

Problem-based learning in secondary school: Status and prospects

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ABSTRACT

Problem-based learning is one of the promising innovative technologies for the educational process in the school. The study is based on system-activity and technological approaches. The study was based on the survey, which was attended by 185 teachers of physics, mathematics and computer science at general education schools of Mordovia. This article presents the materials of research devoted to determining the rating and status of problem education in secondary school. Based on the analysis of the results of the conducted experiment, the main difficulties of teachers in the organisation of problem education and the reasons for its low rating in secondary school are revealed. The developed recommendations are presented, the implementation of which, in our opinion, would improve the status of problem education in secondary educational institutions.

Keywords: Problem learning, problem situation, educational problem, technology of problem learning, logical and heuristic thinking, creative thinking, lateral thinking.

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1. Introduction

The Federal State Educational Standard (FSES) of Secondary General Education, the methodological basis of which is the system-activity approach to learning, requires the provision of student readiness for self-development and continuing education through the organisation of their active learning and cognitive activity (Shalavina, 1984). The existing system of training in general education organisations allows to solve this problem only partially. Despite the measures taken to improve the education system, the level of knowledge and skills of secondary school graduates remains low. In these conditions, there is the search and the introduction of innovations in the mass practice of schools aimed at the solution of tasks set forth in FSES. This task can be solved most fully by problem-based learning, the positive impact of which has been proven not only on child intellectual development, on his emotions, will, imagination and other mental processes and personality traits but also on the motivation of learning (Abushkin, 2014; 2015; 2018; Kudryavtsev, 1969; Lapteva, 1982; Lerner, 1974; Makhmutov, 1975; Shalavina, 1984). Currently, many issues in the theory of problem-based learning are fully developed and presented in the literature.

Problem learning ideas have a long history. Its elements were used by Socrates and the Pythagorean school. At the turn of the 19th and 20th centuries, the individual methods of problem-based learning (heuristic, experimental heuristic, the method of laboratory lessons, etc.) were introduced into teaching to activate students' thinking.

More than a century ago, Dewey philosophised about the power of educational experience to promote a disturbing state of perplexity, the importance of curiosity in learning and steps in the problem-solving process (Dewey, 1910; Dewey, 1938). The incorporation of PBL methods, however, did not gain footing in education until the 1970s, when it was introduced in medical education in the 1970s at McMaster University (Barrows, 1996; Barrows & Tamblyn, 1980; Zubaidah, 2005). In a reform of the existing lecture and memorise method, medical students learned content and clinical reasoning by identifying symptoms in real patients, simulated patients or written case studies (Barrows & Tamblyn, 1980); diagnosing medical conditions; and prescribing treatments (Barrows, 1996). With successes in medical education, PBL emerged in other professional education programmes, including nursing, architecture, engineering, advertising, physical therapy and business administration (Barrows, 1996; Gould & Sadera, 2015; Quinn & Albano, 2008; Rideout & Carpio, 2001; Zubaidah, 2005).

Modern American theories of problem-based learning (Alexander, Halverson and others) have their own characteristics in contrast to the Dewey theory. In particular, they have no student self-expression and the teacher's role is diminished; they introduced the principle of problem collective solution instead of the individual solution; the method of problem solution in learning is not unique but has an auxiliary value.

In the third quarter of the 20th century, they developed the popular concept of problem-based learning by the English psychologist E. de Bono, who created the concept of lateral thinking and the practical technique of its use. He proposed a new approach to the evaluation of perception, which is based on the model of self-organising information structure (Edward de, 2015).

The teachers from Poland, Bulgaria and other countries have achieved certain results in the development of problem-based learning theory. The works of Polish teachers Kupisiewicz (1964; 1965) and Okonia (2007) studied the conditions for problem situation creation. The Bulgarian teachers Petkov and Markov studied the applied issues. In their studies, they focused on the organisation of problem-based education in primary school.

The origin of problem-based learning ideas in the national school belongs to the first quarter of the last century. The theory of problem-based learning during this period was based on the pragmatic theory of thinking by John Dewey. 'Problem learning on such a methodological basis represented an uncontrollable process, which, in its turn, did not meet the principles of our education system

development. Therefore, the ideas of problem-based learning were criticised and subsequently hardly used during this period'. (Abushkin, 2018; Marra, Jonassen, Palmer & Luft, 2014).

At the present stage, the main ideas of problem-based learning in line with the studies of thinking psychology began to be developed in the fifties under the guidance of well-known psychologists Leontiev (1957) and Rubinstein (1958). The results obtained in these works were developed in psychological and pedagogical studies of the learning process regularities (Brushlinsky 1983; Kudryavtsev 1969; Lerner 1974; Matyushkin 2003; Makhmutov 1975; Pidkasistyj 1977). They found out the following:

- according to basic laws, the process of knowledge mastering is the process of special problem solution, called problem-related ones;
- one of the main conditions of learning management, ensuring the development of thinking, is the deliberate creation of problem situations and problem solution.

In these works, they substantiated logical-methodological, psychological, pedagogical and practical aspects of problem-based learning. They developed and concretised the category apparatus not only of problem-based learning but didactics as a whole. The results of these studies are used in pedagogical practice to control the process of thinking in learning (Abushkin, 2018).

The aim of our study was to identify the level of teacher preparedness to implement problem-based learning at school.

The review pursued the following goals:

- to determine how often teachers, use problem-based learning to students;
- to determine the level of problem-based learning main category understanding by teachers and the place of these categories in the structure of problem-based learning;
- to determine the level of teachers' knowledge concerning the technology of a problem lesson;
- to identify the status of problem-based learning in general education school.

1.1. Research methods

A qualitative approach consisting of an analysis of the contents of the concept maps and interviews with teachers. The study is based on system-activity and technological approaches. The study was based on the survey, which was attended by 185 teachers of physics, mathematics and computer science at general education schools of Mordovia.

1.2. Questionnaire

1. Do you use problem-based learning to organise the learning process in your subject?
2. What are the advantages of problem-based learning over traditional?
3. What is the essence of problem-based learning, in your opinion?
4. What are the main patterns of creative thinking?
5. Which of the following problem-based training skills are mastered weakly by you?
 - a) the ability to conduct scientific and methodological analysis of educational material to plan and develop the system of problem lessons;
 - b) the ability to plan and develop a separate problem lesson;
 - c) the ability to create a problem situation and to formulate an educational problem;
 - d) the ability to manage the activity of students to solve educational problems.

2. Results and discussion

Problem lessons are given by about 18% of teachers. Moreover, most of them conduct such lessons sporadically.

Discovering the role of problem-based learning in the educational process, many (83.8%) were convinced that the main and almost the only purpose of problem-based learning is to improve the quality of knowledge acquired by students. The rest did not disclose this question.

More than 70% of teachers do not understand the essence of problem-based learning and do not know the basic laws of creative thinking. The essence of problem-based learning, in their opinion, comes down to the question posing that a student cannot answer due to the lack of necessary knowledge. In this case, the teachers do not take into account the main circumstance—the posing of such a question or a task, which leads to conscious difficulty, that is, a problem situation. It is known that a student begins to conduct search work to get an answer to the posed question only in the context of a problem situation (Abushkin, 1958; 2013; 2015).

The fifth question of the questionnaire was to reveal the basic skill level of teachers concerning the problem-based learning use in their work. It turned out that only 16.1% of teachers can conduct the analysis of the educational material on the taught subject to highlight the main phenomena, concepts, laws, dependencies that can be studied problematically, and to plan a system of problem lessons on this basis followed by their development.

23.2% of surveyed teachers can plan and develop a separate problem lesson. In this case, teachers have less difficulty than in the case of problem lesson system planning and development. This situation should be explained, first, by the low general theoretical and methodological preparedness of teachers on the subject taught and their lack of problem-based learning essence understanding since the development of a system of lessons requires a teacher to master the theory at a higher level.

The ability to create a problem situation is important during problem-based learning use. 47.6% of the interviewed teachers believe that they can create a problem situation with its subsequent analysis and a learning problem formulation. However, the data obtained on the basis of other research methods (the analysis of visited lessons, the conversations with teachers, the study of lesson summary) show that many identify the problem situation with the formulation of the lesson cognitive task. Moreover, a formulated question or a task is not a problematic situation but the means of its creation. Many teachers do not distinguish between the means of goal achievement and the psychological state of a person, and this is the problem situation that arises among students. In other words, the percentage of teachers who can create a problem situation, to analyse it with the subsequent formulation of a learning problem, makes only about 25% of the number of respondents.

Most of the teachers who took part in the survey believe that problem-based learning begins with the setting of any question by a teacher that students cannot answer. However, not every question can create a problem situation in any audience. For problem-based learning, it is important whether this question will be accepted by a student and whether he will be able to answer it according to his pool of knowledge. Here, we are talking about the question that is in the 'zone of a student nearest development' (Abushkin, 2007). On the other hand, it should be said about the student's motivation and the level of his intellectual development to accept the learning problem question and formulation. In practice, this means that the problem situation arises for a student only under certain conditions, often in specially created conditions. 'The presence of conflicting data in a problem situation necessarily generates the thinking process aimed at their removal' Rubinstein, 1958 p. 15). 'Consequently, if you enter contradictory data into the educational material or organise it and present it in the form of contradictions, it will give rise to the thinking process, that is, it will provide a special kind of interaction between a subject (a student) and an object (educational material), and thereby will contribute to the creative assimilation of knowledge' (Abushkin, 2018 p.13).

The analysis of the experiment results showed that about 73% of teachers do not use the problem of learning in their practice as the leading stimulus for the cognitive activity of students. It's related:

- with the lack of understanding by most of the problem-based learning essence by the majority of teachers;
- the lack of knowledge among teachers concerning the laws of the creative thinking process;
- the low level of knowledge about the forms of problem-based learning organisation;
- the lack of skills in problem-based learning.

In the context of the performed analysis, it is appropriate to list the main stages of problem-based learning organisation:

1. A teacher formulates a theoretical or a practical task (a problem) or demonstrates an experiment.
2. Students have a problem situation on this basis.
3. The analysis of a problem situation allows students to formulate a learning problem.
4. The solution of the educational problem, and, therefore, the formulated task or the problem.
5. The final stage—the check of the problem solution correctness (Abushkin, 2013; 2015).

It is more difficult for teachers to conduct a scientific and methodological analysis of programme material in order to highlight the main problems of a course, a section or a topic being studied. Based on the analysis, a teacher identifies those issues of the programme, the study of which allows to achieve the greatest pedagogical effect.

The difficulties in the organisation of the problem-based learning appear among teachers at the stage of a learning problem solution when it becomes necessary to control the thinking activity of students. We explain this by the fact that more than 75% of teachers do not have the knowledge about the laws of creative thinking. Most respondents do not know that productive human mental activity can be of two types during a problem solution with the inclusion of new information into the existing system of knowledge and its processing: analytical (or logical) and heuristic (Abushkin, 2015). The management of the problem solution process provides a teacher's ability to use these kinds of thinking. At that, the development of logical operations takes place which makes the part of the universal educational actions (Abushkin, 2014; Kharitonov, 2013).

3. Conclusion

Our research allows us to identify the reasons on which the rating of problem-based education depends in the national school. Let's list the most important of them.

- a relatively low level of general theoretical and methodical training of teachers teaching general educational disciplines;
- the relatively high complexity of problem-based learning theory and the technology of its use at school, which does not allow most teachers to master this technology on their own;
- the absence of purposeful training system for future teachers to organise problem-based learning at school in the practice of higher pedagogical educational institutions.

Summarising, we can say that one of the main ways to improve the status of problem-based learning at school is the targeted training of future teachers in the theory and the technology of problem-based learning within the walls of higher pedagogical educational institutions. We believe that among all the ways of school education level increase, the most productive and effective one is the increase in teacher intellectual level within the university walls.

The results we obtained are close to the results of our studies conducted earlier (Abushkin, 2018). They also correlate with the data from the studies of other authors, in particular, Lapteva (1982) and Shalavina (1984). The status of problem-based education in the national general education school remains steadily low over the past decades. This gives grounds to speak about the low level of teacher preparedness for problem-based learning organisation in different regions of the country, that is, there is a certain tendency of a problem-based approach introduction to learning in entire regions.

The stated above determined the relevance of research aimed at the rating of problem-based learning improvement among innovative technologies used in the domestic education system.

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