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FORMATION AND EVALUATION OF PROFESSIONAL COMPETENCES OF PHYSICS STUDENTS: THE CRITERIA AND LEVELS OF FORMATION

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ABOUT ARTICLE

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Abstract: In the article we discussed the possibilities of developing and assessing professional competencies. The structure of professional competence is presented, the levels of its development are highlighted, as well as the factors and conditions necessary for their successful formation. When determining the criteria for assessing the effectiveness of the formation of professional competence, it is necessary to take into account the level of formation in students of professional knowledge, abilities, skills and profile-specialized abilities that are in demand in the modern labor market. For this purpose, we have identified such structural components as motivational, cognitive, procedural, creative and reflective-evaluative. The motivational component reflects the individual's readiness to master professional competencies. One of the possible ways to evaluate it is to survey students. The cognitive component includes a set of physical knowledge that forms the scientific picture of the world, systems thinking, and intelligence. Indicators of the pace and quality of knowledge acquisition allow us to assess a student's learning ability.

INTRODUCTION

One of the strategic goals of higher professional education is the formation in a university graduate not of a system of knowledge, skills and abilities, but of competence, as a set of special

qualities formed on the ability to apply knowledge and skills in business [1]. At the same time, the quality, effectiveness of education and a humanistic approach to learning take into account the latest data from anthropology, philosophy, pedagogy and psychology [2]. One of the possible approaches to solve these problems is the competency-based approach, which is considered as a set of principles for determining the goals of education, selecting the content of education, organizing the educational process and assessing educational results [3]. The main criteria for the quality of graduate training are competence, which is understood as a set of knowledge, skills, experience, reflected in theoretical and applied preparedness for their implementation in activities at the level of functional literacy, and competence, which combines the intellectual and skill components of the educational outcome, integrates closely related skills and knowledge related to broad areas of culture and activity.

The identification of a competency-based approach as a strategy for the development of higher professional education causes a number of problems to arise. One of the problems is the shortage of teaching materials and methodological readiness of teachers to implement the competency-based approach in higher education. The essence of the problem is that the acquisition, transformation and use of knowledge are processes that require the use of active educational technologies. And therefore, before monitoring competencies, they must be formed using modern pedagogical technologies, which should cover the entire educational process.

When determining the criteria for assessing the effectiveness of the formation of professional competence, it is necessary to take into account the level of formation in students of professional knowledge, abilities, skills and profile-specialized abilities that are in demand in the modern labor market. For this purpose, we have identified such structural components as motivational, cognitive, procedural, creative and reflective-evaluative [4]. The motivational component reflects the individual's readiness to master professional competencies. One of the possible ways to evaluate it is to survey students. The cognitive component includes a set of physical knowledge that forms the scientific picture of the world, systems thinking, and intelligence. Indicators of the pace and quality of knowledge acquisition allow us to assess a student's learning ability. Properties of intelligence characterize the success of a student's intellectual activity in terms of the speed of information processing in the context of solving professional problems [5-8]. Under the conditions of a point-rating system in an exam, the cognitive component can be accessed on the basis of tests, physical dictations, and tests.

1. Fundamentals of professional competencies of physics students

The procedural component presupposes that students possess a certain amount of practical skills. Assessment of the procedural component is possible when students perform laboratory work and solve experimental problems in practical classes. To test your independent experimentation skills, you can set up a home experiment, the results of which should be documented in a separate notebook.

The creative component is assessed on the basis of the ability to generate original ideas, new educational products, and use non-standard methods of activity. In physics classes, this becomes possible when composing crosswords on a given topic, tasks based on an experiment, a children's toy, a paradox, data from other scientific fields, and analysis of literary and cinematic works. Based on the analysis of psychological, pedagogical and methodological literature on the topic under study, we have identified 3 levels of development of professional competencies mastered in the process of studying specialized disciplines.

A high level of mastery of professional competencies is characterized by the formation of a system of fundamental concepts, theories, phenomena, laws of physics, the ability to apply knowledge in a changed situation, and solve problems of a high level of complexity that require the complex application of knowledge; clear mastery of physical experiment techniques and a creative approach to its implementation; the presence of cognitive, professional-value and personal motives; sustainable interest in studying specialized disciplines; satisfaction with learning results. Students with a high level of mastery of professional competencies are characterized by a desire for goal-setting, reflection, and self-education, which is manifested in the constant study of scientific literature and its qualitative analysis. One can observe the generation of one's own approaches and strategies for solving problems.

The average level is characterized by the formation of a knowledge system, mastery of the conceptual apparatus in specialized disciplines, and mastery of material at the level of applying knowledge in a familiar situation. It is noted that the actions that make up the structure of a physical experiment are not fully and not always consistently carried out, and its individual elements are not in demand. Satisfaction with the results of the educational process is characteristic; the desire for self-analysis is noted as interest arises. There is a value-based attitude towards self-education against the background of episodic study of scientific literature, and insufficient knowledge of the methods and techniques of its processing.

A low level is characterized by the presence in students of only an external motive that determines the direction of educational actions, or by an indifferent attitude towards them. This determines the weak formation of the system of fundamental concepts, theories, and laws of physics; an approximate idea of the experimental conditions, poor knowledge of experimental techniques. At the same time, there is no desire for self-education, the student rarely turns to scientific literature, and also does not feel the need to analyze his activities and its results. Assessing competencies using various types of practices is possible through public defense of practices; through examinations in a special form; through grading the list of competencies by the students themselves and practice managers. Thus, checking the formation of professional competencies should include input control of students' knowledge, abilities and skills before introducing special courses into the educational process, milestone diagnostics of mastering modules of special courses, final control of the formation

of professional competencies, diagnostics of student satisfaction with the quality of education, and is also carried out on the basis of an analysis of academic performance results , defense of course projects, final qualifying works and reports on practice, speeches at the annual student scientific conference.

2. Didactic principles of organizing extracurricular activities of students at school

Extracurricular activities are an indispensable part of the educational process in an educational institution. It helps to fully implement the requirements of federal educational standards for general education. Extracurricular work of students combines all types of schoolchildren's activities (except for academic work), in which it is possible and correct to solve the problems of their education and the formation of personality in society. Extracurricular activities are an integral and important part of the educational process, as well as one of the forms of organizing students' personal time. Extracurricular activities are needed to meet the needs of students for meaningful leisure, their time spent in self-government and socially useful work. A properly organized system of extracurricular activities will help to maximally develop or shape the cognitive needs and abilities of each child, which will help develop a free personality. The upbringing of a child always occurs, at any moment of his activity. But this will be more productive in the student's personal time [6]. In extracurricular activities, conditions are met for the development of the student's personality, taking into account his individual abilities, cognitive activity, moral personality traits, and communication skills are formed, and the foundations are laid for the child's adaptation in a complex world as an intellectual and harmoniously developed member of society. In extracurricular activities, a unique emotionally filled environment of interested students and teachers is created.

2.1. Results and effects of students' extracurricular activities.

For the greatest effectiveness in organizing extracurricular activities for students, the ability to understand and distinguish between the results and effects of this activity is of great importance.

The result is understood as what was the immediate result of the student's participation in the activity. For example, a student, participating in a tourist route, not only moved in space from one geographical point to another, overcame the difficulties of the path (the actual result), but also acquired some knowledge about himself and others, experienced something new and felt something as a value, acquired the experience of independent action (educational result).

An effect is a consequence of a result. For example, acquired knowledge, experienced feelings and relationships, and performed actions revealed a person as a person and contributed to the formation of his competence and identity. So, the educational result of extracurricular activities is the direct spiritual and moral acquisition of the child thanks to his participation in one or another type of activity. The educational effect of extracurricular activities is the influence of one or another spiritual

and moral appropriation on the process of personality development in a child, in other words, a consequence of the result. [6]

2.2. Classification of the results of extracurricular activities of students.

The educational results of schoolchildren's extracurricular activities are divided into several levels.

The first level of results is the student's acquisition of social knowledge (about social norms, the structure of society, socially approved and disapproved forms of behavior in society, etc.), an initial understanding of social reality and everyday life. To achieve this level of results, special attention is paid to the interaction of the student with his teachers. For example, when communicating with a child on the topic of a healthy lifestyle, he involuntarily compares this image with the teacher's lifestyle. The effect will be most significant if the teacher himself is the embodiment of this theme.

The second level of results is the assignment by students of experience and a positive attitude towards the basic values of society (family, nature, Fatherland, people, art), and a value-based attitude towards social reality as a whole. To achieve this level of results, the interaction of schoolchildren with each other at the class and school level is of particular importance.

The third level of results is the assignment to children of the experience of independent social action. Only in independent social action, outside the friendly environment of school, does a young person truly become (and not just learn how to become) a social activist, a citizen, an independent person. Only in the experience of independent social action is one acquired that courage, that readiness to act, without which the existence of a citizen and civil society is unthinkable.

The duration of extracurricular activities and their number per week is determined by order of the educational institution, taking into account the requirements of the Basic Curriculum. The number of extracurricular activities courses attended is chosen by the student himself and his parents (legal representatives) [7]. In the absence of conditions for the implementation of extracurricular activities, the educational institution uses the capabilities of educational institutions for additional education of children, cultural and sports organizations (within the framework of the relevant state (municipal) tasks formed by the founder, on a contractual basis). Some extracurricular activities initially involve selecting an activity that is exciting for the student. It can be determined taking into account the wishes of the parents of a particular class (for example, an excursion, a hiking trip). Students have the opportunity to test themselves in various activities, comprehend their interests, and express their desires. Since children are offered selection, planning this part of extracurricular work is allowed either as an end-to-end course for the next year (if desired, laying down the prospect of continuing the course in the coming years of study), or as a course defined for a quarter - then classes are addressed to students of a specific

class, after completion the teacher duplicates the course in the following classes. Extracurricular work provides each student with an individual educational work plan, which is developed by the class teacher and issued in writing to the student and (or) his parents (legal representatives).

The model for organizing extracurricular activities most fully determines the capabilities of an educational institution, determines the need to attract specialists from the system of additional education, culture and sports. It helps to distribute hours of extracurricular activities, figure out what programs of extracurricular activities need to be introduced and developed in an educational institution. To develop a plan for organizing extracurricular work, you need to use some principles:

- The principle of taking into account the needs of students and their parents. To do this, you need to find out what schoolchildren and their parents would like, compare requests with the institution's human resources, and the features of the development program.
- The principle of continuity - it is necessary to choose at least one direction that will be assigned to the school. For example: project activities. The "I am an inventor" circle can work for four years of primary school, and naturally be continued in the form of a club or scientific society in primary school.
- The principle of diversity of areas of extracurricular work, which involves the implementation of all five areas of extracurricular activities proposed in the standard.
- The principle of taking into account the social and cultural characteristics of the school, the development program of the educational institution. For example, if the problem of polytechnic education prevails in a school, then this direction should be reflected in extracurricular activities, starting from elementary school.
- The principle of interaction with institutions of additional education, culture and sports. Some extracurricular activities can be conducted on the territory of additional education institutions and libraries. The head of the circle may be a specialist from the additional education system, or from cultural and sports institutions.
- The principle of diversity of forms of organization of extracurricular activities. The program of extracurricular activities of an educational institution should include clubs, studios, clubs, workshops, sections, societies, etc.

3. Goals and objectives of students' extracurricular activities in the process of teaching physics.

Creating a unified interaction between classroom and extracurricular work on a subject is one of the main ways to grow the teaching and educational process in physics, since the study of any program topic can be continued in extracurricular work. When planning and implementing extracurricular work, physics teachers must choose those forms of work that, on the one hand, help

in solving practical, educational and educational problems, and on the other hand, are time-efficient, meet the interests of the children's team and are combined with the entire educational system. process.

The goals of extracurricular work in physics are:

- development of cognitive interest of schoolchildren in physics.
- consolidation of acquired knowledge;
- acquisition of new knowledge;
- deepening independent work skills;
- summing up the work of teaching schoolchildren;
- children obtaining further goals (including career guidance);
- development of intelligence, ingenuity, flexibility and innovative thinking
- stimulating students' interest in studying the subject;
- comprehensive personality development.

To achieve the goal of extracurricular work you need to complete

the following tasks:

• identify interests, abilities, priorities of students

• help schoolchildren find “their self”;

• create conditions for the comfortable existence of each child in the chosen area of extracurricular activities

• form and systematize accumulated knowledge in the chosen area of extracurricular activities

• develop the student’s creative work experience

• provide conditions for the implementation of acquired knowledge

• develop the experience of informal communication between teacher and student.

It is also necessary to pay attention to the fact that in the process of organizing extracurricular work in physics, it is necessary to take into account both the psychological characteristics of the individual and the psychological characteristics of the team. Such as: the level of its development, the degree of organizational, psychological, intellectual and emotional unity, the focus of the team’s work on the relationships between its members, the emotional state of the class while performing extracurricular tasks.

Knowledge of the psychological characteristics of students is an integral part of the successful selection of appropriate forms of extracurricular work, determining the content of these forms, organizing and conducting extracurricular activities with students.

4. Selection of content and types of activities for organizing extracurricular work of students in the process of teaching physics

The development of schoolchildren's interest in the subject is determined primarily by the work of the teacher himself. He may, at his discretion, introduce those topics into extracurricular activities

that, in his opinion, are poorly reflected in the main physics education program. To improve the quality of students' knowledge, one must try to develop students' cognitive interest in the subject being studied. This can be achieved by influencing the emotional sphere of their personality. To achieve this, unusual and fascinating questions and tasks are needed that surprise students, prompt them to think, and most importantly, attract everyone's attention and improve their understanding of physical laws and phenomena. Experience confirms that the presence of interest in the subject being studied increases attention to the issues under consideration and, therefore, contributes to the acquisition of more reliable knowledge. It is impossible and, most likely, not necessary to develop deep cognitive interests in physics in all students. It is important to interest schoolchildren not only in class, but also in the hours allocated for extracurricular activities. Then, for many of them, their primary interest in the subject will develop into a strong and lasting interest in the science of physics. In this regard, a special place belongs to such an effective pedagogical tool as entertainment. The teacher, using the properties of objects and phenomena, evokes a sense of surprise in students, sharpens their attention and helps create in them an optimistic mood for learning and a readiness for active mental work, regardless of their knowledge, abilities and interests. It is necessary to distinguish between two sides of entertainment: the possibilities of the content of the subject itself and certain methodological techniques. In order for the entertaining material used in the lessons to have a lasting educational effect, some criteria must be observed:

1. The material used should attract the student's attention by posing the question and force him to look for the answer. For example, 7th grade students, after studying the issue of Archimedean force, will read with interest the article "The Mystery of a Water Drop," and 8th grade students, when considering the section "Thermal Phenomena," will read the article "Heat and Cold."

2. The proposed material should not be a fun illustration for the lesson, but rather provoke cognitive activity of students, force them to figure out the cause-and-effect relationships between phenomena. Otherwise, the material will not lead to the development of stable cognitive interests in students. Therefore, the teacher needs to ask students questions: "Because of what?", "Where from?", "Why?".

3. Topics used in lessons must correspond to the age of the students and the level of their intellectual development. By the way, when studying Brownian motion in the 10th grade, it is better to give a figurative description of this phenomenon.

4. The additional material that the teacher chooses for the lesson must correspond to the interests of the students.

5. Information during after-hours hours should not require a lot of time and be a bright, emotional spark of work. Based on experience, it will be better to tell a few of the most typical examples in class than to list spectacular but insignificant facts.

The place of entertainment in the lesson can be different. Consequently, it is possible to intensify the cognitive activity of schoolchildren in physics lessons in different ways, but we must remember that this activation should not be reduced to a simple increase in the number of independent works performed by schoolchildren. The method of including the latter in the educational process is important - the work should develop the mental activity of children to the maximum extent.

Extracurricular activities have the ability to broaden a student's horizons as part of the compulsory school curriculum. Establishing the relationship between classroom and extracurricular activities can be considered using the example of performing production tasks related to the practical application of theoretical knowledge acquired in class. The organization of extracurricular activities is planned directly at the workplace, which has a positive effect on the vocational guidance and labor education of students. It should be noted that this way of establishing interaction between activities in and outside the classroom at the first stage of teaching physics is not always appropriate and not always possible, since students who begin studying physics do not have the necessary stock of knowledge and practical skills to work in production.

5. Extracurricular activities. Kinds. Features of training. Advantages and disadvantages.

An excursion **is** a form of organizing training in a natural landscape, production, museum, exhibition with the purpose of observing and studying by students various objects and phenomena of reality. A characteristic feature of the lesson is that the study of objects is associated with the movement of students.

In the course of the educational subject "Astronomy", the objects of excursions can be planetariums, observatories, latitudinal and actinometric stations, various museums and exhibitions dedicated to the achievements of mankind in space exploration. Before the excursion, preparation is required for both teacher and students depending on the location and purpose of the excursion. Thus, observatories and planetariums can be visited before studying the educational material presented in the data of the complex, and already, based on the knowledge acquired by students, base an explanation of certain issues in the astronomy course. To optimize the quality of assimilation of acquired knowledge, the teacher needs to familiarize students in advance with the technical base (instruments, building design) and methods (methods) of research work of an observatory or planetarium.

Conference. Student learning conferences first appeared in the 1960s. As a form of conducting the educational process, it has quite a lot in common with a traditional lesson, although it has a number of distinctive features. The general thing is that this kind of conference is held on a schedule like a lesson, group work of the class is combined with individual work of students, the leading role is retained by the subject teacher. The difference is that this form of lesson delivery is based on the students' existing knowledge, which they acquired by searching for information in various sources

(scientific, popular science literature, the Internet, etc.). The teacher's responsibility is to organize student presentations, discuss their reports, and make additions and clarifications. For an astronomy course, educational conferences can play the role of general lessons. With a work plan of 35 hours, the teacher is forced to put forward some important topics for independent study, and in order to fully check the completion of assignments, the teacher can allocate a lesson to an educational conference. So, when studying the section "The Nature of the Solar System Bodies" in an astronomy course, he can put forward information about specific planets for independent study, having only examined with the class the general characteristics of the terrestrial planets and giant planets, and then generalize the students' knowledge in the form of a conference.

Astronomical observations. Modern pedagogy gives special place to the use of the visualization method in the classroom. The use of various visual aids in astronomy lessons provides the following opportunities:

1. Supplementing students' independent observation with things that cannot be seen with the naked eye (photos and computer models of cosmic bodies and phenomena).

2. The opportunity to study the essence of many observed phenomena with the help of drawings, drawings, films, digital educational resources.

3. Simplifying the process of students understanding the methods of astronomical research, a visual representation of the methods of operation of astronomical instruments (diagrams of installations, photographs, models of instruments, virtual laboratory work).

Observations, as stated above, are essential for understanding and understanding the information given in the astronomy course. In the educational process, school observations are as important as demonstrations and laboratory work in physics. At the same time, the organization of these observations has its own specific features that differ from the principles of a physical experiment. At the same time, students must retain some short-term perceptions in their memory in order to use them in subsequent physics classes, therefore, the teacher is required to be attentive to the organization and conduct of observations.

1. Forms of extracurricular/extracurricular work:

Elective courses are courses taken by choice. The curriculum proposes the organization of extracurricular and project activities for schoolchildren for two hours a week in high school.

The teacher can choose an elective course program from ready-made ones or create his own based on the classroom equipment.

The content of the elective course may:

1) offer an in-depth version of studying the material;

2) provide an introduction to one of the sciences or professions;

The club is the main form of extracurricular work in physics. The main participants of the circle, in most cases, are students of general education institutions who are interested in physics.

The methodology for organizing circle work is based on voluntariness, the connection of circle work with academic work, expanding the student's zone of proximal development, and the development of creative abilities. Entertaining "theoretical" classes form the basis for starting work in the circle. Such classes may be accompanied by lectures from the leader and reports from the circle participants. The main principle of theoretical classes is maximum activity of participants. When conducting lectures and reports, you need to use the equipment and visual aids in physics available at the school. The content of students' circle work can be the manufacture of simple instruments, preparation of reports, observation of phenomena and objects, etc. The role of observations in a circle is quite large. The result of the circle's work, first of all, depends on the organization, control and accounting of the work performed. It is advisable to record the results of completed work in a special journal. At the end of the year, it is reasonable to hold a reporting conference, an exhibition of photographic reports based on the observations of the circle participants.

At the end of the formative stage, monitoring of the formed universal educational actions of students was carried out. The wording of skills has been changed in some paragraphs. The monitoring results are presented in Table 1.

Student	Personal	Competent	Cognitive	Communication	Total
Student-1	4	3	4	4	15
Student-2	2	3	1	2	8
Student-3	4	4	4	3	15
Student-4	4	4	4	3	15
Student-5	4	4	4	4	16
Student-6	3	3	4	4	14
Student-7	4	3	3	3	13
Student-8	4	3	4	3	14
Total	29 - 91%	27 - 84%	28 - 87.5%	26 - 81%	

The results show that students with an average level of formed UUD moved to the "High level" category, and students with a low level remained in the same place (Table 1). After monitoring, it can also be revealed that the percentage of formed personal and cognitive actions has increased significantly. The development of competent and communicative universal learning activities is approximately at the same level. (Table 1).

Table 2

Levels of Achievement

Levels	Low	Average	High
№	1	2	3
5-6 grades (8 people)	1	2	5

The results of the stages of experimental search work are presented in diagrams 1.

Diagram 1. Determining the level of formation of universal educational actions of students during the experiment

According to the data obtained as a result of the experimental search work, we can conclude that in the group in which the experiment was conducted, consisting of 8 people, the level of well-formed universal educational actions increased significantly. Students who had a low level exceeded the threshold of an average level, and students who had an average level began to have a high level after the experiment. Thus, at the search stage, the average level of developed educational actions significantly prevailed in the group, and after extracurricular activities with a large content of practical work, a high level of development of educational actions prevailed in the group. Therefore, we can conclude that with regular extracurricular activities of the circle, the introduction of a large number of practical works, activities of various contents, the use of various methods and forms, the level of universal learning activities will increase, which will also have a positive effect on technology lessons on relevant topics.

CONCLUSION

One of the most important transformations in the general education system is the introduction of federal state educational standards for general education of a new generation, dictated by the need to prepare graduates for life in a high-tech competitive world, that is, those people who have the ability to learn and relearn many times. And technology as an academic subject has sufficient opportunities to develop these key competencies of students. In extracurricular activities using technology, the formation of personal universal educational actions increases significantly, since the subject is aimed at developing a personal attitude towards oneself and the world around us, emotional awareness of oneself and the world around us, the formation of a positive attitude towards oneself and the world around us, the use of fantasy and imagination when performing educational actions. Communicative universal educational activities also develop faster due to the constant interaction of schoolchildren with each other and with the teacher. The formation of these actions was facilitated by the forms of conducting classes (paired, group, collective), such as tasks such as: in pairs, find information, analyze. A pedagogical experiment conducted to test the effectiveness of the formation

of universal educational actions with the help of extracurricular club activities on technology showed a positive impact on the level of systematization of students' knowledge, on the quality of assimilation of the sewing concepts being formed, as well as on the level of formed skills in design and modeling. Thus, extracurricular activities contribute to the formation of universal educational activities in students, which has a positive effect on the overall development of the individual and on academic performance in academic subjects.

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