Development of Students' Research Competences by Using Problem-Based Learning Methods in the Implementation of the NIS Program

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Abstract

This article examines the effectiveness of problem-based learning methods in developing students' analytical and higher-level thinking skills in the context of updated educational content. It examines the theoretical foundations of problem-based learning, its essence, stages of implementation, and the advantages and limitations of its application in the educational process.

The aim of the study was to improve the performance of assignments aimed at developing analytical skills in 11th-grade students through the introduction of dialogic, heuristic, and exploratory methods. The study utilized statistical and empirical methods: a comparative analysis of the results of monitoring academic achievement in mathematics and the GPPW was conducted, as well as observation of student learning activities.

The results showed positive dynamics: a 35% increase in academic performance in mathematics and a 2% increase in the GPPW. Increased student motivation, independence, and engagement in project-based activities were also noted.

It is concluded that problem-based learning is an effective tool for developing analytical and synthesis skills, despite the significant time investment required in preparation and organization of the educational process.

Today teachers face many challenges that change their views on roles in the classroom. Teachers often have to look for the most productive teaching and learning methods. If earlier, with traditional teaching, the teacher had to tell and show everything themselves, then with the updated content of education, with the aim of developing a competitive intellectual and creatively thinking personality, the emphasis is placed on the cognitive activity of students, on the use of problem-based learning in lessons, when the student independently searches for knowledge, analyzes and draws conclusions (Komarova, 2013).

According to Karaseva E.M.(2014), problem-based learning is understood as an independent search by students for new knowledge and skills, by constructing an algorithm for the emergence and overcoming of contradictions based on the educational content. Problem-based learning promotes the development of students' cognitive and creative abilities through the development of their thinking using problem situations created by the teacher. Problem situations are questions formed based on the educational material, the answers to which students do not know due to lack of sufficient knowledge on the topic under consideration. The same judgment can be seen in the instructional and methodological letter of the autonomous educational organization "Nazarbayev Intellectual Schools", which classifies problem situations by novelty, by the level of problematicness and by the level of description (“Center for Educational Programs” of AEO “Nazarbayev Intellectual Schools,” 2024).

Makhmutov M.I. had a different opinion regarding problem-based learning: "... the theory and technology of problem-based learning is not universal, it has limits of its application" (Makhmutov, 1974). In his opinion, the teacher must be well prepared for the lesson and students must be highly motivated, therefore the technology of problem-based learning is very difficult to

master. According to the works of Sitarov V.A. (2009), several stages of problem-based learning can be distinguished: understanding the problem situation as a whole; analysis of this situation and highlighting the main essence of the problem; solution of the given problem by putting forward hypotheses and their consistent testing, as well as analysis of the correctness of the implementation of the problem under consideration. This indicates the need to carry out a number of activities related to the analytical and cognitive activities of students. According to W. Kilpatrick, to solve problem situations it is necessary to use the project method, which involves familiarizing students with the methods of research and problem solving (Kilpatrick, 1967.)

In order to understand what skills are best to start developing in students, the results of the initial monitoring of students' academic achievements in the subjects "Mathematics" and "English language" (as GPPW is taught in English only in grade 11 and there is no monitoring for it) were taken into account. After analyzing the data, it was revealed that students often have difficulty completing tasks to practice analysis skills. In this regard, the purpose of the study was to improve the level of performance of tasks aimed at developing analysis skills in students through problem-based learning methods. The relevance of the study lies in the use of problem-based learning methods in the teaching and learning process as one of the tools for supporting students and developing their analysis skills. Based on the results of the study, it is necessary to obtain answers to the following questions: How can problem-based learning methods be used to develop high-order skills in students? How can the quality of students' knowledge be improved?

Study objectives:

- to study problem-based learning methods;
- to conduct a comparative analysis of the results;
- to identify the advantages and disadvantages of using problem-based learning methods.

Some research methods are considered. Firstly, the statistical method, which made it possible to compare the results of monitoring students' academic achievements, the results of completing SAU/SAT (summative assessment for unit\term), and the students' results of the previous (2023-2024) academic year. Secondly, the empirical method through observation. A comparative analysis of the data showed that in the classes under consideration there are students who experience a number of problems when completing tasks to test high-order skills. Based on this, 11th grades were selected for the study.

There are a number of problem-based learning, and it is essential to take into account the level of knowledge and skills of students while studying new material. If students independently came to the solution of the problem posed, through their own thinking, then there is no need to repeat the course of solving an already solved problem. But if the course of solving is chosen by them incorrectly, or the answer is found incorrectly, then the problem situation will give students an understanding of the need to expand their knowledge and skills. In addition, if the problem turns out to be unsolvable or very complex for students, then there is a need to divide this problem into several problem tasks to organize the availability of their implementation (Sorova).

Such problem-based learning methods as dialogic, heuristic and research (especially for GPPW) were selected. These problem-based learning methods turned out to be the most optimal and effective in solving problem-based tasks. We used problem-based learning methods when studying a new topic, as well as when expanding or consolidating it. It can be noted that the heuristic method

was more effective in the 11th grade in mathematics, and the research method (including design thinking) – in GPPW (Stanford D.School), since the students were engaged in project activities.

In order to develop students' skills and abilities to analyze any situation, it is necessary to teach them to understand the text and navigate it, highlighting the main essence; be able to use non-continuous texts; practice solving educational and cognitive problems, practicing practical skills and requiring a complete understanding of the text, and also be able to refute the unreliability of information or assert its reliability. According to the results of the study students improved academic performance by 35% (math) and 2% (GPPW) throughout the academic year.

After conducting the study, some advantages and disadvantages of using problem-based learning methods in mathematics and GPPW lessons were identified. The advantages include the fact that problem-based learning methods contribute to the development of analysis skills, increase motivation for learning, and broaden students' horizons. In addition, as for GPPW, students continue their projects outside of the classroom, so 4 people decided to participate with their works in school and international competitions where all of them became top 3 projects. The disadvantage is that a lot of time is spent both on lesson planning and when students complete assignments. In addition, a lot of time is spent on the high-quality selection and compilation of practical assignments. The study showed that problem-based learning methods such as research, dialogic and heuristic methods of presentation are effective tools for developing students' analysis and synthesis skills. As can be seen from the table above, dynamics are visible for both subjects. The students were active and took initiative in the problem solving process, thereby acquiring new skills and knowledge, offering their ideas, solutions, and independently identifying problems and contradictions when solving problems.

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