prize in 1981 for his "discovery of the connection to the functional specialties of the cerebral hemispheres."

The left hemisphere of the brain controls the right side of the body. Logical thinking mechanisms has developed in it.

The right hemisphere of the brain controls the left side of the body. Mechanism of figurative thinking which creates non-standard ideas developed well in it.

In the human brain, neurons that carry information open specific channels of movement. These canals are like "trails". There are no two people in the world who have the same "paths". Different parts of the human brain develop differently. No matter what we do or learn throughout our lives, it affects the shape and appearance of the neurons in our brain. In other words, it changes its "trails" [6].

Subsequent data moves from the previously opened channel, and over time, this channel becomes dominant and becomes the main path. This means that all similar information is stored in this "main path" (the trace in the brain), that is, in memory. It's about understanding information. This is how comparing new information with what is in the brain ("comparative learning"). If there were no such main path, and if there was a separate path for each piece of information, the brain would be full of paths.

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Comparative teaching is the most effective method in the education system. This feature is unique to man and is one of the main factors that make him superior to the computer. Various "models" have been devised to use this method. For example, in physics, such concepts as "material point", "absolute solid", "ideal gas", "point charge" can be cited as such a model.

In his works, Al-Beruni expressed his views on the universality of the laws of nature. G. Galileo, on the other hand, observed the shadows of the mountains on the Moon and found experimentally that the laws of shadow formation were valid for the heliocentric system.

E. Rutherford, who knew the motion of planets in a heliocentric system, analyzed the experimental results and proposed a “planetary model” of the atom.

It concluded that in electrodynamics, based on the Feynman diagram (quantum electrodynamics), which shows that the interaction of charged particles takes place by means of photons, a strong interaction between quarks also occurs by means of similar gluons (G) (quantum chromodynamics).

There are many examples of such unification in physics.

"Comparative learning" is a good way to activate the brain and develop "imagination" and "creative thinking" skills. Allows the brain to "perceive" information in order to "imagine."

Mind - the process by which information is received and analyzed in the brain. It allows us to evaluate things and events in the external world and act accordingly.

Perception, based on information received through sensory channels about things or real events happening around them, is called **direct mind**.

Perception of information given in written, oral and other (visual) forms is called **indirect mind.** [6]

At the same time, the question of how intuition affects perception has been in the spotlight of scientists since ancient times. More precisely, does all information about the external world come through our senses, or is a certain part of it transmitted to perception through the "mind independent of the external world"?

This issue is especially important for the "natural sciences" - the sciences whose subject matter is the laws of nature, the laws that do not arise in human activity. This is because most of the knowledge gained in the study of physics, chemistry and biology, which falls into this category, is obtained "indirectly". In other words, they are obtained through various technical means, computers, information prepared by others, and improved by analyzing their knowledge and experience.

Experience has shown that some of the information we receive for perception has no connection with existence. According to the English philosopher and psychologist Dj Locke's concept of "nativis" vertical (nature-nature), perception is based on the "mind" given to man by nature, more precisely, the information passed through our DNA. Only this information is activated by experience, knowledge, thinking. Our brains store information from the outside world in the form of "memory traces". They, in turn, have a direct impact on perception, the nature and meaning of the "imagined" images.

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Imagination is the remembering of things and events, situations, images of reality.

1) **Passive or compulsive** - unforeseen events, travel, landscapes, communication, imaginary images can occur independently of human will.
2) **Active or voluntary imagination** - it is an image based on information that a person perceives and already exists in the brain. Creative imagination is also active imagination. At the same time, "passive imagination" plays an important role in the "creative process." [6]

Imagination performs several functions:

- Visualize real things in images and use them to solve some problems. For example, the "little human model" (SME). This idea is directly related to the process of thinking.
- Emotional management. Man satisfies some of his needs with the help of "imagination". For example, he imagines good things and enjoys them.
- Manages cognitive processes and the human condition. In particular, it controls perception, attention, memory, speech, emotion. For example, a person can use art to draw attention to an event. With the help of these images, he can control perception, memory and speech.
- Design and programming of activities. Evaluate whether it is done correctly.

There are many ways to develop creative thinking skills. Below we will get acquainted with one of the modern methods "Mind map".

A "mind map" is an analytical tool for finding a solution to any problem based on "creative thinking." [7-9]

Visualizing verbal information increases the effectiveness of teaching several times. In this sense, the Mind Map is an ideal way to teach 'creative thinking'. [10-14]

When creating a mind map, it is necessary to pay attention to the following:

Color. Multicolor helps to improve one's memory and creative thinking. It enlivens the image and enhances its appeal. Helps keep data in memory for a long time.

Image. The brain perceives images faster than words. According to R. Hober's experiment on "image recognition" in 1970, such human memory is in fact "photographic" memory. The average person can remember more than 98% of the 10,000 photos shown to them. As a result, a "Mind Map" of color images can be used as the best means of storing information in the brain.

Word. On the branches of IX are written special words. The point is that each word has its own connection. This in turn leads to the emergence of new ideas. This is because the words in the following sections provide an interest in the content of the object and get to the heart of the matter. In other words, it acts as a loop for the brain and can be used to hang impressions. So creating a “mind map” leads to the development of imagination. This, in turn, activates the right hemisphere of the brain and, consequently, improves "creative thinking" skills.

This has led to the widespread use of Mind Maps in education.

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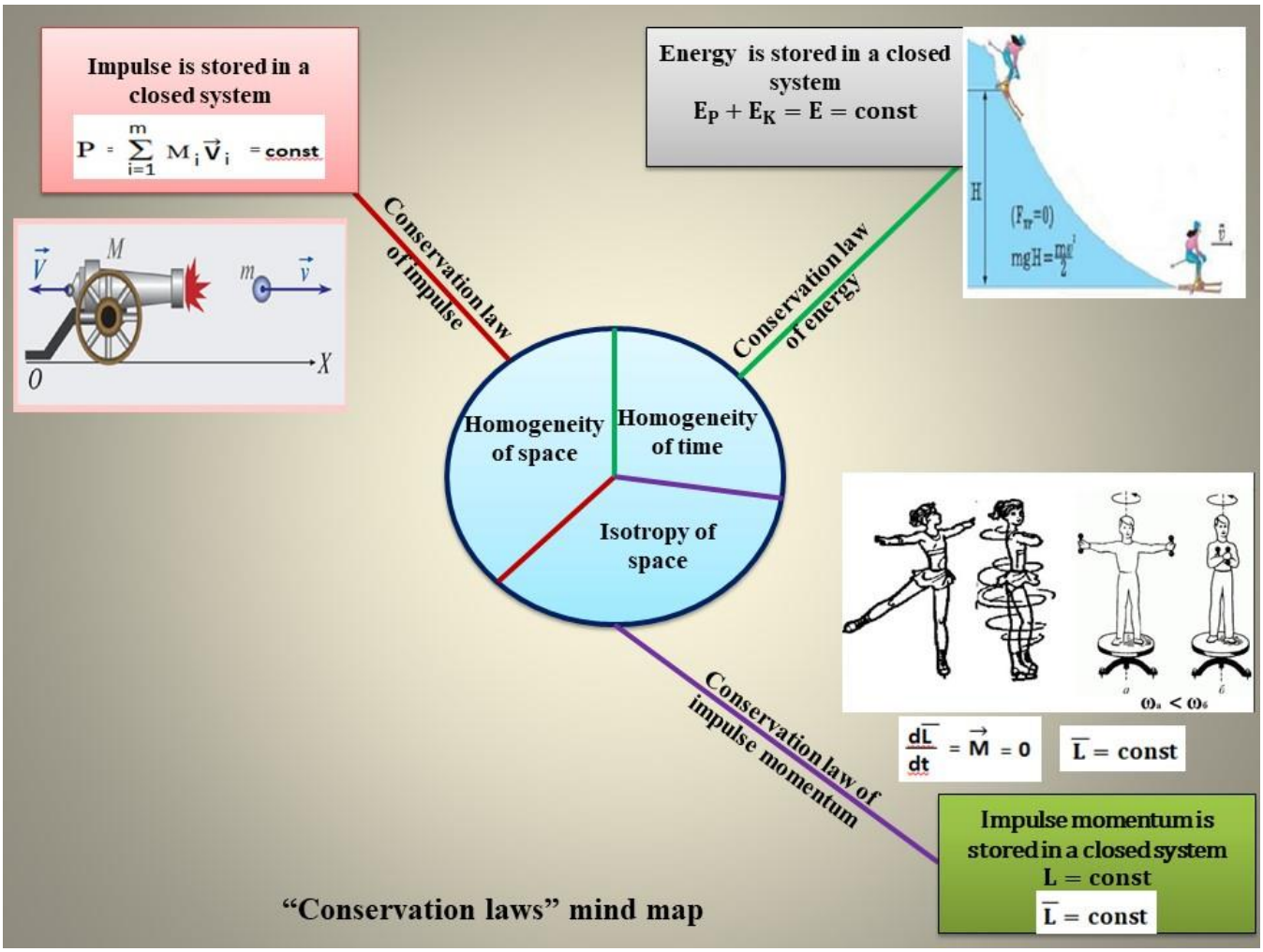
RESULTS

We know that physics studies the general properties of matter, the laws of motion of matter and space. The motion of matter, that is, matter and space, takes place in space and time. Therefore, the question arises as to whether there are universal laws that regulate all the processes that take place in space and time. Such laws exist, and in physics they are called conservation laws. [15,16]

The accuracy of a theory or experimental results is checked by the observance of these laws.

On what are these laws based? Since the motion of matter takes place in space and time, these universal laws must also be based on space and time, that is, on some of their properties. These properties are the homogeneity and isotropy of space, and the homogeneity of time. E. Netter, who introduced this idea to science, believed that the calculation of time, the transfer and rotation of the coordinate system do not affect the properties of the physical process, and that each symmetry of the system corresponds to a certain law of conservation.

This is reflected in the 'Law of Conservation' mind map.



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This mind map shows that the laws of conservation are based on the fundamental laws of nature, which show that the motion of matter is directly related to space and time.

The mind map helps students to "imagine" that the laws of nature are in harmony with space and time, and to develop such skills.

Conservation laws apply in a closed system.

The forces exerted by external bodies on material points in a mechanical system are called external forces. A mechanical system that is not affected by external forces is called a closed system.

Homogeneity of space means the equal strength of all its points. In other words, the physical process takes place in the same way, regardless of where the experiment takes place. The law of conservation of momentum (momentum) is the result of the homogeneity of space.

The law of conservation of momentum for a closed system. To do this, let us record the momentum of each material point that enters the closed system. The momentum of a material point

$$\vec{P}_i = m_i \vec{\vartheta}_i$$

we know that the vector in the form is determined by the magnitude. The total momentum $\vec{P}$ of a closed system consists of the geometric sum $m_1 \vec{\vartheta}_1$, $m_2 \vec{\vartheta}_2$,..., $m_n \vec{\vartheta}_n$ of the momentum of each material point entering the system, i.e.

$$\vec{P} = m_1\vec{\vartheta}_1 + m_2\vec{\vartheta}_2 + \ldots + m_n\vec{\vartheta}_n = \sum_{i=1}^{n} m_i \vec{\vartheta}_i = \sum_{i=1}^{n} \vec{P}_i.$$

So, in a closed system $\vec{F}_t = \frac{d\vec{P}}{dt} = 0$ and for it

$$\vec{P} = \sum_{i=1}^{n} m_i \vec{\vartheta}_i = const.$$

This expression represents the law of conservation of impulse.

The momentum of the closed system is maintained, that is, does not change over time.

The law of conservation of impulse is one of the basic laws of nature, which is fully implemented not only in classical mechanics, but also in all branches of physics. So far, no process has been observed in nature where the law of conservation of impulse has not been fulfilled.

The isotropy of space is the equivalent strength of all its directions. In other words, the physical process takes place in the same way, regardless of the direction in which the experiment takes place. The law of conservation of momentum (impulse momentum) is the result of the isotropy of space.

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If the system is closed, the moment of external forces is zero, that is $\vec{M}$ =o. Then the basic equation of rotational dynamics (dL $^{\rightarrow}$) / dt = M $^{\rightarrow}$ takes the following form $\frac{d\vec{L}}{dt} = \vec{M}\frac{d\vec{L}}{dt}$ =o

Or

L=const.

Thus, in a closed system, the impulse momentum L is maintained, that is does not change over time.

Homogeneity of time. The homogeneity of time means the equal strength of each of its moments. In other words, the occurrence of a physical process does not depend on when the experiment begins (at eight o'clock in the morning or ten o'clock in the evening). The law of conservation of energy is the result of the homogeneity of time.

Energy is a quantitative measure of various forms of action and interaction (from the Greek word energeia - effect). Depending on the shape of the motion of matter, energy also varies. For example, mechanical, thermal, electromagnetic, nuclear energies, and so on. As a result of the interaction, one type of energy is converted into another. But in all these processes, the energy transferred from one body to another (regardless of its shape) is equal to the energy received by the second body from the first.

Is the law of conservation of energy fulfilled in nature? Numerous experiments and theoretical conclusions show that the law of conservation of energy in nature is strictly observed. Only in nature does energy change from one type to another (for example, from mechanical energy to heat energy). That is why this law is also called the law of conservation and circulation of energy. It is one of the basic laws of nature and applies not only to macroscopic but also to the system of microorganisms. That way, the energy is never lost or created. It can only go from one round to another. In a closed system, full energy is stored.

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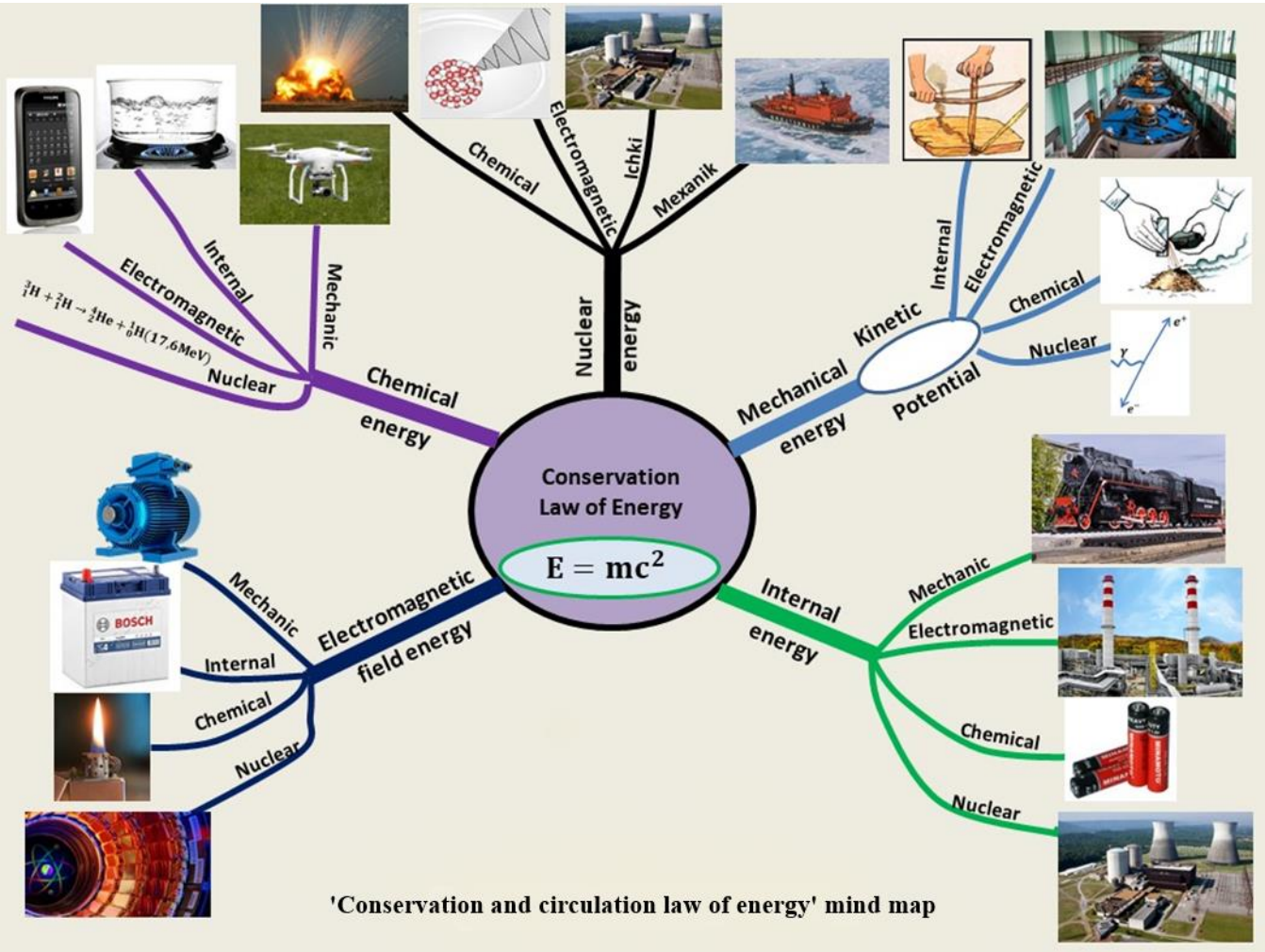

'Conservation and circulation law of energy' mind map

So far there is not any process which does not do the law of conservation of energy. The law of conservation of energy helped in the discovery of the neutrino. The law of conservation of energy was developed by R. Mayer, G. Helmgols, Dj. Joule opened. From the expression E = mc2 it can be seen that in a system where mass and energy are closely related and the speed of light is c = 1, they are equal.

For example, electricity is converted into heat energy, light energy, sound energy, mechanical energy, and so on. [17].

Nuclear energy is the energy that depends on the location of nucleons in the nucleus.

When a nucleus explodes, the energy changes its shape, and the energy stored inside the nucleus is converted into the kinetic energy of the particles, the energy of the electromagnetic field, including the energy of light. But the total mass (mass in mc2) does not change.

Because mass is not matter, it is one of its characteristics. [18,19]

The chemical energy of combustion and explosion is related to the change in the electron shells of atoms.

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Chemical energy is the sum of the gravitational energies of atoms and the energy of attraction of electrons to protons. [20]

This mind map shows the cycle of energy in nature. It helps the student to visualize these various processes and to form ideas about how they happen in our daily lives, in technology, and to develop the skills of 'imagination' and 'creative thinking'.

CONCLUSION

- In the process of learning, it was considered that students can develop the skills of "imagination" and "creative thinking" and improve their memory.
- The human brain "compares" new information with existing ones. Comparative learning is the most effective method of education and is unique to man
- Most of the information in physics is "indirectly perceived", which in turn helps to develop students' "imagination".
- The article introduces students to the basic concepts of physics using the mind map "Laws of Conservation".

"A mind map of nature's fundamental law of conservation and circulation of energy has also been published."

- These "Mind Maps" not only contain a lot of information, but also encourage students to "imagine" and "think" about the processes that take place. This, in turn, helps students develop the skills of "imagination" and "creative thinking."

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