PROFESSIONAL ASSIGNMENTS AS A MEANS OF TEACHING MATHEMATICS AS A DIRECTION FOR THE PROFESSION IN TECHNICAL HIGHER EDUCATION INSTITUTIONS

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Аннотация:
В данной статье рассматриваются профориентационное задание и профориентационные проекты как средства повышения качества и эффективности преподавания математики в технических вузах.

Ключевые слова: профессионально-ориентированное задание, профессионально-ориентированная задача, профессионально-ориентированный проект, математика.

Abstract:
This article is said on career-oriented assignments and career-oriented projects as a means of improving the quality and effectiveness of mathematics teaching in technical higher education institutions.

Keywords: professionally oriented assignment, professionally oriented task, professionally oriented project, mathematics.

Introduction

Today, the importance of mathematical knowledge in preparing future engineers for effective professional activity in technical higher education institutions is increasing day by day. It's no secret that mathematics is rapidly entering all areas of our lives today. Its increasing importance in the development of science and technology requires students, regardless of the profession they choose, to think logically, to have mathematical concepts and to be able to apply them in their professional field, that is, the mathematical preparation of students is important for the scientific and technical development of society and the social-determines readiness for economic development.

The technical direction is determined by the fact that the main importance of the mathematics course in higher educational institutions is the practical possibilities of this subject, in other words, the need to use mathematical methods in any activity. Therefore, vocationally oriented teaching of higher mathematics in secondary educational institutions is one of the main tasks of this subject, and it should be reflected in the content of the form and methods of teaching.

In addition to the unique application of pedagogical tools that ensure the mastery of knowledge, skills and abilities provided for by the State Education Standards, interest in the chosen profession, respectful approach to it, effective professional characteristics in the person of the future engineer allows to form.

Pedagogical research and teaching practice show that career orientation is one of the ways to improve the professional training of students of higher education institutions. Teaching of higher mathematics subject to professional orientation implies the development of independent cognitive activities of students for conscious mastering of its content.

Vocational teaching of higher mathematics is one of the ways to improve students' level of mathematical preparation. This can be explained by the development of students' cognitive activity, the creation of conditions for the conscious and solid acquisition of the content of the higher mathematics course, as well as the study and strengthening of mathematical knowledge as necessary and important knowledge. It is necessary to organize the teaching of higher mathematics in higher education institutions in such a way that as a result of it, students should develop personal characteristics such as striving to apply acquired skills in different situations, acting with initiative, achieving the set goal, and standing firm in their vision based on their knowledge and life experience.

One of the important means of vocationally oriented teaching of higher mathematics in technical higher education institutions is vocationally oriented issues. There are several definitions of career-oriented issues in pedagogical research [1,7]. R.M.Zaykin emphasized the understanding of textual problems whose solutions are sought using mathematical tools, and the fable is focused on a certain field of human professional activity. According to N.V. Skorobogatova, "a professionally oriented problem is a problem that represents an abstract model of the real situation that occurs in the professional activity of an engineer and is solved using mathematical tools, the content of which envisages the possibility of various conditions, procedures and results" [7].

Analyzing these definitions, we came to the conclusion that the common aspect that is characteristic for them is to define two directions of career-oriented issues, that is, content and process. The first direction describes the content of the issue from the point of view of professional completion. It is carried out through the fable of a problem that arises as a result of a specific situation related to professional activity or models it. An example of such problems is solving the system of linear equations when solving problems on the subject of "Kirchhoff's law" in electrical engineering. The second direction is related to the methods used in solving the problem. In these definitions, it is noted that the problem is a model of the situation that arises in professional activity, but it is solved by mathematical methods.

These directions help to form professional competences in students, but studying mathematics should form general competence in future professionals. Therefore, as stated in the definition given by R. M. Zaykin, it is appropriate to include the third direction, that is, development, in the approach to the definition of professionally oriented issues. It can be done by increasing the motivation to study through the content of the problem and the methods of solving it, by developing the student's observation, memory, attention, and other personal qualities. So, as a professionally oriented problem - a problem that represents an abstract model of a real situation that occurs in professional activity, is solved by mathematical models or methods used in the professional activity of future specialists, and contributes to the development of the personality of a future specialist.

When dividing the professionally oriented problems into types, we were based on the classification proposed by I.G. Mikhaylova, which defines two main types: "The first type is a set of problems in which professional concepts and terms are used to give a special meaning to mathematical concepts. The second type is a set of problems that put the student in a specific professional situation that requires the use of mathematical methods. Problems of the first type are often used as motivational problems in

constructing a mathematical model and presenting new material. The second type of problems allows to develop the student's professional thinking, to prepare him for the future professional activity with the help of mathematical tools, and to increase interest in activities directly related to mathematics [4]. Any professionally oriented problem has a practical character, because it allows solving problems that arise outside of mathematics with the help of mathematical models.

Specific features of vocationally oriented issues are as follows: for different categories of students, the same issue may be practical for some, and professionally oriented for others.

For example, for students of the "Construction of buildings and structures (by types)" direction, the problem of calculating the strength of a beam, which is solved using differential equations, is considered a professionally oriented problem, because its content is focused on the field of professional activity, "Enegetics (by networks)", "Electrical energy (by networks and directions)", "Electrical engineering, electrical engineering and electrical technologies (by networks)" and other directions are only practical in nature, as it is not related to their professional activities.

Based on this, we understand the complex of professionally oriented issues as the issues of professional importance in the field of future professional activity, selected on a specific topic of some branch of mathematics. In order to include a complex of professionally oriented issues in the content of the mathematics course, the following steps should be taken: 1) selecting the necessary theoretical material from the subject area of mathematics; 2) to establish all kinds of interdisciplinary connections between the subject areas of special and general professional sciences between mathematics and practical applications related to the field of future professional activity.

Solving various career-oriented problems helps to master basic mathematical concepts together with professional terms, and the technical direction is the main means of implementing the principle of professional orientation in teaching mathematics in higher education institutions. It is precisely the systematic use of a set of mathematical concepts together with professional terms that allows deepening vocationally oriented teaching in mathematics education. It is important to note that students learn to apply both mathematics and knowledge to their future careers by solving career-oriented problems throughout the mathematics course. It corresponds to the State educational standard and qualification requirements in the process of professional training of future specialists. Therefore, introducing the content of career-oriented issues into the content of mathematics courses in all areas of technical higher education institutions is considered one of the most effective ways to improve the quality of professional training of future engineers.

These types of issues, in turn, must meet the following requirements:

- ease of modeling: at the stage of constructing a mathematical model, students should be able to construct a mathematical model of the problem. To achieve this requirement, the teacher must be able to engage the students in the environment described in the problem. Compilation of methodological instructions for creating a model allows to apply such issues in the study of various topics of the mathematics course;
- the presence of a technical fable of the problem, which helps to stimulate high motivation to study the relevant mathematical material;
- goal orientation: solving problems should help to master the mathematical knowledge, methods and methods that are the basis of professional activity;
- the interdisciplinary nature of the issues that appear in the process of the condition or solution.

The application of career-oriented issues at the voluntary stage of education performs the following specific functions:

- as a carrier of knowledge and methods of action of new professional importance as a form of presentation of career-oriented content at the stage of learning new material;
- technical direction at all stages of education as a means of implementing the mathematical modeling method, which is one of the most important methods of teaching mathematics in higher education institutions;
-motivational function provided by the technical fable of the matter.

Career-oriented issues are a means of developing students' interest in learning and forming intellectual flexibility at all stages of training.

In the organization of the process of teaching mathematics in technical higher education institutions, it becomes possible to apply career-oriented issues in the entire educational process. When learning new material, career-oriented issues play a motivating role.

At the stage of performing independent work outside the audience, career-oriented problems can be considered as a part of the task to be solved after the formation of the ability to solve problems of purely mathematical content. The use of career-oriented issues at the control stage allows to diagnose the ability of students to apply the acquired knowledge and skills in their professional activities.

Systematic application of career-oriented issues allows students to maintain a high level of educational motivation, which is achieved due to the formation of a strong interest in mathematics and specialized subjects. Pedagogical experience shows that the use in career-oriented problems leads to an increase in the level of acquisition of mathematical knowledge. The main mechanisms of the influence of career-oriented issues on the formation of mathematical knowledge and skills are: high level of student motivation; implementation of the graph of compatibility that fulfills the didactic goals of teaching students in technical higher education institutions; adequate selection of the content of mathematical education and methods of its development based on the didactic model of vocationally oriented mathematics teaching in technical higher education institutions.

We have come to the conclusion that the concept of "professionally oriented problem" should be filled with the condition of solving the problem with the methods used in professional activities, and the tasks that are performed by professional methods can be fully covered with the help of professionally oriented problems. Here we are talking about solving problems with the help of computer technologies. Problems in the mathematics course must meet the following requirements: completeness of the content, limited time to solve it; the existence of a specific mathematical method to solve it. However, in the professional activities of "Construction of buildings and structures (by types)", "Production of construction materials, products and structures" and other specialists, the mathematical problem can be implemented as an object of their professional activity. It does not require a special professional content, but its professional orientation is reflected in the use of a special method used in professional activities when solving it.

For this reason, we tried to develop a set of career-oriented tasks that can be solved using computer technology tools. When completing such assignments, the student uses computer and practical programs as a personal assignment and a personal solution tool. Professional orientation of students in the organization of independent work outside the auditorium can be done not only by solving career-oriented issues, but a student with a sufficiently large time resource (50% of the workload of the

auditorium) will have the opportunity to perform larger tasks. For these purposes, it is appropriate to use the method of projects [1].

This, in turn, requires the use of a more general concept, that is, the concept of a career-oriented task, rather than the concept of a career-oriented problem. A task oriented to a profession is understood as such a task, in the course of which the professional activity of a future specialist is modeled. The following two types of career-oriented tasks can be used in the teaching of higher mathematics in technical higher education institutions: career-oriented problems, career-oriented projects. Each type of assignments is used in a specific way of organizing the educational process using special teaching methods and tools. Each type of tasks fulfills its pedagogical functions and has its own mechanism of influence on educational motivation, acquisition of mathematical knowledge and skills. It is precisely for these reasons that we consider two types of career-oriented tasks separately. A set of career-oriented assignments means all types of assignments that allow the implementation of connections with the modeling elements of the professional activities of future specialists and specialized subjects of mathematics in the "Mathematics" course.

In the implementation of the principle of career orientation in technical higher education institutions, it is important to carry out career-oriented tasks using a package of practical programs.

Modern computer technologies and applied applications allow solving purely mathematical problems, bypassing complex and tedious calculations by hand. This, in turn, requires an expert not only to be able to work superficially with a calculator, but also to have more complex knowledge and skills to perform complex numerical calculations and calculation-graphic works that appear in solving many engineering problems. The specific features that distinguish the practical tasks performed in mathematics in technical higher education institutions from the tasks performed in physics or chemistry are that there is no need for expensive and complex equipment, and it is not necessary to conduct some practical experiments. On the other hand, as mentioned above, the implementation of these works is connected with the need to make complex and inconvenient calculations.

Experience shows that often students rarely work with practical programs, and they even have a very superficial knowledge of the capabilities of such common programs as Microsoft Excel. That's why students, by completing career-oriented tasks in mathematics, develop skills in using software products such as Microsoft Excel, MathCAD, as well as strengthening theoretical knowledge in relevant sections of mathematics.

From our point of view, the main positive result of properly completed career-oriented assignments is the student's sufficient mastery of the method of solving mathematical problems described in the assignment. The ability to perform calculations correctly, although important, is of course secondary.

The principle of vocationally oriented teaching of mathematics in the organization of independent work outside the classroom is implemented through the completion of vocationally oriented tasks and vocationally oriented projects.

A project is a form of organizing educational activities that implies the collective nature of the activities of all participants of the educational process in obtaining educational products within a certain period of time [8-9-10]. Among the many classifications of projects, there is a classification according to the type of main activity proposed by E.S. Polat, in which practical or practice-oriented projects are distinguished [5-6]. A distinctive feature of this type of projects is that the activity directed at the social interests of the participants is clearly defined from the beginning. This, in turn, requires a well-thought-out structure of the scenario of all the activities of each of its participants.

We are looking at a career-oriented project. Taking into account the definition given by A.V.Khutorsky and the principle of professional orientation described by M.I.Makhmutov, by profession-oriented project we understand the form of organizing the educational activities of students for the creation, research and implementation of mathematical models that are important in the professional activities of future specialists. [3]. Working on the project helps to form and improve important professional qualities of the future specialist. In the system of vocational education of mathematics, the following two types of vocational projects are distinguished: substantive and procedural. Content projects - we understand the projects of applying mathematical models to the content of related disciplines. Examples of such projects are: "Solving a system of linear equations when calculating current in a circuit", "Solving a system of linear equations when solving optimization problems", "Performing operations with complex numbers when calculating current in a circuit", etc.

Procedural projects imply the implementation of a ready-made mathematical model used in professional activities with practical programs or by developing a personal software product.

Career-oriented projects perform the following functions in the vocational education of mathematics: educational: mastering theoretical materials and methods of solving mathematical problems, strengthening the mathematical preparation of a specialist, mastering theoretical materials from related disciplines; developing: development of students' research skills, algorithmic thinking, important professional qualities of the future specialist; educational: to educate a sense of responsibility for the result of work, the ability to work independently and in a team, to form the professional culture of a future specialist; motivational: increasing students' learning motivation, developing interest in mathematics and related subjects.

The impact of career-oriented projects on the formation and development of mathematical knowledge, skills, and competencies is carried out through the following mechanisms:

-maintaining educational motivation at a high level by making projects practically oriented and involving students in the field of professional activity;

-implementation of the correspondence graph between the subjects of mathematics and specialized subjects, aimed at achieving the didactic goals of teaching mathematics to students with a career orientation;

-enrichment of the student with professional knowledge in conditions of successful acquisition of mathematical knowledge and skills.

As a conclusion, it can be noted that the technical direction is aimed at expanding students' imaginations about mathematics in higher education institutions, the use of profession-oriented assignments of various forms and levels of complexity in teaching it, ensures the implementation of the principle of professional orientation in mathematics education.

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