



THE STAGES OF SOLVING ENGINEERING PROBLEMS FROM PHYSICS AND ITS EDUCATIONAL AND METHODOLOGICAL SUPPORT

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Based on the review of S.S. Khudaiberdiev, docent of the Department of "Mathematics and Natural Sciences", Candidate of Physical and Mathematical Sciences, Tashkent Institute of Architecture and Construction.

Table with 2 columns: ABSTRACT and KEYWORDS. The abstract text describes the article's focus on solving engineering problems and educational support. The keywords list terms like competence, model, analysis, theoretical knowledge, independent work, individual, invariant, physics course, educational and methodological support, and educational process.

INTRODUCTION

It is known that the creation of a model of the implementation of professional orientation of the physics course requires the development of educational and methodological support based on the comparison of the stages of solving physics and engineering problems. Based on the analysis of scientific and educational-methodical literature, it is possible to determine the characteristics of the structure of educational-methodical support in various subjects.

In the process of learning a general physics course, the educational methodological support of preparing future engineers for professional activity should fully cover the set of materials necessary for students to study a certain subject in the course of classroom training and independent work in accordance with the requirements of the State Educational Standard (SES). In the literature, educational and methodological support is described as a system of normative, methodical and information-reference documents, which includes regulatory documents, collections for conducting all kinds of classes in this subject, determining the regulatory and legal bases of the specialty, competence requirements, independent work and monitoring the knowledge of students.

Literature Review

M.G. Minin [1], M.S. Saaduev [2], I.B. Fedorov, V.E. Medvedev [3] and other scientists stated that it is necessary to update the educational and methodological support of the educational process with new

quality indicators of the results obtained in accordance with the State educational standards. Gorkaeva defines the uniqueness of the educational-methodical complex as a system of normative and educational-methodical materials and educational tools.

According to T.M. Frolova, continuous updating of teaching-methodical support, continuous improvement of educational technologies, intensification of this process allows for individualization, transition from passive to active forms of education [4]. N.G.Berdennikova [5], V.P.Bespalko [6] describe information-methodological complexes as a means of activating students' independent cognitive activities and using computer technologies.

In order to improve the structure and content of educational-methodical support, Yu.L. The author defines the second group as a variable part, and includes diversity depending on the didactic, methodical and scientific training of the teacher [7]. Scientists divide didactic support into invariant (fundamental) and variable components. This approach allows to use the developed materials in teaching students of different specialties while preserving the theoretical core of the course and designing its shell based on the specialties of the students.

Taking into account the introduction of the credit-module system into the educational process, the role of physics in the training of future construction engineers and its integration with other special general engineering disciplines were discussed. In addition, instructions and recommendations on the effective organization of lesson processes and independent education are presented [8,9,10].

A. Yu. Kurin is based on the following principles in the process of formation of educational and methodological support [12]:

- 1) the activity and independence of learners, which is carried out through the active independent activity of learners and the guiding and corrective activity of the teacher;
- 2) developmental and educational education, which is carried out by encouraging self-expression of students in their future professional activities;
- 3) a differentiated and individual approach implemented through a special grouping of tasks and materials of different complexity levels [11].

In the development of teaching-methodical support, it is necessary to pay attention to the volume, complexity and time spent on tasks for independent work, consideration of permissible errors, dividing the task into small tasks in order to achieve educational goals.

Summarizing all of the above, we define the structural elements of educational and methodological support as a means of acquiring certain components of the basic professional competencies of students as the basis of the success of future professional activity.

In addition to regulatory documents (state educational standards, programs, curricula), the modern educational and methodological support of the general physics course should include:

1. Brief theoretical information on the studied sections in order to help students in the implementation of the theoretical stage of problem solving (formation of cognitive-analytical competences).
2. Material created for independent implementation of the analytical stage of solving educational and professional tasks (formation of cognitive-analytical, knowledge competences).
3. Instructions for solving issues necessary for students' independent work (formation of cognitive competence).
4. Algorithms, algorithmic type indicators, generalized methods of solving problems (formation of cognitive competence) in order to teach independence and reasonableness of decision-making.

5. Brief theoretical information on mathematics and informatics, which are often used by students to complete the practical stage of solving problems (formation of information-mathematical competence).
6. Questionnaire materials for searching for the necessary information and independent verification of the obtained information (formation of reflexive components of basic general professional competences).
7. Examples of solving the main types of problems to ensure independent work of students (activation of independent activity).
8. Examples of solving professionally-oriented tasks (formation of the motivational component of basic general professional competences).
9. Tasks for independent work (formation of the reflexive component of basic general professional competences).
10. Supervision and independent works (summarization and systematization of the mastered material).

Analysis and Results

In accordance with these requirements, the educational and methodological support of the general physics course was developed based on the comparison of the stages of solving physics and engineering problems. This supply structure is shown in Figure 1.

The developed educational and methodical support performs the following tasks in the educational process:

1. Educational. From the point of view of the traditional approach: it helps to systematize and generalize the knowledge of the general physics course, it helps to solve the problems in education. From the point of view of professional direction, it helps students to generalize, distinguish the main ones, make reasonable decisions, learn to prove their point of view, helps to form the knowledge and functional components of the main general professional competences.

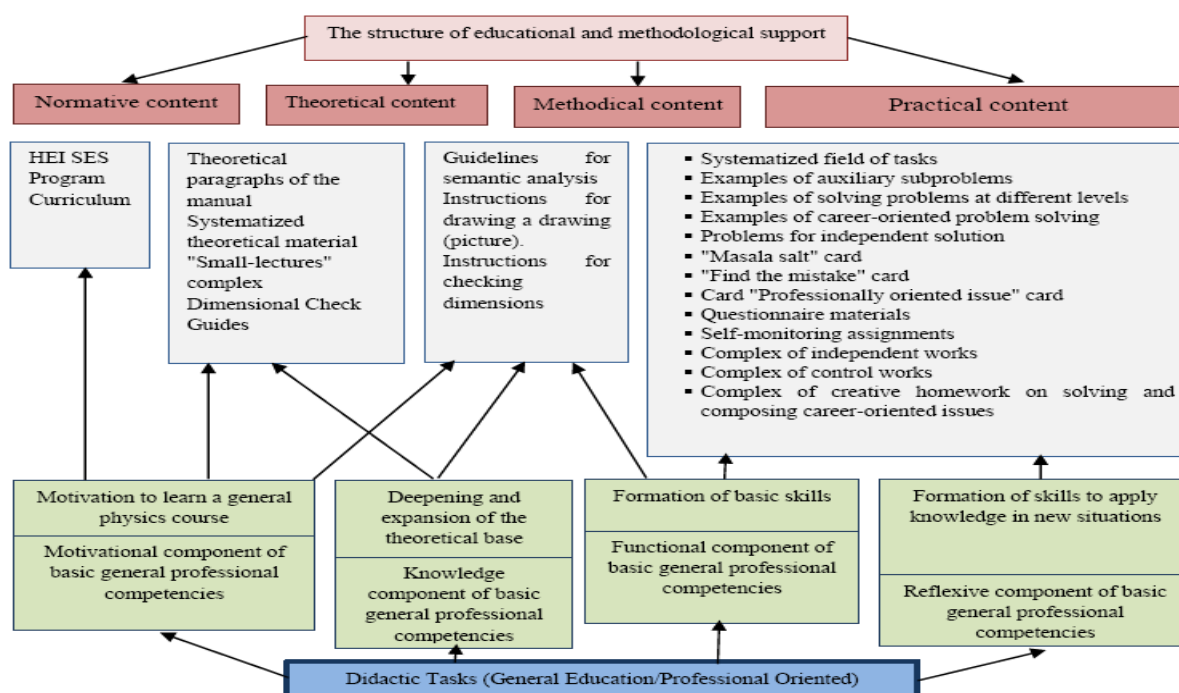


Figure 1. Educational and methodical support structure.

2. Controller. The level of mastering of theoretical knowledge and the ability to solve educational problems, as well as the levels of formation of basic general professional competences (as well as the analysis of mistakes made) allow the implementation of intermediate and final types of control.
3. Educational. From the point of view of the traditional approach: it activates the cognitive activity of students, encourages them to study the general physics course as a science and as one of the foundations of future professional activity; from the point of view of a competent approach: forms the direction of activity in solving problem situations towards the result, helps to form the motivational component of the main general professional competencies.
4. Reflection. Traditional approach: learning to check the obtained result, finding the optimal way to solve the educational task, allows self-evaluation. Professionally oriented approach: forming the need to check the results of one's activity, finding an effective way to perform a professional task, a critical attitude towards oneself, helps to strive for self-development. Contributes to the formation of the reflexive component of basic professional competencies.
5. Individualization of the teaching of the general physics course and formation of the basis of professional competence due to the ability to use a large part of the educational and methodical training in the independent work of the students.
6. Optimizing the educational process due to the activation of cognitive activity and independent work of students.

The task of educational and methodological support is as follows: organization of theoretical and practical preparation of future engineer-students for professional activity, as well as systematization and generalization of the studied material; development of creative abilities. The proposed teaching-methodical support allows the teacher to perform control and corrective tasks at each stage of its application (Fig. 2).

In higher education institutions, a certain structure of practical training on the general physics course has been developed. At the beginning of the practical session, the teacher usually checks the completion of the homework, answers the students' questions when there are difficulties in completing it. Then a questionnaire is conducted and repeated on the material passed, theoretical information on the topic of this practical lesson is analyzed in order to reflect the level of mastery of the theory, the teacher answers the students' questions.

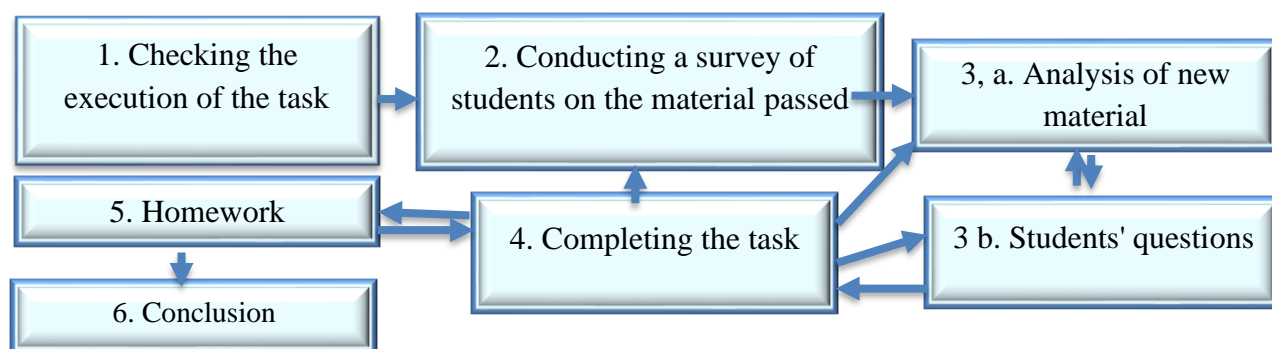


Figure 2. The structure of practical training

In the main time allocated for practical training, it is necessary to perform educational tasks, which consists of the following stages: analytical, theoretical (physical), practical (mathematical) and reflexive (analysis of problem solving). After the tasks are completed, the teacher announces the

homework and completes the lesson together with the students. Thus, the structure of the practical lesson allows to implement all stages of formation of basic competencies.

Conclusion/Recommendations

In short, the organization of theoretical and practical preparation of future engineer-students for professional activity, as well as systematization and generalization of the learned material, development of creative abilities, the proposed teaching-methodical support allows the teacher to perform control and corrective tasks at each stage of its application.

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