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IMPROVING PROFESSIONAL COMPETENCE OF STUDENTS BASED ON THE DESIGN METHOD

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Abstract
The article studies stages of the organization of professionally oriented physics training according to the method of designing objects of professional activity, a model of formation of project activities in physics lessons, solved the practical task of calculating the mechanical properties of buildings and structures by the design method directed directly to the construction industry, as well as the types of competencies, and the types of competencies were studied, formed as a result of project activities.

Keywords: Design method, physical science, physical training, objects of professional activity, mechanical properties, interdisciplinary integration, design, construction objects, future builders-engineers.

Introduction

The engineering education system in Uzbekistan is one of the most developed systems today. Engineering education is one of the main priorities of the country's high level of professional training of technical, engineering, and scientific personnel. The training of scientific and technical personnel and engineering personnel plays an important role for the country, since the scientific and technological development of development is directly related to the most important discoveries and achievements of the past century. World leaders are countries and states that have accumulated scientific achievements and a high level of intellectual power, thereby increasing the national wealth of society. In our modern society, at the stage of transition to a new systemic state, it is necessary to rely on the best traditions of the local engineering education system, which has preserved valuable and important approaches to the training of highly qualified engineering personnel. The integrity of the educational process for the training of specialists in the fields of architecture and construction in higher technical educational institutions is achieved through interdisciplinary integration. The interdisciplinary approach to teaching allows students to independently acquire knowledge from various fields of science and industry, group it and direct it to solve a specific professional problem. In this case, the boundaries between courses and disciplines are fluid, which allows students to form an integral system of knowledge.

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Literature Review

Researcher Z.F. Beknozarova developed didactic principles based on organizational-functional, independent activity of future engineers in the process of teaching physics, and means of improving the integrativeness of modular technologies based on didactic support with interactive methods. In the research work of VV Soboleva, recommendations and instructions are given to students studying in the field of architecture and construction on how to express the main physical processes and phenomena in the form of mathematical equations and to choose the main physical laws and apply them in practice to solve professional problems. In this regard, it is studied that the study of the physics course of students studying in higher technical educational institutions is a fundamental basis, and that future construction engineers should understand the need to use physical laws to solve general and professional problems. The scientific article " Model of the methodology for the formation of design skills of bachelors-builders in physics classes " describes in detail the basic rules and stages of the physics teaching methodology, instructions and recommendations for ensuring the effective preparation of future builders-engineers for the design of professional objects . It is said that these tasks should be directly correlated with the topics of their future diploma projects, and the physical and technical characteristics of the object, as well as the climatic parameters of the construction site , should be taken into account. The topic is about designing a building envelope that provides favorable microclimate parameters inside the building and meets the required building performance . Dinara Ilgizarovna Fakhertdinova 's research work discusses the organization of an educational process aimed at determining the pedagogical conditions for teaching physics to students of architecture and construction specialties in the process of distance learning, conducting experimental tests, and strengthening the interconnection of physics with other general engineering disciplines . The scientific article "Curriculum integration in the teaching of physics to first-year engineering students" by F. Neri de Souza, Nilza Sosta, and S.G. Oliveiras examines the methodological foundations of teaching physics to students studying in the fields of architecture and construction based on integrated educational technologies.

Research Methodology

The fundamental essence of knowledge acquired in physics implies that the knowledge formed by students in physics lessons in technical higher educational institutions creates the basis for studying general professional disciplines, mastering new techniques and technologies. The content of the physics course should contribute to the formation of students' ideas about the modern physical picture of the world. In this case, physical knowledge is integrated, and the disciplines being taught are united by a common construction methodology focused on interdisciplinary connections . The success of implementing the method of designing objects of professional activity in physics classes depends on the mutual cooperation of professors-teachers of natural and general professional disciplines. To ensure this, a physics professor must have a clear understanding of the following:

-knowledge of the fundamentals of general engineering sciences;

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-correctly interpret physical laws, concepts, and definitions used in general engineering sciences.

This allows to eliminate the ambiguity in the interpretation of the same physical concepts by professors-teachers in different subject blocks. In the didactic model of the method of designing objects of professional activity, internal and external connections are distinguished.

Internal communication is the result of analyzing the content of a general physics course to identify the guiding principles and key connecting elements within it.

External communication consists of a structural and logical analysis of the topics of special subjects in the curriculum, highlighting the degree of interconnection of their content with the basic laws and concepts of physics, and identifying the basic interdisciplinary knowledge necessary to train specialists in the study of physics.

The organization of professionally oriented teaching of physics according to the method of designing objects of professional activity consists of four stages.

Stage 1 - when learning new information in lectures, the teacher formulates a problematic situation that arises in professional activity and, together with the students, identifies its physical essence and determines ways to solve this problem based on physical theories;

Stage 2 - students acquire skills in implementing the method of designing professional activity objects in a certain way in various topics of the physics course;

Stage 3 - students, having already realized the necessity and importance of the knowledge gained in physics for their future professional activities, organize their activities in all different forms of search, design, and thinking;

Stage 4 - forms the independent activity of students in the widespread use of this method in completing course and diploma works.

The model for developing design activities in physics lessons is shown in Figure 1.

This model includes the following structures:

- *target structure* **-** determines the final result of the developed methodology. These are students who have mastered the methods of performing the stages of design activity in the process of studying physics and can use them in solving educational problems in the cycle of architecture and construction sciences, and in completing graduation qualification works;
- *the organizational structure* includes the stages of design activity carried out using physical knowledge:

-calculation of mechanical characteristics of construction objects or their individual elements;
-calculation of acoustic characteristics of construction objects or their individual elements; calculation of thermophysical characteristics of construction objects or their individual elements;
-calculation of lighting characteristics of construction objects or their individual elements);

- generalized methods for their implementation; basic knowledge of the general physics course for the implementation of generalized methods; integration of physics into architectural and construction sciences as a result of the implementation of generalized methods.

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- *procedural structure - a methodology for forming* design activities for training specialists in the fields of architecture and construction in technical higher education institutions in the study of physics ; a set of didactic tools that include exercises, assignments with engineering content, study cards, as well as forms and methods of conducting classes;
- *value-semantic structure* - consists in understanding the importance of the physics course in mastering the methods of implementing design activities through the formation of general professional competence of students.

The developed methodological model includes *a control structure that takes into account the criteria and means of assessing the formation of methods for students to perform the stages of design activity.*

The success of implementing the method of designing professional activity objects in physics lessons depends on the cooperation of professors and teachers of physics and general engineering disciplines.

The developed rules allow us to outline a program of actions for developing a methodology for teaching design activities to students of technical higher education institutions in physics lessons, that is,

To develop the goal of preparing students for structural design activities in physics lessons; to identify the main stages of design activities that can be taught in physics lessons and to distinguish specific generalized methods for their implementation;

Development and implementation of a methodology for preparing students for design activities in physics teaching.

Analysis and Results

Conducting practical exercises in physics for students of technical higher educational institutions using the design method ensures their direct integration into the fields of architecture and construction and creates the basis for the formation of professional competence. Also, the design method ensures the integration of physics into general engineering disciplines. The solutions to practical problems related to calculating the mechanical properties of buildings and structures directly aimed at the construction sector using the design method are presented in the tables below.

Table 1.

No.	Implementation of common methods	Actions to be taken
Calculation of mechanical properties of buildings and structures		
1.	Problem statement:	Find the strength limit of a concrete column with a permanent base, not exceeding 1.5 m in height, in a construction project (Figure 1).
2.	Highlighting an object or its individual elements :	A concrete pillar with a permanent surface, no more than 1.5 m high.
3.	Distinguish between the types of loads that affect the object being considered or its individual elements:	A concrete column is loaded by its own weight.

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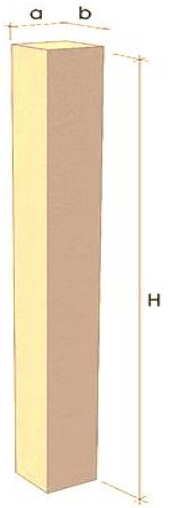
4.	Show types of deformation and physical phenomena:	A column made of concrete undergoes compression deformation under the influence of its own weight.
5.	Graphic representation of the nature of the object being designed or its individual elements.	 Figure 1. General view of a concrete column.
6.	Determination of physical quantities expressing the types of deformation under consideration:	compression deformation, mechanical stress.
7.	Describe the physical laws that describe the nature of an object or some of its derived elements under given conditions.	The limit of strength , $\sigma = \frac{F}{S}$ is determined by the expression. The total acting force is: $F = P$, where is $P = mg$ the weight of the concrete column. The mass of the concrete column is, $m = \rho \cdot V = \rho \cdot S \cdot h.$ Then for the stability limit , $\sigma = \rho \cdot g \cdot h$ The expression will be generated.
8.	Solve the resulting system of equations and determine the values of the physical quantities being sought:	To find the ultimate strength of a concrete column $\sigma = \rho \cdot g \cdot h$ we use expressions and perform calculations, $\sigma = \rho \cdot g \cdot h = 2500 \cdot 9{,}81 \cdot 1{,}5 = 367787{,}5 \frac{N}{m^2}$
9.	Comparison of calculated values that comply with design rules and technical conditions:	The calculated results comply with construction standards and regulations.
10.	As a result of design activities, integration into which general engineering disciplines is ensured:	construction mechanics; earthquake resistance of buildings and structures; metal structures.
11.	Types of competences formed as a result of design activities:	professional competence; technological competence; construction competence.

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Conclusion/Recommendations

Conducting practical exercises through the project method is aimed at further increasing students' interest in physics, more complete and deep acquisition of knowledge about the subject, and the formation of skills to independently apply the acquired knowledge in professional activities. The creation and introduction of this model into higher technical educational institutions will allow students to conduct practical, laboratory training in science and direct them to creative activity in independent learning, apply the acquired knowledge, skills and competencies in new situations, learn the laws of interaction between physical phenomena and processes, and develop the skills to propose the most optimal methods for carrying out design and construction work.

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