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Developing the Competence of Future Specialists Through Solution of Professional Problems

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Abstract. In order to effectively organize higher education in the world, to ensure its integrity, continuity and integration, new demands are being placed on the development of the learner's personality. Prospective education in the process of training competitive specialists at the level of labor market requirements in accordance with the Global Convention on the Recognition of Qualifications concerning Higher Education of the UNESCO organization on educational, scientific and cultural issues in prestigious universities and innovative educational centers of developed countries. implementation of technologies is recognized separately. In the process of modernization of higher education in our country, special attention is paid to the supply of qualified specialists. Today, at a time when the process of qualitative renewal is taking place in all parts of our society, the educational system is also rising to a new stage in its development history, now special attention is paid to the creation of an integrated flexible system of continuous education, and it is recognized as one of the priorities of the integration of education and production. Pedagogical conditions, mechanisms, methods and technologies of the formation of a specialist are not fully developed, insufficient integration of education and production in the process of developing the student's professional competence, the integration of theory and practice is not fully ensured.

INTRODUCTION

Technical higher education institutions are characterized by the fact that the professional activities of trained specialists are directly directed to solving complex problems using regularly improving techniques and technologies, and to the production of products that are competitive in the domestic and foreign markets [1]. Therefore, the paradigm of higher technical education is fundamentally different: its purpose, content, and management principle are required to flexibly adapt to the updated production system.

Teaching of general professional subjects in a higher educational institution allows for the formation of professional competence, as well as the creation of psychological and pedagogical conditions that help students to focus on the professionally important direction of professional activity. The teaching technologies developed and used by the teaching staff of higher education institutions are a component of the educational system for determining and training the professional competence of the future specialist, as well as theoretical, practical and motivational training for the initial creation of the professionally important base of acquiring the profession, for the implementation of professional activities at a high level. and helps in the gradual formation of the ability.

The professional development of a future specialist recognizes that the professional qualities and abilities of a person, the growth of professional knowledge and skills, the integration of education and production should find their practical application in work, but as the main factor - the individual's own ability to creatively manifest his capabilities in his professional activity; it is considered that he can build new inner feelings, actively change his lifestyle and his inner world [2].

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Professional competence does not mean the acquisition of separate knowledge and skills by a specialist, but the acquisition of integrative knowledge and actions in each independent direction.

Also, competence requires constant enrichment of professional knowledge, learning new information, understanding important social requirements, finding new information, processing it and being able to apply it in one's work [3].

The development of the specialist's professional competence is manifested by the expression of his unique characteristics in educational and pedagogical situations [4]. In the educational process, the qualities related to intellectual, subject-practical and motivational factors are particularly evident.

Development of professional competence of a future specialist in higher education institutions requires the presence of certain conditions and effective tools.

METHODS

Successful implementation of reforms in the field of education in a society where science and technology are developing requires the organization of ways to improve the educational process in technical higher education institutions, adapt the content, forms and methods of teaching to world standards based on the demands and needs of customer enterprises [5]. Today, there is a mismatch between the requirements for future professionals and the practical professional knowledge and skills of emerging professionals.

In the formation of professional competence of specialists in the higher education system, attention should be paid to the following factors:

- to ensure compatibility of the requirements for the development of the specialist's professional competence with the needs of vocational educational institutions and society;
- taking into account the dependence of the professional competence development of the specialist on education and socio-cultural environment;
- in the professional training of a specialist, the main focus is on the content of educational subjects, the organization of the educational process, and the compatibility of the tools with the student's personal capabilities;
- to be able to see the problems that may arise in professional activity and to achieve the training of a specialist with personal activity who is ready to find their solution;
- education of characteristics aimed at ensuring the organization of professional activity and further development in the specialist;
- the expected and achievable results of the specialist's professional activity, the personality of the student, his direction (requirements, interest, valuable direction, work, consciousness, reasons); level of education (knowledge, qualifications, skills, desire to constantly enrich their knowledge and skills); state of upbringing; socialization; It is determined by such a condition as culture (ability to accept socio-cultural values, intellectual, economic, ecological). The highest level of expected results is the professional competence and qualification of the specialist.

Below we present the analysis of the methods used in the development of the professional competence of future specialists trained in higher educational institutions.

On the basis of the analytical method, scientific and methodical literature on the development of issues related to physical phenomena in technological processes used in mining and metallurgical enterprises were systematically analyzed and ideas were embodied in practical training [6].

On the basis of the observation method, the use of career-oriented issues was observed in higher education in the field of mining and metallurgical industry.

On the basis of the comparison method, methodological bases of solving career-oriented problems and didactic possibilities of teaching in the development of professional competence of students in specialized training sessions in the field of mining and metallurgical industry of higher education were compared.

Based on the method of experiment, a systematic analysis of the methods of solving them was carried out on the basis of the issues that include the technological processes in the production of the studied topic, in order to make the professional training of future specialists of the mining and metallurgical industry system more effective.

RESULTS

Currently, employers in the labor market pay attention not only to the professional knowledge and skills of engineers, but also value the presence of the following personal qualities: independent thinking and the ability to solve various problems; mastery of critical and creative thinking; the presence of a rich vocabulary based on a deep understanding of humanitarian knowledge; ability to adapt to changing life situations while independently acquiring the necessary knowledge; the ability to apply knowledge in practice to solve problems; independent critical thinking, the ability to see emerging problems, the ability to find ways to rationally solve them using modern technology; clearly imagines the possibilities of how to apply existing knowledge; the ability to generate new ideas; competence in working with information; communication (communicability).

Many reforms in the field of higher education carried out in our republic lead to the creation of modern requirements for higher education in the field of mining and metallurgy, as well as in all educational areas.

In the future, the further development of this field is aimed not only at providing services to existing social technologies, but also at the issue of forming an expert personality capable of implementing innovative processes and self-development [7]. At this point, it is necessary to pay attention to the following aspects of higher education in the field of mining and metallurgical industry in order to increase the effectiveness of specialized training:

In order to make the professional training of future specialists of the mining and metallurgical industry system more effective, the following can be indicated as the criteria of the teacher's activity in order to carry out the teaching technology in an integral connection with the production:

- the presence of clear and diagnosed goals, that is, understanding and actions as the result of the expected training, the methods of diagnosing the achievement of the goal in the learner's activity are shown in an orderly and measurable condition;
- presentation of the methods of solving them in a systematic form based on the issues that include technological processes in the production of the studied subject;
- the existence of a sufficiently strict sequence, logic and certain stages in the coverage of the topic;
- demonstrating the relevance of action methods to practice at each stage of the educational process;
- the teacher's use of the most optimal (in terms of effectiveness of the educational process) teaching tools;

It is well known that the role of natural sciences, especially physics, is invaluable in the thorough study of modern manufacturing industry in the field of mining and metallurgy. At this point, it is appropriate to explain with clear evidence how important a phenomenon or law is in the mining and metallurgical industry, not just to give students knowledge and skills in the physics course. Researches have shown that in teaching the topics of the physics course, the content of its production will be disclosed, as well as increase the interest of students in the science, and serve to further increase their professional competence. As a result of the conducted research, it has been shown that the conduct of specialized training in technical higher education institutions is the guarantee of quality training of future specialists for practical activities.

Creating a system of specialized problems (logical tasks) in each department of physics, conducting practical training will further increase the quality of the educational process and lead to the following positive results:

- an opportunity is created for deep and thorough mastering of the given topic;
- the sign leads to the formation of the initial skills and qualifications of specialists and the growth of creative ability and professional competence;
- logical thinking of students is activated;
- students develop the ability to conduct scientific research in their specialties;
- the resulting creative ability leads to the development of independent work skills;
- skills and competencies of working with additional technical literature are formed.

In conclusion, practical training focused on specialization plays an important role in the development of education and production integration.

DISCUSSION

Considering the increased need for minerals around the world, as well as the fact that their extraction and processing are very complex technical processes, the growing demand for qualified personnel for the development of the mining and metallurgical industry requires a fundamental change in the educational process in higher educational institutions that train specialists in this area.

An important element of practical training is the educational task (problem) proposed to be solved. When the teacher selects examples (problems and logical tasks) for practical training, he clearly imagines the didactic goal, what skills and competences will be absorbed as a result of solving each problem, what diligence is required from learners, what is the demonstration of students' competence in solving problems, and the possibilities of revealing their abilities [8]. A feasible solution should be the main criterion.

The analysis of the methodology of solving problems from physics shows that the problem solving algorithm related to all departments of physics has common aspects and distinctive aspects of each department.

We conditionally distinguished the following three steps as a sequence of problem-solving algorithms in practical exercises:

- stage I -each problem is based on a special case of physical laws, therefore, before solving the problems related to the same section, it is recommended to study the physical theory that includes these problems in depth;
- stage II - solving the problem begins with reading it carefully several times and understanding its content. As soon as you read the condition of the problem, you should not immediately focus on the amount you are looking for, try to find it quickly. On the contrary, it is necessary to thoroughly understand the physical phenomena reflected in the problem, to remember the physical laws and formulas underlying this phenomenon. If it is necessary to find a physical quantity or to calculate a chain, it is necessary to clarify what values are given in the problem and hidden conditions, quantities to be found;
- stage III **-** if a diagram or scheme is given in the problem, it is necessary to study them carefully. If there is no drawing or diagram in the problem, the student should draw a diagram that fully reflects the content of the physical process in accordance with the conditions of the problem.

In all technical higher education institutions, problems on determining the density of solids are solved. For example, the hydrostatic gravity method is used to find the density of a rock sample.

For this, a sample weighing 500 g is soaked in paraffin. After that, the weight of the sample in air is 7 N and its weight in water is 4 N, and the true density of the sample rock is found. As additional information, the density of paraffin is given as 870 kg/m^3.

When solving problems of this type, it is appropriate to provide samples of rocks as solid bodies for future specialists of the mining and metallurgical industry. So, it follows what should be taken into account when determining the structure and density of rocks belonging to the type of solid bodies, that is, minerals.

First of all, it should be explained to students that almost all rocks consist of a multiphase system consisting of a solid phase and voids (pores) filled with air and water, and it is not correct to express the density of rocks by the ratio of mineral mass to its volume. When determining their density, the need to take into account the solid and hollow (pores) masses of rocks and the volume they occupy is emphasized, and the expression of rock density is written as follows:

$$\rho = \frac{m_0}{V_0} = \frac{m_к + m_б}{V_к + V_б}, \qquad (1)$$

where m_0 is the mass of the rock consisting of solid $m_к$ and void (pore) $m_б$. The volume V_0 is said to be the sum of solid $V_к$ and void (pore) $V_б$.

Archimedes' law is used to determine the density of solid bodies that do not have the same shape by the method of hydrostatic gravity, according to this law, any body immersed in a liquid loses its weight by the weight of the liquid in the volume displaced by the body, i.e.

$$P_1 - P_2 = \rho_c V_0 g \qquad (2)$$

where P_1 is the weight of the body in air, P_2 is the weight of the body in the liquid, ρ_c is the density of the liquid in which the body is immersed, g is the acceleration of free fall, V_0 is the volume of the body whose density is being determined.

When determining the density of rocks, the porosity of their shape does not allow the use of usual formulas, therefore, the "paraffinization" method is used. In this case, the weight of the sample is first P_1 in air, then immersed in melted paraffin and reweighed [8].

After the paraffin hardens and forms a waterproof layer on the body, the weight of the sample in air P_2 and the weight in liquid P_3 are measured. Based on expressions (1) and (2), we write the improved formula for determining rock density as follows:

$$\rho = \frac{P_1}{P_2 - P_3 - \frac{P_2 - P_1}{\rho_n}} \qquad (3)$$

where ρ_n is the paraffin density.

Creative activity of students is ensured in the practical classes organized in this way, it provides an opportunity to check acquired knowledge, to connect theory with practice, and to study in-depth specialized sciences based on physics. In this case, the teacher should describe the situations in which the technological processes in production enterprises are reflected with the help of the given problem, and distinguish the concepts, formulas and laws related to the same topic that are used in it.

In the practical exercise "Kinematics of a material point", we will give examples of solving problems related to the mining and metallurgical industry.

1. A piece of ore accelerated vertically upward as a result of an ore explosion in a quarry fell back to the ground in 4 seconds: In this case, the ore; 1) initial speed. 2) determine how high it rises. Ignore air resistance.

Given:
$g=10\ m/s^2$
$t=4s$
ϑ_0 -? h -?

Solution:

According to the condition of the problem, if the ore rises vertically, the time of its rise and fall will be equal. In that case, the full descent time of the ore fragment is $t=t_1+t_2$, and the rising time is $t=2t_1$; we will determine that it is from this $t_1=\frac{t}{2}=2c$

From the found rise time, we find the initial velocity of the ore: $\vartheta_0=g\cdot t_1=20m/s$

Given that a lump of ore rises vertically upwards, it moves in a straight line with a flat deceleration, then we determine the height of ascent as: $h=\vartheta_0 t-\frac{gt^2}{2}=20\cdot 2-\frac{10\cdot 4}{2}=20m.$

2. If the coordinate of the ore-carrying train in the mine is given by the time equation x=100+4t-3t2, what is the acceleration of the train?

Given:
$x=100+4t-3t^2$
a -?

Solution:

Progress is the speed of a material point in motion, and to find the speed $\vartheta=\frac{dx}{dt}$, we take the first-order derivative with respect to time from the equation of motion of the train: $\vartheta=x'=(100+4t-3t^2)'=4+6t$

If we derive from this equation one more time in terms of time, we arrive at the expression for calculating the acceleration: $a=\vartheta'=(4-6t)'=-6\frac{m}{s^2}$

3. ϑ 0=1m/s A truck loaded with ore, which is accelerating with an initial speed, has a speed of ϑ 1=7m/s after passing a certain distance. What will be the speed of the belaz in half of this distance.

Given:
ϑ_0=1 m/sec
ϑ_1=7 m/sec
ϑ - ?

Solution:

Its speed after a distance $\vartheta_1^2=\vartheta_0^2+2aS$ will be. And the speed at half the distance is, $\vartheta^2=\vartheta_0^2+2a\frac{s}{2}$ According to the condition of the problem, a truck loaded with ore moves with uniform acceleration.

$aS=\frac{\vartheta_1^2-\vartheta_0^2}{2}$ putting this expression in (4), we derive the expression for calculating the speed of the belaz car at half the distance traveled:

$$\vartheta^2=\vartheta_0^2+\frac{\vartheta_1^2-\vartheta_0^2}{2}=\frac{\vartheta_0^2+\vartheta_1^2}{2} \qquad (4)$$

Based on the physical quantities given in the problem condition, we determine the speed:

$$\vartheta=\sqrt{\frac{\vartheta_0^2+\vartheta_1^2}{2}}=\sqrt{\frac{1^2+7^2}{2}}=5\frac{m}{sek} \qquad (5)$$

There are many issues like the above. Solving professional-oriented issues in the teaching of various subjects of physics helps to understand the practical application of the subject in the field [9]. There are opportunities to solve such problems in the example of all departments of physics. Solving career-oriented problems in physics practical training is important for future specialists of the mining and metallurgical industry to quickly find solutions to problems and technical issues that may arise during their work, to increase their interest in science, and to become qualified specialists in the field.

CONCLUSION

When explaining the topics specified in physics in the curriculum for the training of engineering personnel in technical universities, solving problems focused on professional activity, reflecting the physical processes and production technologies that future specialists should have, is one of the important steps in improving the professional competence of the future specialist.

Creating a system of professionally oriented issues related to the topic and choosing the necessary issues for training increases the effectiveness of the educational process, as a result of research, it has been proven that the lessons conducted in this way not only increase the interest of students in the chosen specialty, but also teach them to think creatively and create a wide opportunity to develop the coherence between science and production. Research has shown that in the teaching of physics subjects, revealing its content in production serves to further increase students' interest in science and professional competence.

Today, the future specialist needs to develop the scale of scientific research aimed at creating the necessary conditions for the activities of personnel as mature specialists in their industry in modern production conditions, the introduction of professionally oriented training technologies, improving teaching methods, and providing an educational, methodological and didactic system.

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