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V.M. Bazurin
Glukhiv national pedagogical university named by Olexander Dovzhenko, Ukraine
vbazurin@gmail.com

PRACTICAL-ORIENTED APPROACH IN FIELD OF PHYSICS OF FUTURE TEACHERS OF PROFESSIONAL EDUCATION AND TEACHERS OF TECHNOLOGIES

Abstract. *The article deals with the main ways of applying the practice-oriented approach in the study of general physics of students in the areas of training 015.01 "Vocational education. Construction" and 014.10 "Secondary education. Labor training and technology": situational tasks and practical-oriented laboratory work. Differences in the subject of tasks and laboratory work are determined, which is connected with the specifics of future professional activity of students. For students the direction of preparation 015.01 "Professional education. Construction "professionally-oriented tasks are static tasks, problems on equinoxpressed motion, tasks on heat conductivity, heat exchange, calculations of electric circuits of alternating current, determination of illumination in the room. For students the direction of preparation is 014.10 "Secondary education. Labor studies and technologies »such tasks are tasks on tension-compression, tasks on the dynamics of rotational motion, the problem of changing the aggregate state of matter, the problem of calculating the circuits of constant and alternating current, the task of determining the illumination of the room. Practical-oriented laboratory work also takes into account the specifics of future professional activities of students. The application of a practice-oriented approach to learning contributes to the growth of student motivation and, accordingly, their success in the process of studying general physics.*

Key words: *general physics, practice-oriented approach, future teachers of vocational training, future teachers of labor education and technologies.*

Formulation of the problem. In today's conditions, the requirements for the fundamental training of teachers of vocational education and technology teachers are growing. However, the number of classrooms devoted to studying the disciplines of the fundamental cycle decreases each year. This leads to the fact that the level of fundamental training of students of these specialties is gradually decreasing. Scientists [9] note a decline in the level of knowledge of physics students of the first year.

However, it should be noted that for the engineer-educators in the direction of preparation "Construction" physics is one of the most important fundamental disciplines, since their further education and future professional activities are inextricably linked with the implementation of calculations. Following the study of general physics, future faculty members of the construction discipline study construction mechanics, reinforced concrete structures and a number of other disciplines that rely on knowledge of physical laws and phenomena.

For technology teachers, knowledge of physical laws and phenomena is based on disciplines such as the basics of production, resistance to materials, thermal and hydraulic machines, technical mechanics, and others.

Consequently, the importance of general physics is due to its connection with other disciplines. One of the ways to increase the motivation of students in the process of studying physics is the professional orientation of the course of general physics in pedagogical universities, that is, a practice-oriented approach. However, reducing the number of hours to study general physics, reducing the level of knowledge of entrants in physics, and a number of other factors predetermine the need to use all possible factors for motivating students to study this discipline.

Analysis of actual research. Problems of teaching physics in higher educational institutions were studied by B.I. Sus, S.P.Velychko, M.I. Shut, O.M. Lyashenko, M.V. Golovko, P.S.Atamanchuk, V.P.Sergienko and others.

Problems of realization of a practical approach to the study of physics are given attention in the works of S.M.Kilimnik [5]. The researcher notes that the formation of the skills of the professionally-oriented activities of students depends not only on the skills and abilities of mental activities, but also on the degree of student's motivation development.

Problems of the development of teaching and methodological support in physics for students of higher educational institutions are devoted to the research of Yu.V.Eceklo [3], A.M.Silveister [9] and others.

Purpose of the article. The purpose of the article is to reveal the peculiarities of situational tasks and professionally-directed laboratory works as means of implementing a practical-oriented approach in the study of general physics.

Presenting main material.

Situation tasks as one of the means of implementing a practical approach in the study of physics. General physics plays an important role in the fundamental training of technology teachers and professors in the construction sector. Students in these areas of study will further study a number of disciplines based on the knowledge, skills and abilities acquired during the study of general physics. Future technology teachers will continue to study materials science, technical mechanics, thermal and hydraulic machines, resistance to materials and other disciplines. Most of the above disciplines involve performing calculations based on physical tasks. The logic and consistency of calculations are similar to those that are performed in physical tasks. Therefore, it is advisable to develop physical tasks of professional direction.

Future teachers of practical training in the direction of "Construction" will further study theoretical mechanics, building materials science, building mechanics, concrete structures and other disciplines. These disciplines provide for the implementation of calculations related to the further professional activity of students.

When entering higher education, students have chosen a profession, therefore they have some motivation to master the chosen profession. Accordingly, the greatest effect of learning will be in the case when students will study disciplines of professional orientation, and disciplines of the fundamental cycle will have a professional orientation.

Researchers [4] note that students acquire professional skills in the study of fundamental disciplines, which include general physics. That is why an important professional-oriented approach becomes important.

I. Palshkova interprets the practice-oriented approach as a "set of theoretical and methodological positions", which makes it possible to understand "the practical activity of teachers as object-object interaction, the consequence of which is a change not only in the object environment, but also in the subject itself ", and social reality appears as a set of human practices (skills, skills, actions, customs) [8].

Practical-oriented approach to the study of physics is that the student's activities are aimed at acquiring not only fundamental knowledge, but also the practical exercise that is characteristic of professionals in the profession.

Practical-oriented approach to the study of general physics becomes important. One of the ways of implementing this approach to the study of physics in a higher educational institution is the use of professionally-oriented tasks in physics. Professionally oriented tasks must be constructed so that the student's actions are directed not only to achieve the result but also to perform the calculations themselves, to search for the necessary information, that is, to carry out actions that will be carried out in the course of professional activity [5, p.25] .

One of the types of professionally oriented tasks is a situational task. One of the most commonly used methods is the method of situational problems.

Situation problem is a problem that contains a description of a particular situation, usually problematic [1]. These tasks can be calculated and qualitative. We are more interested in settlement tasks, because any inferences, made by a future specialist, must be supported by calculations. This distinguishes the process of studying physics in high school from its study in high school.

Situational tasks are a powerful learning tool. In the case of skilled applications, situational tasks have a positive effect on the motivation of learning [6]. In order to create maximum effect, situational tasks must meet certain requirements. Scientists [7] formulate the following requirements for situational tasks:

1. Relationship with life. The task should be formulated so that the student could establish a direct connection of the problem with life.

2. The possibility of interpreting this situation from the point of view of participants.

3. There is a problem and contradiction. This is what motivates students to solve problems.

4. Compliance with the level of knowledge, skills and abilities of students, as well as the time frame. In practice, this means that students should set a task that is feasible for them. The task solution should not go beyond the timeframe for studying the discipline or module.

5. Possibility of different solutions. The task must have different solutions. This encourages students to find solutions to the problem, and forms the ability to evaluate the advantages and disadvantages of various options for solving problems.

However, in the process of studying general physics, most of the tasks used are usually typical, since this greatly reduces the time for teaching students the methods of solving tasks.

Typical tasks consist of a condition and non-problematic issues. The answer to such tasks is usually non-alternative: yes or no, or numerical value. To solve typical tasks, it is enough to explain to the student the algorithm of their solution.

Situational tasks have certain differences from the typical ones. The algorithm for solving situational problems is usually absent, students need to independently develop it. The solution of a situational problem may have several options, and the student must choose the best option and justify his choice.

In situational problems a situation is created that simulates the professional activity of a future specialist or a case of life, as well as formulates the problem in the form of problematic issues or tasks. In this case, the practice-oriented approach is organically combined with the problem approach in the study of physics. Solving the problem situation is unknown to the student, requires the use of previously acquired theoretical knowledge and skills. Problem situation should cause the student difficulty and the need to apply a creative approach [7].

Situational tasks can contain elements of typical tasks (calculations). This is due to the fact that in the further professional activity and engineer-educators of the construction profile, and the technology teacher must perform the calculations. With regard to the situational task, the calculations should justify the optimality of the chosen solution for the problem.

The structure of a situational task should contain the following elements:

1) the condition of the problem (a description of a practical situation that simulates the elements of professional activity of a specialist, a case of life or interpersonal relations);

2) Problem issues or tasks for which there are no ready answers. To answer these questions, you should apply the previously acquired theoretical knowledge and practical skills, creatively approach the task solving;

3) non-problematic issues (in the case when the task contains elements of typical tasks [7].

Scientists [7] note that during the development of situational tasks should take into account the principle of individualization of training, that is, each student must solve the problem in its own way. The number of tasks that a student should solve on a practical lesson depends on the level of preparation of the group and the complexity of the tasks. All these factors are difficult to consider.

M.K Alferieva divided situational tasks into three groups:

1) interdisciplinary tasks;

2) tasks of social life;

3) tasks from various fields of professional human activity [1].

For students the directions of training 014.10 «Technological education» and 015.01 «Professional education. Construction »are common: 1) interdisciplinary tasks; 2) the tasks of social life.

Tasks of the third group (from different fields of professional activity of the person) differ for students of both directions of preparation. Therefore, it is necessary to analyze the peculiarities of the professional activity of these students in order to identify common features and further unify the course of general physics.

The course of general physics for students of the areas of training 015.01 «Construction» and 014.10 «Technological education» consists of the following modules: «Mechanics», «Fundamentals of molecular physics and thermodynamics», «Electricity and magnetism», «Optics, quantum and nuclear physics». However, the future professional activity of students of these areas of training is significantly different (for almost complete identity theoretical training and similarity of typical tasks).

Future teachers of disciplines in the construction profile require a good understanding of such physical processes and phenomena, the execution of calculations:

Table 1

The subjects of physical tasks for students studying in the field of training 015.01 "Vocational education. Construction"

Module name	Understanding physical processes and phenomena	Performing calculations
Mechanics	static load Acceleration in equilibrium motion distribution of static load on the rod;	durability of solid and combined structures; load movement up and down
The Basis of Molecular Physics and Thermodynamics	Heat Transfer, Thermal Conductivity	Thermal Conductivity of Walls and Roofs of the House; indoor heat exchange
Electricity and magnetism	electrical conductivity, resistance, ohm law, inductive and capacitive resistance	current in a circle of single-phase and three-phase current, calculation of resistance of conductor, calculation of circuit resistance in AC circuits
Optics, quantum and nuclear physics	light flux, illumination	the room illumination

Illustrate what you said with examples of problems.

Static The strength of the brick is 90 MPa. Determine the maximum height of a brick wall, which has a six-fold safety margin.

Dynamics. The strength of the steel cable of the crane is 120 MPa. Determine the maximum acceleration with which the crane can lift a load of 3 tons.

Thermodynamics. Determine the minimum thickness of the brick wall of the building if it is to provide thermal insulation for a temperature difference of -20 ° C (outside) to + 20 ° C (inside).

Electricity and magnetism. Determine the resistance of the coil with an inductance of 0.1 mH in an alternating current circle, if the current frequency is 50 Hz.

Optics. Determine the illumination on a table height of 0.7 m, which is located directly below the incandescent lamp of 100 W, hanging at a height of 2.5 m.

Table 2

Subjects of physical tasks for students studying in the field of preparation 014.10 "Secondary education. Labor training and technology"

Module name	Understanding physical processes and phenomena	Performing calculations
Mechanics	of kinematics dynamics of rotational motion mechanics of fluid and gases	rotation frequency of the workpiece forces acting on the cutter tensile strength compression bending strength torsional strength moment of inertia of the flywheel flow regime of liquids and gases
The basis of molecular physics and thermodynamics	the transition of substances from one aggregate state to another heat transfer phenomena	heat of combustion of substances aggregate states of matter heat exchange in internal combustion engines heat exchange in steam and gas turbines heat of combustion indoor heat exchange
Electricity and magnetism	the circle of constant and alternating electric current	calculation of electric circuits of direct and alternating current calculation of the resistance of the conductor
Optics, quantum and nuclear physics	illumination	illumination of the room

For future teachers of labor education and technology, the orientation of the subject matter of our tasks seems to us to be such.

Mechanics. Determine the speed of the cutting tool relative to the surface of the workpiece rotating in the lathe cartridge, if the rotational speed is 120 rev / min, the diameter of the workpiece is 110 mm.

Thermodynamics. Determine the efficiency of the solder with a rated power of 50 W, if the melt of tin droplets weighing 2 g taken at room temperature requires 20 seconds.

During the processing of aluminum workpiece on a lathe, it was heated to 70 ° C. Determine the diameter to which the workpiece must be sharpened if its diameter after cooling is to be 104 mm.

Electricity and magnetism. The electric heater has an efficiency of 40% and is designed for a voltage of 220 V. Determine the current strength consumed by this device, if to bring to a boil 1.5 liters of water is necessary for 10 minutes. The initial water temperature is 20 ° C.

Optics. Determine the illumination of the worker's workplace if the incandescent lamp with a power of 40 W is at a distance of 60 cm from the spindle of the machine tool.

There are a number of situational tasks that include calculations common to students in the areas of training 015.01 "Professional Education. Construction »and 014.10« Secondary education. Labor training and technology ». That is why it is advisable to develop tasks for performing typical calculations, which will be the same for students of both directions of training.

It should be noted that both situational and typical tasks that have a practical orientation should not occupy all the time devoted to the study of physics, because in this case the skills acquired by students will be fragmentary, unsystematic, and all physical education - one-sided. Professionally oriented tasks are only part of the tasks that are used in the training of physics by students in these areas of training. In order for the students to have a complete picture of the physical phenomena, In addition, from the field of view in this case, the phenomena of quantum and

nuclear physics disappear. Therefore, the study of the course of general physics should not be limited to situational tasks, but should be complex.

Practical-oriented approach in the organization of a laboratory workshop on general physics. Practical-oriented approach to the study of general physics involves the use of professionally-oriented tasks and in a laboratory practice.

Unlike practical classes, a laboratory workshop involves students doing typical calculations. Only the input data to the experiment change (mechanical characteristics of the substance, specific resistance, density, etc.). However, for typical calculations, it is possible to envisage the following subjects of work, so that they take into account the professional orientation of students.

On the basis of analysis of educational programs in the disciplines of professional direction, such an indicative list of laboratory works of professional direction for the students of the direction of preparation 015.01 "Vocational education. Construction":

1. Deformation of tension-compression.
2. Bend deformation.
3. Determination of the thermal conductivity of the material by the method of a flat wall.
4. Determination of the thermal conductivity of the material by the method of a cylindrical wall.
5. Determination of the internal resistance of the current source.
6. Determination of coil inductance.
7. Calculation of the illumination of the premises.

Approximate list of laboratory works for students of the direction of training 014.10 “Technological education”:

1. Study of the laws of dynamics of rotational motion.
2. Determination of the velocity of a ball by a ballistic pendulum method (or by a rotating cylinder method).
3. Deformation of tension-compression.
4. Determination of resistance of the conductor.
5. Determination of the internal resistance of the current source.
6. Transistor
7. Definition of coil inductance.
8. Calculation of the illumination of the premises.

After analyzing the listed lists of laboratory works, one can highlight the topics of laboratory work, which are the same for students of both directions of training:

1. Deformation of tension-compression.
2. Determination of the internal resistance of the current source.
3. Determination of the coil inductance.
4. Calculation of the illumination of the premises.

Consequently, 4 laboratory works are common to students in the areas of training 015.01 "Vocational education. Construction” and 014.10 “Secondary education. Labor training and technology”. In addition, 3 laboratory work takes into account the professional orientation of students in the field of training 015.01 "Vocational education. Construction "and 4 laboratory works - professional direction of students of the direction of preparation 014.10" Secondary education. Labor training and technology ».

Conclusions. Practical-oriented approach in the teaching of general physics for bachelors of training courses 015.01 "Professional education. Construction "and 014.10" Labor training and technology "contributes to the growth of students' motivation to study, and, accordingly, to increase their success. The content of the course in general physics provides opportunities for implementing this approach with the help of situational tasks and practical-oriented laboratory work. However, it is considered inappropriate to confine ourselves to a practice-oriented approach to the study of general physics, since this reduces the role of the fundamental component of the physics course. Physics is a fundamental science, and the reduction of the role of the fundamental component leads to a decrease in the role of physics in general. Therefore, the practice-oriented approach must be combined with research, problem and other approaches.

Prospects for further research in this area are the development of a system of practical-oriented tasks and laboratory work on general physics for students of the areas of training 015.01 "Professional education. Construction »and 014.10« Secondary education. Labor training and technology ».

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ПРАКТИКО-ОРІЄНТОВАНИЙ ПІДХІД У НАВЧАННІ ФІЗИКИ СТУДЕНТІВ НЕФІЗИЧНИХ СПЕЦІАЛЬНОСТЕЙ

Базурін В.М.

Глухівський національний педагогічний університет імені Олександра Довженка, Україна

Анотація. *У статті розглядаються основні шляхи застосування практико-орієнтованого підходу у навчанні загальної фізики студентів напрямів підготовки 015.01 «Професійна освіта. Будівництво» і 014.10 «Середня освіта. Трудове навчання та технології»: ситуаційні задачі і практико-орієнтовані лабораторні роботи. Визначено відмінності у тематиці задач і лабораторних робіт, що пов'язано зі специфікою майбутньої професійної діяльності студентів. Для студентів напряму підготовки 015.01 «Професійна освіта. Будівництво» професійно-орієнтованими задачами є задачі зі статики, задачі на рівноприскорений рух, задачі на теплопровідність, теплообмін, розрахунки електричних кіл змінного струму, визначення освітленості у приміщенні. Для студентів напряму підготовки 014.10 «Середня освіта. Трудове навчання та технології» такими задачами є задачі на розтяг-стиск, задачі з динаміки обертального руху, задачі про зміну агрегатних станів речовини, задачі на розрахунок кіл постійного та змінного струму, задачі на визначення освітленості приміщення. Практико-орієнтовані лабораторні роботи теж враховують специфіку майбутньої професійної діяльності студентів. Застосування практико-орієнтованого підходу у навчанні сприяє зростанню мотивації студентів і, відповідно, їх успішності у процесі вивчення загальної фізики.*

Ключові слова: *загальна фізика, практико-орієнтований підхід, майбутні викладачі професійного навчання, майбутні вчителі трудового навчання та технологій.*