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FORMATION OF PROFESSIONAL COMPETENCE OF FUTURE ENGINEERS ON THE BASIS OF INTERDISCIPLINARY INTEGRATED EDUCATION OF PHYSICS

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A B S T R A C T	***K E Y W O R D S***
In the article, the professional competence of engineering students in physics based on interdisciplinary integrated education the method of formation is explained.	engineer, competence, competence, irrigation, hydraulic engineering, integration.

Introduction:

Nowadays, the pace of development of technology is leading to fundamental changes in the life of the society, so the demand for skilled engineers is increasing day by day. An engineer is a "scientific creator of actions aimed at the creation and development of industrial civilization."

Educators and methodologists have researched problems related to professional training of engineering students. In particular, the problems of forming students' professional competencies in teaching physics have been studied by many scientists. The analysis of the research results of the leading pedagogic scientists and methodologists showed that solving the problem of increasing the effectiveness of practical training in physics is inextricably linked with the formation of imparting physical knowledge to future engineers based on the principle of professional orientation of education, as well as research on the development of practical skills in teaching physics. Such conclusions make it possible to study all aspects of the process of preparing future engineers for the engineering profession, taking into account the requirements of the State Education Standard. One of them is to prepare a competitive specialist who successfully applies his knowledge and skills acquired in physics in professional activities. Therefore, the issue of increasing the effectiveness of the knowledge gained from physics by students remains relevant [1].

Teaching physics to engineering students in technical higher education institutions should be career-oriented. Such education is externalized to achieve a goal-oriented learning outcome. For this purpose, physical training should be specially designed. N.A. Kleshcheva states in her research that "One of the main problems of higher education is to achieve its integrity." In the multi-level structure of training future engineers for professional activities, there are insufficient systematic connections between different stages of engineering activities, and it should consist of various activities directed to one common goal [2-3].

The formation of professional competence of engineering students on the basis of interdisciplinary integrated education is directly related to the specialization of the educational field and the areas of professional activity. For example: "Hydropower facilities in irrigation systems" bachelor's education field, based on qualification requirements, areas of professional activity:

- is a direction in the field of science, production and service, and covers a complex set of issues related to project-research work, design, construction, operation and maintenance, reconstruction, repair and reconstruction of Hydroelectric Power Stations (GES) built for irrigation networks [4.8].

In the course of our research, we developed the professional competences of design, construction and research in the course of teaching physics to engineering students in preparation for scientific-research, design construction professional activities. It is envisaged to develop research competence in preparation for scientific-research activity, design and construction competence in preparation for project-construction activity, and pedagogical competence in preparation for pedagogical activity.

The following requirements are set for the professional competences of students of the undergraduate education of hydropower facilities in irrigation systems:

1. General competencies:

to know the current issues of state policy, to be able to independently analyze socio-economic problems and processes;

to understand the nature of documents and works related to his professional activity in one of the foreign languages, to have the necessary knowledge within the scope of his professional activity in natural sciences and to be able to use them in his professional activity on a modern scientific basis;

to be able to use information technologies in his professional activities, to have mastered the methods of collecting, storing, processing and using information, to be able to make independent decisions in his professional activities;

able to independently acquire new knowledge, work on oneself and externalize labor activity on a scientific basis;

to have an idea about a healthy lifestyle and the need to follow it.

2. Professional competencies:

- to have the skills to study special literature, scientific and technical information in the field of hydropower devices and stations, achievements in the field of science and technology achieved abroad and in our republic;
- to acquire the skills of automated development of the project of parts, details and assembly units of hydropower facilities based on a systematic approach;
- to acquire the skills of conducting tests to determine the working parameters and workability of hydraulic machines and equipment and their elements;
- to have the skills to outsource the use, repair and maintenance of hydropower installations, equipment and their engines;
- to have the skills to develop and implement quality management processes of production activities;
- knowledge of the implementation of engineering and design solutions;
- knowledge of quality management in the production process;
- to have the skills to draw up a work plan and control this work, to plan the resources needed to complete the work, to evaluate the results of one's work;

- to acquire the skills of monitoring compliance of production processes with the requirements of the environmental and labor safety control system [5,9].

We implemented interdisciplinary integrated education in the development of professional competence of engineering students in the process of teaching physics, taking into account the requirements for general and professional competences in accordance with the curriculum. The following subjects were separated from subject blocks:

Block 1: physics, mathematics; Block 2: basics of electrical engineering and electronics; Block 3: hydroelectric power stations; Block 4: use of hydropower devices.

In the process of teaching physics, we will introduce interdisciplinary horizontal integration and interdisciplinary vertical integration of disciplines (Fig. 1, 2). The purpose of this is to provide integrated education with specialized subjects in physics lectures, practical, laboratory, independent study and group classes, and at the same time, to improve the quality of coursework, professional practice, and graduation work related to specialized subjects.

We will develop a road map for the development of professional competence of engineering students in the process of teaching physics based on interdisciplinary integration (Table 1).

In order to create a case in practical training in physics, it is first necessary to analyze the content of the studied topic of the physics course, to distinguish the main concepts and laws from it. The topic of electromagnetism includes the law of electromagnetic induction, magnetic field strength (H) and induction (B) concept is included.

After analyzing the content of this subject, develop the ability to correctly perform the inspection of engineer technical equipment, which helps to form the basic professional competence; formulas of educational tasks such as finding the differences between physical and engineering measuring instruments and determining their purpose were determined. When making certain physical measurements, students need to choose the correct measurement tools. The given tasks are also important in the study of "Electronics and Electrical Engineering" science, because the current measurement tools differ in terms of construction and operation approach. Making measurements and calculations, evaluating measurement results, and developing measurement skills are the basis for any engineering activity. Physics course "Electromagnetism"

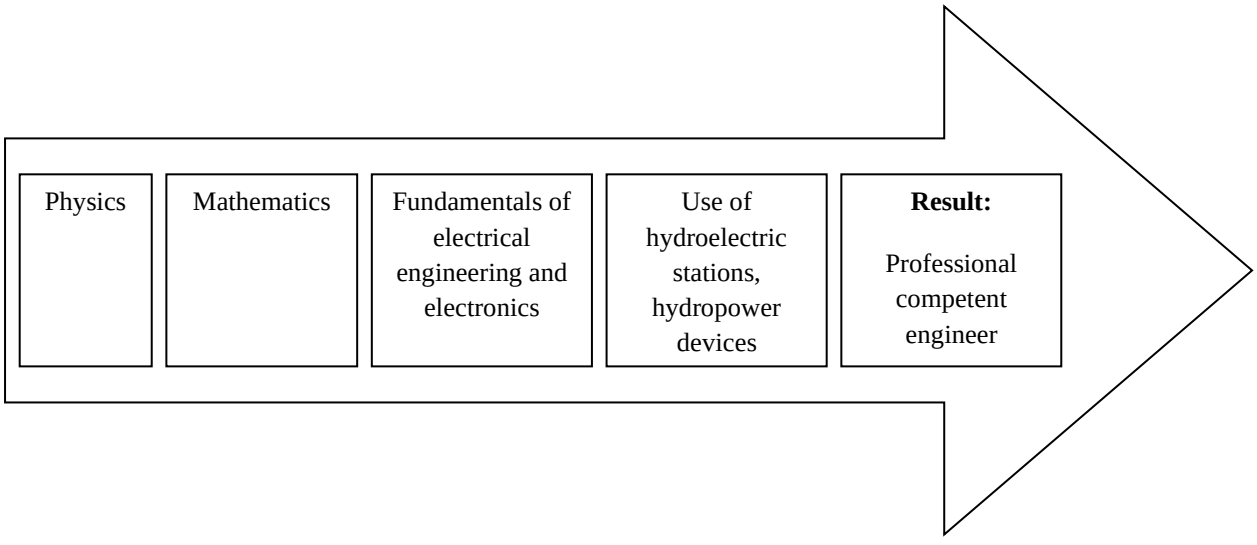

Figure 1. Interdisciplinary horizontal integration

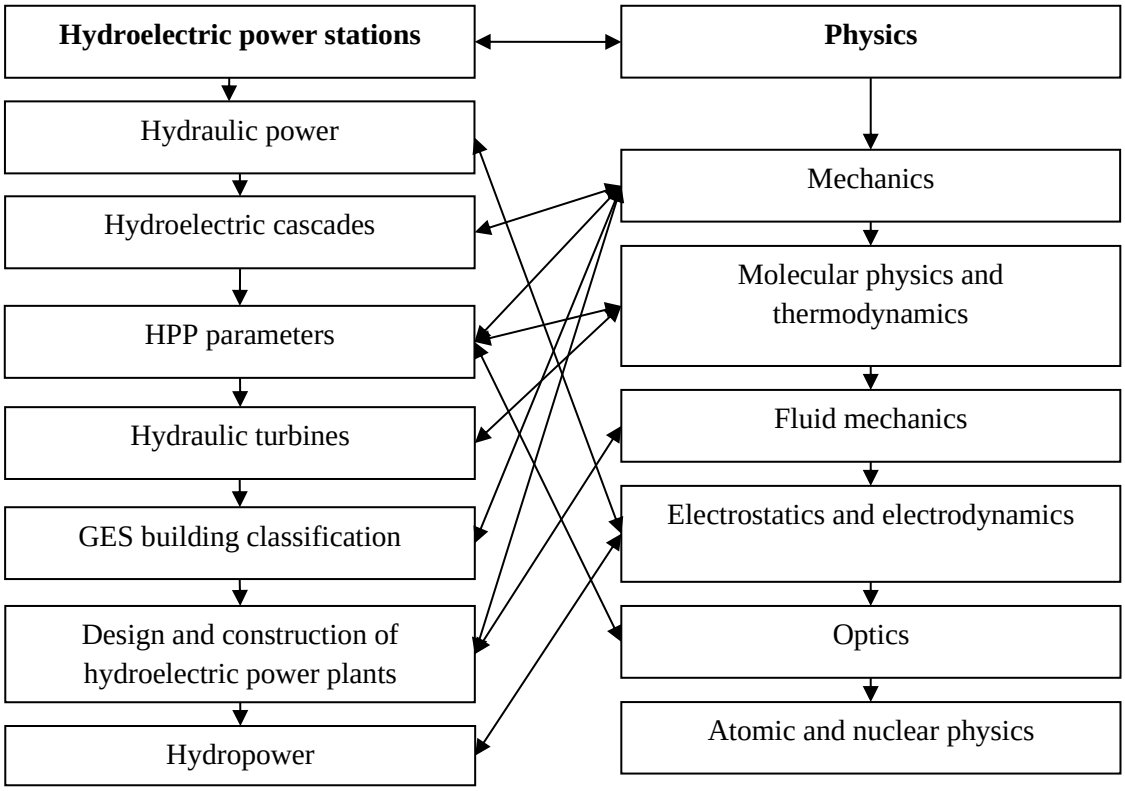

Figure 2. Interdisciplinary vertical integration of hydropower plants and physical sciences.

Table 1 A roadmap for teaching physics based on interdisciplinary integration

The goal	Interdisciplinary Integration		Physics forms of teaching	Develop competencies to survive	Educational methods	Result
Development of professional competence of students in the process of teaching physics	Mathematics	PHYSICS	Lecture	Modeling	Problematic education	ENGINEER
			Practical	Projecting	Case study	
	Fundamentals of electronics and electrical engineering		Laboratory	Construction	Interactive educational technologies	
	Hydroelectric station		Independent education	Research	Integrative educational technology	

Thus, career-oriented tasks help to solve the problem situation at a qualitative level. In addition, it is possible to continue studying this phenomenon, taking into account the principles of operation of other electrical equipment.

The ability to train future engineers to think coherently in the field of engineering, to think based on scientific evidence, to develop hypotheses, to reject conclusions in non-standard situations and to find

the right solutions does not appear by itself. It cannot be mastered without solving logical problems from physics to the profession. This, in turn, helps to solve professional problems in the subsequent engineering production activities.

An important condition for the successful implementation of knowledge activities and professional activities of future engineers is its complex structure. Pedagogical technology (case technology) is proposed to be implemented in three stages: preparatory, basic and final. It is important to use the model developed by us in the formation of professional competence of students of technical higher education institutions in interdisciplinary integrated teaching of physics[8-9].

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