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Some Aspects Of The Application Of Problem-Based Learning In Universities At The Present Stage

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Abstract: This article examines the theoretical foundations of the problem-based learning (ПОО) method in higher education institutions. The study also presents the results of its implementation in teaching at technical and medical universities in Russia, Finland, Spain, and Singapore.

Additionally, the article analyzes the strengths of the method as well as the challenges associated with its integration into the educational process. In the concluding section, an overview of its future prospects are shown.

Keywords: Problem-based learning, critical thinking, teamwork, independent learning, real-world problem analysis, professional competencies, adaptation to the professional environment, hypothesis formation, professional training.

Introduction: At the present stage, new approaches to teaching in the field of technical education are required. Today, students must develop critical thinking, solve problems independently, and adapt to rapidly improving technologies. In the context of digitalization, the growth of information volumes, and the need to train specialists capable of making prompt decisions, traditional teaching methods are becoming less effective. In this regard, problem-based learning is a promising tool for actively mastering knowledge and applying it in practice.

The purpose of the research is to study the theoretical foundations of problem-oriented learning, analyze its implementation in various universities, and identify the advantages and disadvantages of the method in technical education. To achieve this goal, it is necessary to solve the following tasks:

- Define the concept of problem-oriented learning and its key characteristics.
- Examine the history and developmental stages of the method in educational institutions.
- Analyze the experience of applying problem-oriented learning in different universities, identifying the features and adaptation of the method.
- Compare practical results and identify factors influencing the success of implementing this methodology.

Thus, this study is aimed at substantiating the need to introduce problem-oriented learning in technical universities and identifying its impact on the learning process, academic performance, and professional training of students.

METHOD

Theoretical aspect

Problem-oriented learning is a teaching method where complex real problems are used as the main tool for students to master key concepts and principles, unlike the traditional approach based on direct information transfer. This method promotes critical thinking, problem-solving skills, and communication skills, as well as encourages independent information search and lifelong learning (Duch, Groh, and Allen, 2001) (1).

Capon and Kuhn (2004), Bilgin et al. (2015) and Ghufron and Ermawati (2018) argue that problem-oriented learning not only helps to transmit knowledge but also develops the use of knowledge to solve specific tasks.

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Szczyrba & Wiemer (2011) note that one of the goals of problem-oriented learning is to develop students' personal responsibility, which makes the process of acquiring knowledge more sustainable. The method contributes to the formation of communicative and social skills, as well as allows students to master the creative solution of problems in conditions close to their future professional activities (2).

Problem-oriented learning as a method was first used in the 1960s at McMaster University (Canada) by medical faculty teachers. Scientists and educators Howard Barrose and David Tamblin developed this approach as a more effective alternative to traditional medical education (3).

Soon, the concept began to spread and adapt to various disciplines. As early as the 1970s, problem-oriented learning was adapted at the University of Maastricht, where the method was formalized into a seven-step process focused on newly admitted students (Knegtmans, 1992; Servant, 2016). These innovations made it possible to expand the application of the method, making it structured and convenient not only for medicine but also for various fields of study.

Simultaneously, in Denmark in the early 1970s, new university centers began to open, including Rosquille in 1972 and Olborg in 1974, which served as a catalyst for the development of a project-based approach to learning (Berthelsen, Illeris, & Poulsen, 1977; Hansen, 1997).

In Rosquille, the first two years of bachelor's students studied in an interdisciplinary environment, working on problem-oriented projects. Teachers acted not as classic lecturers, but as consultants, helping students independently find solutions to complex problems (Illeris, 1974).

However, in 1974, when the methodology was transferred to the University of Olborg, it acquired a more applied engineering character (Servant-Miklos & Spliid, 2017; Whitehead, 2007).

In the 1990s, the University of Olborg began actively promoting its version of problem-oriented learning called the "Olborg Model," which is especially popular in engineering education (Kjærsdam & Enemark, 1994). This model involves combining traditional courses with project work in a 50/50 ratio, allowing students to master theoretical material and immediately apply it in real projects. In 2007, the university received the title of “UNESCO Chair for Problem-Based Learning in Engineering Education”, which contributed to the further dissemination of the methodology (Kolmos, 1996; De Graaff & Kolmos, 2003) (4).

Problem-oriented learning plays a key role in modern university education, as it encourages active learning, deep conceptual understanding, critical thinking, problem-solving skills, and collaborative work. Instead of passively assimilating information through lectures, students face real problems that require independent search for solutions, data analysis, and practical application of knowledge. This approach makes the learning process more meaningful and focused on the real tasks faced by graduates in their professional activities.

In a rapidly changing labor market and increasingly complex technological processes, problem-oriented learning becomes particularly relevant, as it develops students' ability to continuously learn and adapt. Developing flexible skills (soft skills) such as teamwork, analytical thinking, and the ability to apply theoretical knowledge in practical situations makes graduates more competitive.

Thus, problem-oriented learning not only improves the quality of specialist training but also lays the foundation for a successful professional career, providing universal competencies necessary for solving complex tasks in various fields of activity (6).

Practical aspect

In recent years, the problem-oriented learning method has been actively used in some universities of Europe and Asia in teaching university students, especially in medical and technical fields.

For example, this method was applied at the University of Huelva (University of Huelva, Spain) in 2013 when teaching engineering specialties, particularly construction engineering, to students. The method was implemented within the framework of an experimental program, the essence of which was to compare traditional lectures with teaching based on the problem-based learning method.

During the study, students were divided into two groups: one studied according to the standard system with lectures and problem analysis by the teacher, the other used problem-oriented learning, where students independently sought solutions, working on real problems. In the 2014-2015 academic year, individual interviews were added to the quantitative analysis to study the method's impact more deeply.

The results showed that the application of PPE led to a significant improvement in student performance. The average score of students who studied using problem-oriented learning increased by more than 30%, and the

number of those who successfully passed the exams increased significantly.

Analysis of the test results showed that students who studied problem-oriented learning demonstrated better problem-solving skills, made fewer calculation errors, and demonstrated greater creativity in approaching engineering problems. Furthermore, the study revealed the important role of the teacher-mentor: their leadership qualities and ability to organize the learning process significantly influenced the effectiveness of the method. As a result, Welwa University continued to develop problem-oriented learning in engineering-oriented educational programs, integrating methodology into new disciplines (7).

In 2024, a problem-oriented learning element was introduced into the educational process for 5th-year students of the "Future Medicine" Department of Emergency Medical Care at Sechenov University. The experiment involved discussing clinical cases in English to develop both linguistic and professional competencies. Students worked in small groups, analyzed medical data, formulated hypotheses, proposed solutions, and argued their point of view. The methodological basis was the textbook "Medical English" (Peter Gross, Daniel C. Baumgart), which contains clinical cases and discussion questions.

The results of the experiment showed that this methodology increases students' engagement in the learning process, develops critical thinking and teamwork skills. When analyzing the A Woman with Diabetes Mellitus case, the students were able to correctly interpret the laboratory data, identify risk factors, and propose solutions. The discussion took place in several stages: familiarization with the material, group work, intergroup discussion, and final discussion with the teacher.

Using problem-oriented learning allowed students not only to improve their English proficiency in a professional context but also to learn to independently search for information, analyze data, and make decisions. The experiment confirmed the effectiveness of this approach: students noted its practical benefits, as well as increased motivation to study both medical terminology and clinical thinking (8).

In 2016, problem-oriented learning was implemented at the Polytechnic Institute in Singapore. In particular, an experiment was conducted on comparing problem-oriented learning and the traditional lecture format. The purpose of the study was to assess the impact of problem-based learning on academic performance, student engagement, and critical thinking. 447 graduates participated in the experiment: 260 of them studied using the problem-based learning method, and 187 underwent training in the form of lectures. The study included quantitative analysis (questionnaires) and qualitative methods (focus groups and telephone interviews).

The results showed that students who studied using the problem-based learning method were more involved in the learning process, took initiative in completing tasks, and worked more actively in a team compared to those who studied in the traditional form. Moreover, students who studied using the problem-oriented learning method demonstrated higher academic performance. They also improved their skills in independently finding solutions and applying knowledge in practice (9).

In 2006, an experiment was conducted at the University of Helsinki to introduce the problem-oriented learning method in translation courses. The purpose of the research was to study the effectiveness of problem-oriented learning in the analysis of translation problems and the integration of translation theory into students' practical activities. The experiment was conducted in two courses: the first included six second-year students, the second - nine first-year students. During the sessions, students worked in groups, discussed translation problems, formulated research questions, searched for information, and exchanged results in a seven-stage problem-oriented learning process format.

The results of the experiment showed that the application of problem-oriented learning contributes to a better understanding of the translation process. One of the key advantages of the method was the students' awareness of different approaches to solving translation problems, as well as the connection between theory and practice.

Students' feedback was mostly positive: they noted that the problem-oriented learning method helped them to consider translation tasks from different perspectives and deepen their knowledge through active information search. However, some students experienced difficulties adapting to the new methodology, as well as noted the complexity of the secretary's role, who recorded key points of discussion (10).

Overall, the application of problem-oriented learning in all the universities considered had a positive impact on their motivation, academic performance, and professional training, however, specific approaches to implementing problem-oriented learning were adapted to the specifics of each university.

Advantages and disadvantages of the problem-oriented learning method

Problem-based learning has several significant advantages that contribute to the development of critical thinking, independence, and teamwork skills. Research shows that this method has a positive impact on learning motivation, engagement, and the desire to deeply master the material. Unlike traditional methods where students often act as passive listeners, problem-oriented learning makes them active participants in the educational process. They independently explore questions, find solutions, and apply their knowledge in real situations.

Additionally, problem-oriented learning helps students master key professional competencies necessary for a successful career, including communication skills, teamwork, and decision-making. Many students and teachers note a high level of satisfaction with this approach, as it makes the learning process more meaningful and closer to real professional conditions.

Despite its advantages, the application of problem-oriented learning also has certain difficulties. The method requires more time for preparation from both students and teachers, which can create additional workload. Unlike traditional lectures where material is presented in structured form, problem-oriented learning requires independent search for information, which can cause difficulties for students, especially at the beginning of learning.

Some of them find it difficult to adapt to the active format of work and the uncertainty associated with open tasks. There are also difficulties with resource provision, as the successful application of the method requires sufficient educational materials and access to information.

Despite this, most studies confirm that the positive effects of problem-oriented learning significantly outweigh its shortcomings, making this method an effective tool of modern education (11).

CONCLUSION

Problem-based learning has proven itself as an effective method that promotes critical thinking, independence, and the ability to apply knowledge in practice. In various universities, the method is adapted to specific educational directions, which confirms its universality and flexibility. Despite the identified difficulties, problem-based learning continues to be implemented in educational programs, demonstrating high effectiveness in training specialists in various fields.

Given the current demands on education and the dynamically developing labor market, problem-oriented learning is becoming increasingly in demand. In the future, it is possible to integrate it more widely into educational programs and develop digital tools that facilitate the organization of problem-oriented learning.

For the successful implementation of problem-oriented learning, it is advisable to consider some recommendations:

1) it is necessary to provide support for teachers, including methodological materials and professional development, so that adaptation to the new learning format is easier.

2) It is important to develop clear performance assessment strategies to consider not only group work but also each student's individual contribution.

3) Create an accessible information base that includes educational materials, examples of solutions, and recommendations for working in problem-oriented learning format to minimize difficulties in finding information.

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