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Content and Description of Experimental Skills in Physics, Didactic Foundations

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Abstract: It is necessary to form the skills of future physics teachers to independently and creatively study the experimental content of physics education, perform and automate existing laboratory work, and use new innovative technologies. Based on the characteristics of professional activity, it is appropriate to determine the content of both physical and informatics knowledge and professional skills of the future physics teacher and to develop a methodology for their formation. In this article, the basics of the methodology of organizing modern laboratory classes in physics in higher educational institutions are covered.

Keywords: innovative technologies, laboratory work, methodology, professional skills, qualified education, experimental skills.

Introduction

The Law of the Republic of Uzbekistan "On Education" states that "Persons with appropriate education, professional training and high moral qualities have the right to engage in pedagogical activity" [1]. This puts the responsibility of increasing the quality of preparation of students for pedagogical activities from a professional, as well as a personal-psychological point of view, in all systems of pedagogic educational institutions. The rapid development of computer science depends to a large extent on the formation of professional-pedagogical qualities in the future teacher in a time of increasing complexity of educational tasks. The system of relations of the future teacher to his chosen profession, the subject he teaches and students as subjects determines the quality of his pedagogical activity.

The content and structure of education in higher education institutions are of particular importance. After all, the higher school not only equips the content of education with modern knowledge, specially qualified education but introduces the development of sciences, their scientific-methodological and ideological foundations. Therefore, the automation of the educational process in the higher school system requires high skills and abilities from the pedagogue [1-3]. One of the most important pedagogical components is the teacher's programming skills. In today's era, every person should be a skilled master of his profession along with being an authoritative knowledge holder.

Each of the young, modern generation lives, grows and matures in social and historical conditions specific to their time, era, and the society they belong to. A person's work, vital activity, and interaction with people form the basis of his maturity, in particular, his upbringing. Activity, in the broadest sense, is a form of human effort and is the internal (mental) and external activity of a person guided by a conscious goal.

All interactions of a person with nature and society in the material, spiritual, and spiritual aspects are understood as his activity.

Many psychologists, such as L.S. Vygotsky [4], P.Ya. Galperin [5], V.V. Davidov [6], M.G. Davletshin [7], A.N. Leontev [8], M. Mavlonov [9], E. Ghaziyev [10] psychologists engaged in their scientific research with the problems of studying and researching human activity and revealing its essence.

Skill is the activity of thinking through certain actions based on the acquired experiences of a person. Skills relate to practical activities and are a component of activities related to the ability to apply knowledge in practice. Skills are methods of successful performance of an action in

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proportion to the purpose and circumstances of the activity. It is always based on knowledge, it is the basis of skill (qualification). Skills are divided into practical (physical) and mental, and simple and complex types in terms of content. Practical skills are aimed at performing labour activities, intellectual skills are aimed at acquiring knowledge and mastering it. Skills should not be confused with knowledge, because knowledge is expressed in judgments that accurately reflect reality. Skills are more embodied in mental and physical actions [11].

The main part

The skills that are formed during learning the basics of science and are necessary for their successful learning are called learning skills. General learning skills are reading, writing, planning answers, working with literature, and scientific organization of work. Common skills for subjects in the natural-scientific direction are working with educational literature, measuring, calculating, drawing graphs, making tables, and observing and conducting experiments.

Skills are divided into general and special, intellectual and practical types, depending on the direction of actions. This division has a conditional character. Experimental skills are considered a special skill in physics education. Formation and development of experimental skills, teaching them to use in future teaching activities, pedagogy is one of the main tasks of education of higher educational institutions.

Experimental skills mean a set of skills that enable a student to independently perform experimental research. These are: planning the experiment, designing the device and preparing it for work, observing the phenomenon, performing measurement work, etc. Each stage of research requires specific skills. For example, at the "Assembly of an experimental device" stage, students should demonstrate the following skills:

1. assembling an electric circuit;
2. using a tripod;
3. use of a calorimeter;

4) use of a heater, etc.

In turn, each individual skill is divided into several simple actions - skill elements. For example, the skill of using an educational dynamometer includes the following elements: knowing which quantity the instrument is designed to measure (measurement of force), determining the division value and measurement limit of the instrument scale, during measurement correct positioning of the dynamometer, taking into account the indication of the instrument and determining measurement errors [12-15].

A large number and multifaceted skills should be formed in education. To increase the efficiency of the skill formation process, it is desirable to study skills that have common or similar characteristics in groups.

The state education standard "Physics and Astronomy" presents various forms of skills and competencies. But it is a complicated process to observe similarity, interconnectedness and consistency in their formation [16]. For this reason, it is appropriate to analyze the results of the important educational laboratory in physics with the help of a computer, to divide them into types, to determine their essence and mutual relations. To make the process of formation of educational skills (private, special, programming) in physics effective, they are divided into three groups: programming, experimental, and research (constructive).

In this work, we will learn the important experimental skills of conducting and demonstrating physics experiments, performing laboratory work, and analyzing the obtained results using a computer program. In order to make the process of formation of experimental skills more effective, the bases of their classification should be selected. As such a basis, the following, which has a general didactic character, can be taken:

1. the nature of moving actions;
2. composition and structure of skills;
3. duty;
4. the scope of the skill.

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The formation of experimental skills is related to the subject activity of the student. By subject activity, we understand that students and pupils deal with natural objects (tools, physical bodies, collections of things, computer equipment, etc.). Also, the subject activity includes working with visual (scheme, drawing, pictures, etc.) and some marked (conditional designations of tools, their layouts, models) objects.

In this case, natural objects are considered the main ones in the subject activity, and demonstrative and symbolic objects, which are the image of natural objects, are auxiliary.

According to M.N. Tushev [18-21], an experimental skill is a skill that is formed in subject activity and reflects its operational side and is united with the content of the subject.

Subject activity is based on intellectual skills. Intellectual skills are the ability to effectively perform mental operations (formed) in solving various problems. This refers to the ability to perform logical operations. Logical operations include comparison, analysis, synthesis, abstraction, generalization, classification, and conclusion. These skills are general for applying knowledge in practice (practice) [22-24]. Thus, knowledge "works" for experimental skills directly, through intellectual operations. Intellectual skills are formed in the mental activity of students, and experimental skills are acquired by working with tools based on the content of the educational material. Experimental skills are formed based on intellectual actions, at the same time this process,

A skill describes a person's ability to perform an activity. And any activity comes from a practical need. Therefore, various skills, as well as intellectual skills, can be called practical skills [25-27].

In education, some skills do not depend on the content of the educational material and are limited by it. They are called general and thematic skills, respectively. In the literature, general skills are referred to as generalized skills. "Generalized skills are skills that can be used not only in one subject but also in other educational subjects and in practical activities" [26-29]. General experimental skills are formed and used in the study of all subjects of physics. They are considered to be basic (universal) skills in the educational material of any content. General experiential skills include a wide range of skills and are structured as simple and complex skills. General skills are highly transferable, not only within a subject, course, or department but also across disciplines. Formation of general skills is one of the main tasks of physics education.

Thematic skills mean the student's ability to determine physical constants experimentally, activities on indirect measurement of physical quantities, and special activities specific to some topics (spring levelling, determination of current and voltage in series and parallel connections, etc.)) indicates that the ability is formed.

In general secondary school, thematic skills form an important group, many general skills are involved in their formation. They are the basis for thematic skills. Thematic skills prepare students for the complex activities of the next level of education. Due to the diverse nature and complex nature of the activity, the ability to enumerate all skills is limited. However, the table lists the types that form the basis for other experimental skills.

One of the most important signs that arise from the nature of the skill will be "the use of the right methods and types of activity in new or radically changed conditions, the implementation of this activity in solving a certain mental issue, consciously and purposefully adapting the knowledge that corresponds to it".

Conclusion

When other, more complex demands are placed on the student by changing (diversifying) the conditions of activity, the skill improves as a means of achieving new goals. When changing the conditions of activity, it is necessary to take into account the most important links of skill development. It is appropriate to take into account didactic issues, the sphere of influence of this skill, and the period of its formation.

What are new or modified (changed) terms? The conditions for the formation of experimental skills are defined by the system of requirements for the student's knowledge, skills, and abilities, as well as the available equipment, the nature of the task, and the management method (the presence

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of written instructions). The following conclusion, which is important for practice, follows from this: if the skill is formed at a certain level, then it is necessary to create new conditions in the laboratory for its development.

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