процестерді дамыту (есте сақтау, ойлау, зейін), ұсақ моториканы дамыту. Осы бағыттардың мазмұны оқытудың сабақтастығы қағидатына негізделеді. Мектеп жасына дейінгі балалардың фонемалық есту қабілетін дамыту, дыбысты айтуды дамыту, дыбыстық талдауды дамыту, сондай-ақ лингвистикалық ұғымдармен жұмыс істеу мәселелері қарастырылады. Мектеп жасына дейінгі балалармен сауаттылық негіздері бойынша сабақтарда қолданылатын әдістемелік тәсілдерге мысалдар, сондай-ақ психикалық процестерді дамытуға арналған жаттығулар келтірілген. Мектеп жасына дейінгі балаларды сауаттылыққа үйрету процесінің бірқатар әдістемелік мәселелері анықталған сауалнама нәтижелері ұсынылған. Тәрбиешілерді дайындауға назар аударылды: ЖОО-да пәндерді оқу модульішілік және модульаралық байланысқа ие болуы керек, ал әдістемелік пәндерді оқу дуальді оқыту элементтерімен өтуі керек.

Түйінді сөздер: сауаттылыққа үйрету, мектепке дейінгі дайындық, сауаттылыққа үйретудегі сабақтастық, психикалық процестер, фонемалық есту, сөздерді дыбыстық талдау.

Literacy training for preschoolers at the present stage

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Annotation

The article deals with the problems of teaching literacy to preschoolers at the present stage. The authors are of the opinion that literacy training should be carried out in several directions: the development of the child's oral speech (phonemic hearing, sound analysis), the development of mental processes (memory, thinking, attention), the development of fine motor skills. The content of these areas is based on the principle of continuity of education. The issues of the development of phonemic hearing of preschoolers, the development of sound pronunciation, the development of sound analysis, as well as work on linguistic concepts are considered. Examples of teaching methods used in classes on the basics of literacy with preschoolers, as well as exercises for the development of mental processes are given. The results of the survey are presented with a number of methodological problems identified in the process of teaching literacy to preschoolers. Attention is paid to the training of educators: the study of disciplines at the university should have an intra-module and inter-module connection, and the study of methodological disciplines should take place with elements of dual education.

*Keywords: l*iteracy, preschool education, continuity in literacy, mental processes, phonemic hearing, sound analysis of words.

Поступила в редакцию 06.04.2022.

IRSTI 29.01.45 *DOI 10.51889/1138.2022.58.27.004*

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PROBLEMS OF FORMATION OF FUNDAMENTAL SCIENTIFIC CONCEPTS

Abstract

The system of concepts is the basis of knowledge, all data is concentrated around them. Mastering scientific concepts contributes to a deeper and better understanding of the laws and theories of natural science, as these laws and theories reflect the interdependent relationship between scientific concepts. The high quality of students ' knowledge depends on the degree of formation of their system of concepts. The assimilation of scientific concepts by students, the ability to apply them in practice, in life occurs only with purposeful learning.

The formation of scientific concepts is an active activity aimed at solving cognitive tasks. This activity includes setting and solving problems, formulating and testing hypotheses. The meanings of scientific concepts are revealed only in their system, through their relationships, which reflect the objective connections of things and phenomena. Our article describes the methodology for the formation of scientific concepts. We took the concept of energy as one of the examples of the formation of scientific concepts.

*Keywords: s*cientific knowledge, scientific concept, formation of physical concepts, methodology, level of formation of concepts.

Introduction. Improving students' knowledge of the general subject is developing the knowledge elements that form the basis of that subject. In order to improve the quality of teaching, high school students need to develop scientific laws, theories, and conclusions.

When teaching physics and other natural sciences, the emphasis is placed on scientific concepts, knowledge of basic concepts forms a positive attitude to science and helps to understand physical phenomena.

The structural elements of physical knowledge and physical concept are shown in the figure 1 [1, p.12]. These elements of physical knowledge are closely related to each other. All this learning process is learned, developed and improved at school.

Special attention should be paid to improving the process of forming scientific concepts in the school physics course.

Concepts, having arisen at a certain stage of the development of scientific knowledge, do not remain unchanged. Some of them deepen, refine, expand and rise to a higher level of abstractions, others are replaced by new ones. In nature, all phenomena and bodies are interconnected and interdependent. Concepts reflecting real reality are also in a certain connection with each other and mutually determine each other. So, the concepts of current, resistance and voltage are interrelated. The formation of concepts in the student's mind is a complex and lengthy process of consistent disclosure of qualitative and quantitative features of objects and phenomena.

The main purpose of this scientific article is to show students the methodology for forming scientific concepts.

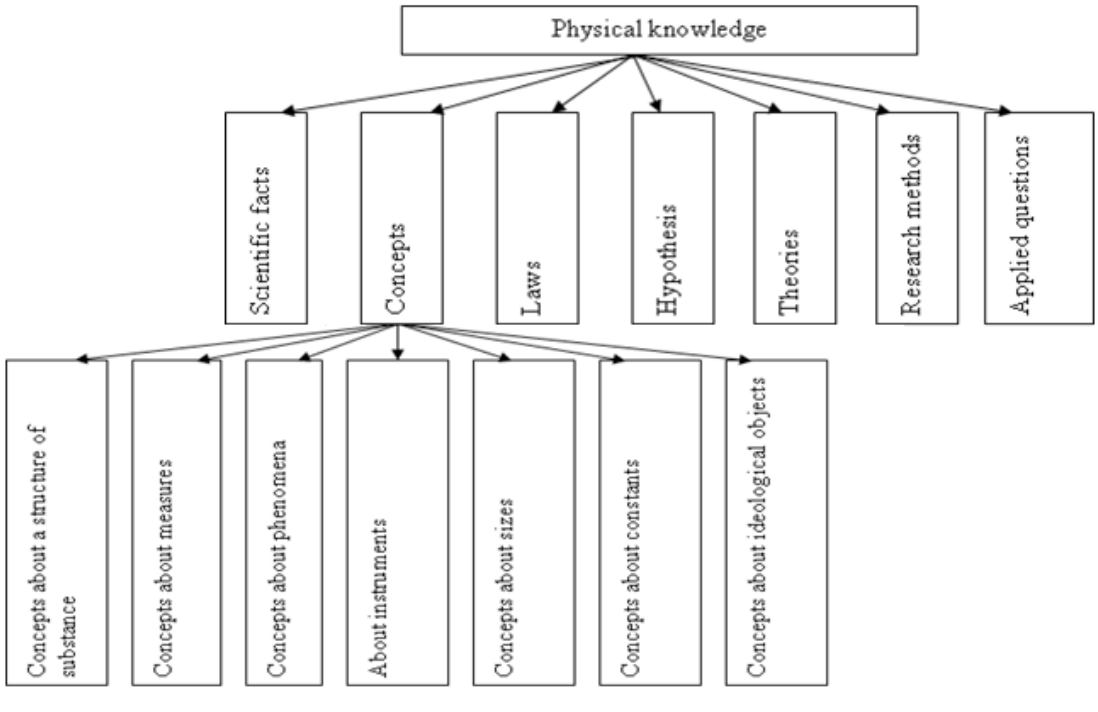

Figure 1. **Structure of physical knowledge and physical concepts**

Research methodology. The basis for the formation of concepts in the minds of students is the creation of certain perceptions and their corresponding representations, as a result of which a temporary connection or conditioned reflex is formed. Each new connection formed is included in the system of temporary connections formed earlier in life experience. The article provides methodological recommendations on the formation of the concept of «Energy» in the school physics course.

Teaching the concept of energy in high school begins in the 7th grade and continues until the 11th grade. For this reason, the teacher needs to know the stages of implementing continuity in energy training in high school.

The concept of energy is one of the main concepts of physics. This concept is also widely used in other natural sciences – chemistry and biology. The essence of the worldview of the formation of this concept is connected with its great role in philosophy[2-4].

The concept of energy is of great importance in improving students ' scientific views and polytechnic training. The importance of the concept of energy in the context of a scientific approach is associated with its great role in philosophy.

The formation of the concept of energy in high school students can be attributed to a specially created system of exercises.

The system of exercises is a didactic condition for improving students ' knowledge and skills and forming skills in the educational process.

In high school, students can use the following ways to form the concept of energy: intra-subject communication between classes, a system of exercises, experimental tasks, information and communication technologies, renewable energy sources[2-4].

When choosing tasks in the system of exercises, special attention is paid to the comprehensive fixation of the signs of the concept. The teacher constantly monitors the accuracy of tasks, especially at the stage of preparatory and control exercises, because students ' mistakes can be corrected. The training system can be organized according to the stages, starting with standard tasks and reports.

The system of exercises is divided into 3 groups according to their role in mastering concepts, which are:

– exercises to identify essential features of the concept and distinguish them from non-essential ones;

– exercises to distinguish similar concepts from each other by certain characteristics;

– exercises for determining the relationship between concepts.

In order to implement the principle of continuity in energy education in secondary school, the use of a system of exercises is of great importance for the development, consolidation of students ' knowledge of energy, and improving their creative abilities [5].

To perform experimental tasks, experiments are carried out with the help of special equipment, and the resulting values are calculated. In the process of creating experimental problems, students 'interest increases, their control develops, and their skills and flexibility in working with equipment are improved. Students will learn more about physical phenomena and patterns. An example of an experimental task is the following task.

Task 1. Determination of the conversion of energies of a load suspended on a thread, the law of energy conservation.

Necessary tools: thread, tripod, cargo

I followed a load tied to a string on a tripod. Just slightly higher than the load, fix the horizontal ruler, for example, a demonstration meter (Fig.2).

It deflects the load to the level of the meter and draws students ' attention to the fact that the load has a potential energy equal to the work performed when lifting it.

He put down his load and stopped again, without hesitation. Attention is drawn to the height at which the cargo rises at the beginning of the demonstration, and to the same height (its attenuation in one swing is not taken into account). He explains that when a load moves downwards, its potential energy is gradually converted to kinetic energy, and when it moves upwards, on the contrary, its kinetic energy is gradually converted to potential energy. During these transformations, the total mechanical energy is preserved without changes.

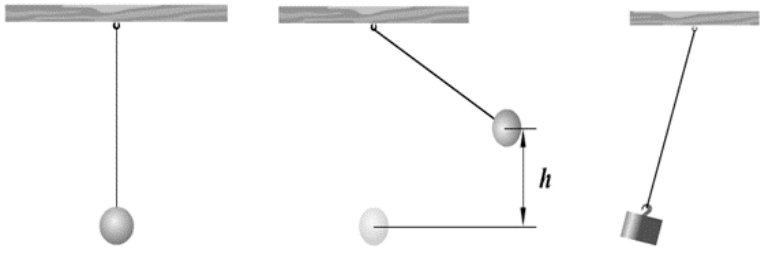

Figure 2.

The gradual attenuation of the pendulum oscillation is explained by the fact that with each swing, some of its energy is irreversibly spent on the work performed against the forces of resistance.

In school, students 'assimilation of scientific concepts within a single joint system can be achieved through their connection with the concepts of other systems studied in previous classes. For example, when forming the concept of thermal motion for students, the teacher gives specific examples, explaining that it is different from the concept of mechanical motion in the past. In the process of forming new concepts in students, previously formed concepts are deepened [6].

In teaching physical concepts in secondary school, to use the approach proposed by V. V. Davydov [7], which first defines the concept and then clarifies and summarizes it. For example, when forming the concept of internal energy, it is taught that a body is equal to the sum of the kinetic energies of the chaotic motion of all its microparticles in the counting system connected to the center of mass and the potential energies of their interaction.

The main conclusions in thermo physics, the foundations of molecular kinetic theory in it, are presented in the following figures. (Figure 3, 4)

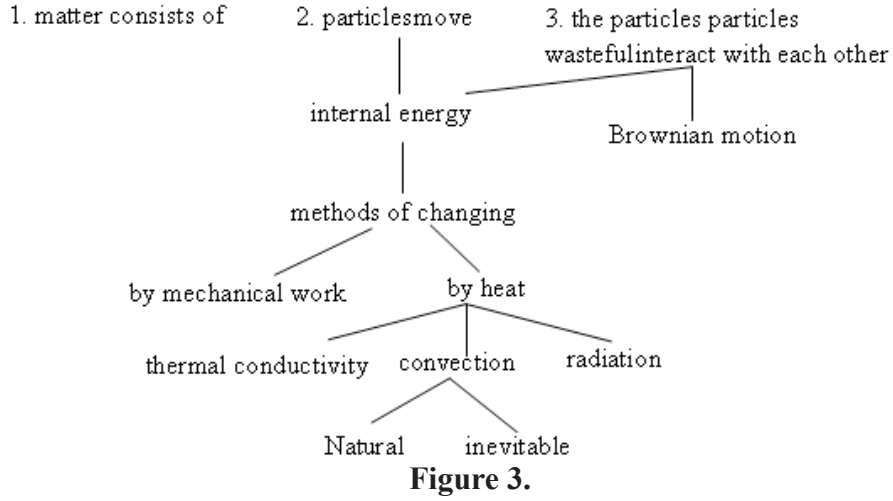

Figure 3.

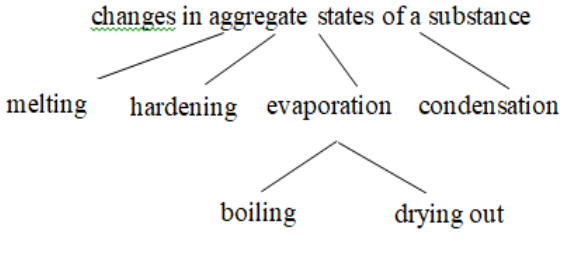

Figure 4.

The next way to form the concept of energy is interdisciplinary communication [8-9], the result will be higher if we take into account the interdisciplinary connection of physics with other natural disciplines, in particular biology. The didactic role of interdisciplinary communication lies in the fact that it allows us to assign the regularity and continuity of knowledge between natural science disciplines[10, 11].

Results and their discussion. It is important to organize independent work for students in order to form scientific concepts. A special place in students' assimilation of concepts is occupied by the use of a generalized plan for studying concepts. The reason why the plan is called generalized: such a plan can be built for all scientific concepts. The plan is useful for both teachers and students when working with any concept. The knowledge of the concept, through the developed plan, opens up a wide range of opportunities for compactness of information about it, emphasis on the most basic issues, and free application to other areas of knowledge. Plans of a generalized nature, which can become the main tool for students to master concepts, are presented below [12, 13].

Based on scientific works and research, we have determined the stages of formation of the concept of energy [14].

Stage 1. With knowledge of energy, students in the 7th grade took part in the «Work. Power. Energy» in the chapter, we get acquainted with the first information about the mechanical energy of a body, its types – kinetic and potential, the potential energy of an elastic deformed spring.

Stage 2. In physics of the 8th grade, students develop their first understanding of internal energy, which they received in Natural Science in the 6th grade, and knowledge of mechanical energy, kinetic and potential energy, which they received in physics of the 7th grade.

Stage 3. The knowledge gained by students in the 7th grade in the law of conservation and rotation of mechanical energy is developed in the 8th grade in the course of passing the topic of conservation and rotation of energy in the thermal process. At this stage, knowledge about mechanical energy, the law of conservation of mechanical energy, internal energy, methods of changing internal energy is developed, and the concept of complete energy is introduced.

At the 4th stage, when teaching the chapter «Fundamentals of thermodynamics» in the 8th grade, students ' knowledge of energy is improved. At this stage, the General Laws of energy transformation that occur in various phenomena of nature are considered. With the development of knowledge about mechanical energy, work, internal energy, fuel energy, the first law of thermodynamics and the second law of thermodynamics are formulated.

At the 5th stage, knowledge of Electrical Energy acquired in the Natural Science of the 6th grade in the 8th grade on the topic: «Operation and power of electric current. Thermal behavior of the current. The law of Joule-Lenz». At this stage, the energy of the electric field, the operation of the electric current, the power, the transformation of the energy of the electric field, the amount of energy (heat) released when the current passes through the conductor, i.e. the Joule-Lenz law, are studied.

At the 6th stage, the concept of energy is further deepened in physics of the 9th grade. At this stage, we implement continuity using the knowledge of mechanical work and mechanical energy familiar to students from the 7th grade. In the 7th grade, students will learn about mechanical energy, its types, the law of conservation of mechanical energy, the transformation of energy from one type to another, and in the 9th grade, on the topics of mechanical work and energy, conservation and rotation of energy, students will learn about the definition of mechanical work by analytical and graphical methods, explain the relationship between work and energy, the law of conservation of energy.

At the 7th stage, when considering the chapter vibrations and waves in the 9th grade, the knowledge gained by students in the 7th grade about mechanical energy, the transformation of mechanical energy from one type to another, and full energy expands. In the 9th grade, students acquire knowledge about energy conversion during vibrations.

At the 8th stage, when teaching the chapter «Atomic nucleus» in the 9th grade, students get

acquainted with the concept of binding energy of the atomic nucleus. In explaining the binding energy of the atomic nucleus, we rely on the knowledge gained by students in chemistry of the 8th grade. «Bond energy» is used to study the structure of the atomic nucleus and the processes occurring in it.

At the 9th stage in physics of the 10th grade in the chapter «laws of conservation» work, energy, kinetic energy theorem, power. The topics of potential energy, conservation of energy and the law of rotation are studied. When teaching these topics, we can implement the principle of continuity based on the knowledge gained by students in Grades 7 and 9.

At the 10th stage, when teaching the chapter «Fundamentals of thermodynamics» in the 10th grade, such concepts as internal energy, methods of changing internal energy, I and II Laws of thermodynamics, and heat engines, familiar to students from the 8th grade, are supplemented and developed. In the 8th grade, internal energy is defined as the sum of the kinetic energies of all particles that make up matter and the potential energies of their interactions: $U = E_k + E_n$. And in the 10th grade, it is taught that a body is equal to the sum of the kinetic energies of the chaotic motion of all its microparticles in the counting system connected to the center of mass and the potential energies of their interaction. In the 10th grade, the concept of degree of freedom is introduced, the internal energy of an ideal gas and the internal energy of a multi-atom gas are studied.

At the 11th stage, students are familiar with the concepts of «Electric field», «Magnetic field» and their characteristics in the section «Electrostatics» in the 10th grade from the chapters fundamentals of electrostatics and electromagnetic phenomena in the 8th grade. In the 10th grade, the concepts of electric field energy, magnetic field energy, energy density, Vortex electric field are studied and the similarity between magnetic and mechanical quantities is shown.

At the 12th stage, based on the knowledge gained by students in the 8th and 10th grades in teaching the chapter of alternating current in the 11th grade, we will introduce you to the basics of electricity generation, supply and advantages of alternating voltage in the supply of electricity, learn the principle of operation of a transformer and its structure, get acquainted with the main sources of electricity in Kazakhstan and the world.

At the 13th stage, in the 11th grade, in the section «Quantum physics», students ' knowledge of the bond energy of Atomic Energy acquired in the 9th grade will be further improved. In the 11th grade, students are shown the calculation of the bond energy of an atomic nucleus and the graphical dependence of the specific bond energy on the mass number of the nucleus.

Based on the works of methodologists, the levels of assimilation of scientific concepts are determined, which we present to you [15, 16].

First level: students distinguish only one object from other objects in mastering concepts, but there are difficulties in reflecting the individual characteristics of this object.

Second level: students can understand the signs of a scientific concept, but they find it difficult to distinguish meaningful signs from meaningless ones.

Third level: students learn all the essential features of the concept, but the concept is not yet generalized to them.

Fourth level: when mastering the concepts of natural science at school, students understand the relationship between the concepts of natural science, which they can use in any situation.

Let's take into account the level of students ' assimilation of these concepts and give specific examples [16-17] (Table 1).

These plans can also be used by students to monitor their activities in mastering concepts, and for teachers to check the quality of students' assimilation of concepts.

The concepts of these plans contribute to the identification of actual problems of learning, help students to work independently with the concept, as well as provide an opportunity to summarize the main ideas of the teacher about the concept, analyze the main directions of teaching the concept.

Working on such plans helps to check the quality of students' assimilation of concepts in a timely manner, and most importantly, students' assimilation of scientific concepts is carried out purposefully and consciously.

Table 1. **Levels of knowledge of concepts by high school students at all four levels**

Physical concept	Main indications of qualitative of mastering physical concepts of students								
	Has knowledges about phenomena characterized by concept	Knows main qualities of concept	Formulate a description of concept free	Can connect concept with other concept	Can show differences of concepts by	Can describe phenomena by concepts	Knows unit of measurement of concent and can	Can write main concept formula	Can solve problems related to
I. The amount of substance (ν)	The relative mass of molecules	m, M, N, N_A connected	+	+	+	+	mole	$\nu = \frac{N}{N_A}$, $\nu = \frac{m}{M}$	+
2.The temperature of gas (T)	Boyle	Changes P, V	+	+	+	+	$^{\circ}C$ (K)	$PV = const$	+
3.Internal energy (U)	The law of conservation and speed of energy	T, V connected	+	+	+	+	J	$U = (\frac{3}{2}\frac{m}{M})$RT	+

Conclusion. The full assimilation of the content of physical concepts by schoolchildren is a condition and a guarantee of successful teaching of physics as a school subject. The importance of the concept of energy in the formation of a scientific worldview in the process of studying the physics course of the main school forces us to rely on the theoretical prerequisites for studying energy, the laws of conservation and rotation of energy, the main property of its objects, reflecting the unity of nature. The level of students ‘ assimilation of the concept of energy is determined by many factors. The most important of them is the methodological training of the teacher. Improving the methodological training of future physics teachers is one of the prerequisites for improving the scientific level of teaching the basic school physics course.

Process of forming physical concepts for students, the teacher should focus on the logical connections and relationships between physical concepts. In order for students to have a high level of knowledge of physical concepts, it is necessary to organize effective methods and techniques.

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Іргелі ғылыми ұғымдарды қалыптастыру мәселелері

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Аңдатпа

Ұғымдар жүйесі – білімнің белдеу қазығы, барлық деректер солардың маңайына шоғырланады. Ғылыми ұғымдар арасындағы тәуелділікті білдіретін заңдар мен теорияларды игеру ұғымдарды меңгермейінше мүмкін емес болып табылады. Оқушылардың білім сапасының жоғары болуы оларда ұғымдар жүйесінің қалыптасу дәрежесіне байланысты болады. Ғылыми ұғымдарды оқушылардың меңгеруі, оны практикада, өмірде қолдана білуі олар мақсатты түрде оқытылғанда ғана жүзеге асады.

Оқушылардың пән бойынша білімі сапалы да, терең болуы үшін оларда жақсы меңгерілген өзара тығыз байланысты негізгі ұғымдар жүйесі қалыптысуы керек. Мақалада физикалық білімнің және физикалық ұғымдар жүйесінің құрылымдық элементтері көрсетілген. Сондай-ақ, мектеп оқушыларына физикалық ұғымдарды қалыптастыру әдістемесі берілген. Физикалық ұғымдарды қалыптастырудың белгі-шарттары, көрсеткіштері және деңгейлері көрсетілген.

Түйін сөздер: ғылыми білім, ғылыми ұғым, физикалық ұғымдарды қалыптастыру, әдістеме, ұғымдарды қалыптастыру деңгейі.

Проблемы формирования фундаментальных научных понятий

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Аннотация

Система понятий – это основа знаний, все данные сосредоточены вокруг них. Без овладения понятиями невозможно и сознательное усвоение законов и теорий, так как они выражают связь между понятиями. Высокое качество знаний учащихся зависит от степени сформированности у них системы понятий. Усвоение учащимися научных понятий, умение применять их на практике, в жизни происходит только при целенаправленном обучении.

Для того чтобы знания учащихся по предмету были как качественными, так и глубокими, у них должна сформироваться хорошо усвоенная система тесно связанных между собой основных понятий. В статье представлены структурные элементы физического знания и системы физических понятий. Также дана методика формирования физических понятий у школьников. Рассмотрены критерии, показатели и уровни формирования физических понятий.

Ключевые слова: научное знание, научное понятие, формирование физических понятий, методика, уровень сформированности понятий

Received 07.06.2022.

IISTI 14.35.07 *DOI 10.51889/7267.2022.67.51.005*

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EDUCATIONAL OPTIONS OF SCIENCE AND RESEARCH IN DEVELOPING THE CREATIVITY OF AN ENGINEERING STUDENT

Abstract

The goal of this essay is to assess the potential of scientific research in both national and international professional education in the creation of a future engineer's creativity.

Methods of research: theoretical examination of foreign and local literature, dialogues, questionnaire analysis, personal experience, undergraduate assessment and self-assessment, generalisation and systematisation of data collected

Research outcomes: the article gives a theoretical analysis and analysis of research results, which allows: to give a formulation and disclose the substance of the idea of "scientific search," to define it as a significant side of the future engineer; to identify processes, models, principles, rules, and kinds of scientific research; to create a methodology for the application of research research as a way of developing a future engineer's creativity;