AMERICAN JOURNALS
Open Access, Peer Reviewed Journals

American Journal of Research in Humanities and Social Sciences
ISSN (E): 2832-8019 Volume 31, | December - 2024

FORMATION OF PROFESSIONAL COMPETENCES OF FUTURE PHYSICS TEACHERS IN PERFORMING LABORATORY WORK

Khamdamov Begali Isroilovich
Dzhizak State Pedagogical University,
Sharofa Rashidova-4, Dzhizak 130100, Uzbekistan

Isroilov Ulug'Bek Begali o'g'li
Tashkent Medical Academy,
Tashkent Medical Academy 100109, Tashkent, Uzbekistan Farabi street 2

A B S T R A C T

The article considers approaches to changing the structure of laboratory work in physics related to the implementation of Educational Standards. A distinctive feature of the new standard is the formulation of requirements for the results of mastering the main educational programs in the language of competencies, which raises the problem of finding means not only for the formation of competencies, but also for checking the level of their formation. The analysis of textbooks for conducting laboratory work in general physics showed that their structure and content do not fully contribute to the formation of competencies related to future professional activities in the field of teaching methods. The following structure of laboratory work is proposed: setting the goal of the work, control tasks (the goal is to update knowledge), theory of work, control tasks (the goal is to check knowledge of the theory), description of the setup, control tasks (the goal is to check knowledge of the experimental setup), the procedure for performing work with a table for the results of experiments, final control. Among the tasks proposed at the updating stage, a special place is occupied by physical dictations, tasks for establishing analogies, various types of tests. This approach to building the structure of laboratory work in physics contributes to the development of professional competencies in the field of pedagogical activity.

K E Y W O R D S

Professional competencies, laboratory work, knowledge updating, physics dictations, test, analogy

Introduction

The transition of higher professional education to new Educational Standards poses new problems of both substantive and technological nature. This is due to the fact that the main distinguishing feature of the new generation standard is the formulation of requirements for the results of mastering the main educational programs in the language of competencies, which are a dynamic set of knowledge, skills, abilities, methods of activity, abilities and personal qualities that a student can

demonstrate after completing the educational program. In this regard, the structural components of competencies include: “knowledge - cognitive components; values - axiological components; skills, abilities, methods of activity - operational components; personal meaning, motives, positions, attitudes (motivational components); professional and (or) life experience; personal characteristics” [1, 2]. The consequence of this is the problem of developing tools not only for the formation of competencies, but also for checking the level of their formation. The conducted analysis of textbooks and methodological recommendations for conducting laboratory work in general and experimental physics showed that in most cases their structure usually consists of the following sequence of elements: the purpose of the work, a description of the experimental setups and measurement methods, the order of work and test questions [3, 4]. At the same time, the list of competencies formed during their implementation usually includes only those related to the specifics of the subject "Physics". For example, "to know: theoretical foundations and nature of basic physical phenomena; - fundamental concepts, laws and theories of classical and modern physics; the structure and principles of operation of modern physical scientific equipment", etc. This is quite justified, because in reality “the main component of the professional competence of a physics teacher is subject competence, reflecting the presence of the necessary professional knowledge, the volume and level of which are the main characteristics of competence” [2]. Thus, knowledge and understanding of the subject that a graduate will teach students in the future, in our case physics, are one of the important components of professional knowledge. It is quite natural to assert that the study of the general physics course in all types of classes should be aimed precisely at the formation of such subject competencies.

At the same time, there is a need and an opportunity to assert that in the process of teaching physics, competencies related to future professional activity in the field of physics teaching methods should be formed. And with the previous approach to conducting laboratory work and practical work in physics, such competencies are not formed. which proposes one of the ways to correct this shortcoming [3].

According to the work experience described in the article, in the final semester of studying general and experimental physics, individual activities of each student are organized in the laboratory practical course to master, improve and develop a new educational physical experiment. The organization of students' activities in the practical course is characterized by individualization and specificity. Students are given tasks taking into account their abilities, interests and the topic of the course work being completed. Each student is required to make one or more electronic devices for an educational experiment, master a full-scale computer experiment, perform a series of educational experiments and prepare a report on the work, the volume of which is strictly limited. Among the tasks completed in the course of the experimental for such a topic of individual semester laboratory work as "Modern experiments in the study of electromagnetic induction" the following are proposed: "Suggest a method for studying the phenomenon of self-induction using an electronic generator. Develop a summary of a lesson or extracurricular activity for a secondary school, in which the manufactured devices and experiments performed on them can be used." The author of the article notes that this form of organizing educational activities arouses significant interest and positive emotions of students, and the skills and abilities they acquire are characterized by breadth and practical focus.

We propose a different approach to solving the problem of developing professional competencies in the field of pedagogical activity when performing laboratory work in physics. Noting the obvious connection between the professional competence of a future teacher and the formation of universal educational actions in students in the process of his/her further pedagogical activity, the authors propose using certain competence-based tasks and assignments. They include the following among such assignments: assignments for constructing a hierarchy of physical concepts based on a certain feature; presentation of information obtained during laboratory work in various forms; presentation of laboratory work as a scientific study, highlighting the stages of scientific knowledge, etc. [2]. One can agree with the authors of the article that completing this type of assignment also contributes to the formation of skills in their future professional activity to compose similar assignments for students.

However, it is possible to propose a different approach to the structure of laboratory work in physics, which will allow to bring bachelors closer to the issues of theory and methodology of teaching physics and in the process of doing the work to conduct a certain professional of professional competencies of a future physics teacher. This is possible if the structure of the laboratory work includes control at each stage of the laboratory work, and the structure of the work will look like this: setting the goal of the work, control tasks (the goal is to update knowledge), theory of the work, control tasks (the goal is to test knowledge of the theory), description of the setup, control tasks (the goal is to test knowledge of the experimental setup), the order of performing the work with a table for the results of experiments, final control. This structure of laboratory work will contribute to the formation of graduates, for example, such professional competence in the field of pedagogical activity as "readiness to use modern methods and technologies, methods of diagnosing the achievements of students to ensure the quality of the educational process" [3]. This is achieved by the fact that, first of all, at the stage of completing control assignments to update knowledge, the assignments are planned to be presented in those forms that the future teacher should use in his educational activity in the learning process to solve educational tasks.

Among the tasks offered at the actualization stage, physical dictations occupy a special place. Moreover, in those forms that represent a logically and physically correctly composed text. For example, before doing the laboratory work "Studying the Law of Conservation of Energy Using Maxwell's Pendulum" students are offered the following task (fragment): "Read the text and underline the correct word or formula in brackets according to the meaning: "Kinetic energy is the energy of (motion, interaction), and potential energy is the energy of (motion, interaction). If a body is lifted above the ground and released, then (kinetic energy, potential energy) will be converted into (kinetic energy, potential energy). If the force of air resistance is (taken into account, not taken into account), then the total energy of the body is not conserved. If a massive disk rotates relative to a fixed axis of rotation, then it has (kinetic energy of translational motion, kinetic energy of rotational motion, potential energy), and if it rolls on a flat horizontal surface, then (kinetic energy of translational motion, kinetic energy of rotational motion, potential energy)". When completing the work "Measuring the moment of inertia of a rigid body using the torsional vibration method" this type of task becomes more complicated and involves filling in the gaps in the text. Let's present a fragment of this task:

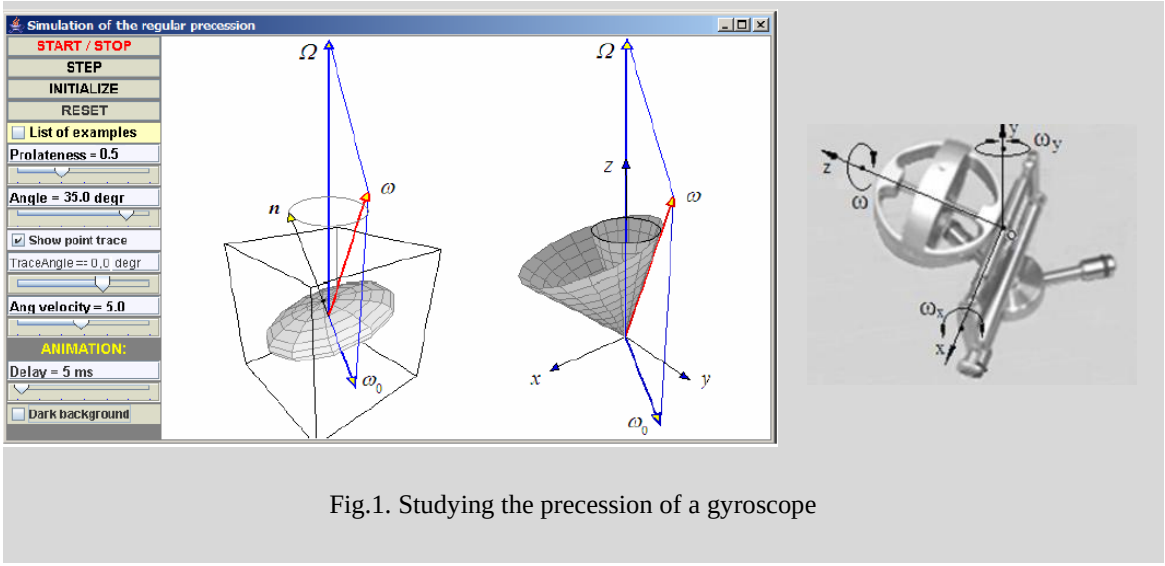

Fig.1. Studying the precession of a gyroscope

This form of dictation also contributes to the formation of such a general cultural competence as "the ability to logically correctly construct oral and written speech." When working at school, assignments for composing correct written speech are associated with the formation of a cognitive universal educational action "the ability to adequately, consciously and voluntarily construct speech statements in oral and written speech." Thus, we can say that such a professional competence as "the ability to use the possibilities of the educational environment to form universal types of educational activities and ensure the quality of the educational process" is additionally formed [4]. Naturally, among the tasks in the laboratory work, there are also various types of tests, as they are widely represented in school practice. For example, when completing the work "Studying the precession of a gyroscope", the tasks of this stage include the following:

1. If the equation for the dependence of the rotation angle on time is $\varphi=\frac{1}{2}+3t+4t^2$, then

a) $\omega=3$ rad/sec;
b) $\omega=2$ rad/sec;
c) $\omega=5$ rad/sec;
d) $\omega=7$ rad/sec.

a) $s=1$ rad/sec^2;
b) $\omega=2$ rad/sec^2;
c) $\omega=4$ rad/sec^2;
d) $\omega=3$ rad/sec^2.

2. The moment of inertia of the disk relative to the axis of rotation passing through the center of gravity of the body is calculated using the formula

a) $J=\frac{1}{2}mR^2$; b) $J=\frac{1}{12}mI^2$; c) $J=\frac{1}{2}mr^2$; d) $J=\frac{1}{2}mD^2$.

The next type of tasks offered to students at the actualization stage is related to establishing analogies and correspondences. When completing the work "Study of Rotational Motion", students are asked to fill in a table, comparing the quantities characterizing translational and rotational motion. It should be noted that the manual also presents other types of tasks. Naturally, the content of control tasks for other stages of laboratory work partially includes tasks of this type. A total of 18 laboratory works on mechanics have been developed, so three cycles of six works are carried out. At the same time, if during the first cycle of works students perform activities to solve the tasks

considered in the article, then in the following cycles students are provided with activities to independently compose all types of tasks. At present, the developed cycle of laboratory works on mechanics of such a structure is being tested in the educational process of training bachelors in the direction of "Pedagogical education" of the profiles "Mathematics" and "Physics". The development of laboratory works of such a structure is beginning in other sections of the general physics course.

CONCLUSION

In the process of teaching, it is important to teach students to apply important rules of science in order to understand and explain the nature of physical phenomena, conclusions from the results of experiments, and the operation of tools and devices. Highlighting the main material in each section of the physics course helps the teacher to focus students' attention on the issues they need to master deeply and rigorously. Physical experiments are an integral part of teaching physics at all stages of education, a source of knowledge and a teaching method. At present, the developed cycle of laboratory works on mechanics of such a structure is being tested in the educational process of training bachelors in the direction of "Pedagogical education" of the profiles "Mathematics" and "Physics". The development of laboratory works of such a structure is beginning in other sections of the general physics course.

References

1. Varaksina E.I. Improving the methodology for forming the basic competence of future physics teachers. Fundamental research. - 2012. - No. 11 (part 6). - pp. 1356-1359.
2. Kolomin, V. I. Methodological system of teaching general physics to future physics teachers. - Astrakhan: Publishing house "Astrakhan University", 2009. - 112 p.
3. Skripko Z.A., Artemova N.D. Formation of professional competence of a physics teacher in laboratory work. Bulletin of TSPU. - 2013. - No. 4. - P. 56-58.
4. Vostroknutov I.E., Doctor of Pedagogical Sciences, Professor of the Department of Physics and Mathematics Education, Arzamas branch of UNN, Arzamas.