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SOLVING A PROBLEM RELATED TO LOGICAL THINKING

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ABSTRACT

The development of logical thinking is a central objective of contemporary education because it underpins decision-making, problem-solving and successful learning in all subjects. Recent research and practice-oriented reports emphasize that systematic work with non-standard problems and inquiry-based tasks significantly strengthens learners' reasoning and metacognitive skills. This article analyses the pedagogical potential of problem-based learning for solving tasks specifically designed to foster logical reasoning in secondary school students. Theoretical foundations are drawn from heuristic problem-solving traditions, particularly the four-step model proposed by G. Pólya, and from modern interpretations of problem-based learning as a student-centred, inquiry-oriented pedagogy. The empirical part describes an intervention in which an experimental group regularly worked with structured logical problems integrated into mathematics and informatics lessons, while a control group followed a traditional, exercise-based curriculum. Data were collected through a logical reasoning test, classroom observations and learner reflections. The article concludes with practical recommendations for integrating logical problem-solving into everyday teaching to cultivate sustainable reasoning competencies.

KEYWORDS: Logical thinking, problem solving, problem-based learning, heuristic strategies, secondary education, reasoning skills.

INTRODUCTION

In the 21st century, schools are expected to teach students more than just how to repeat what they've learned. They should also learn how to think critically, make good choices, and solve problems they've never seen before. Logical thinking is a key part of this larger set of skills because it helps students go from given information to justified conclusions in a clear and verifiable way. But in many classrooms, closed exercises with a single expected answer and a set algorithm still make up most of the lessons. This limits the chances for students to learn how to think flexibly.

Consequently, scholars and practitioners have adopted methodologies that immerse learners in complex problem scenarios where the solution is not readily apparent. Problem-based learning (PBL) and similar inquiry-driven frameworks assert that knowledge and skills should be derived from efforts to address significant tasks rather than from the prior presentation of established rules. In this framework, significant emphasis is placed on problems necessitating the deconstruction of conditions, the identification of implicit relationships, and the assessment of alternative strategies. When these kinds of tasks are consistently included in subject teaching, they can be a great way to help students improve their logical reasoning.

The classical heuristic tradition in mathematics education, exemplified by G. Pólya, provides a conceptual linkage between logical reasoning and problem-solving pedagogy. Pólya's four-phase model—comprehending the problem, formulating a plan, executing the plan, and reflecting—continues to be significantly pertinent in modern classrooms, as it organizes both the cognitive and metacognitive dimensions of addressing non-routine tasks. However, putting these ideas into practice requires careful planning and support from teachers.

This study aims to investigate the impact of consistent engagement with specially designed logical problems, integrated within a PBL framework, on the enhancement of students' reasoning abilities. The emphasis is on standard secondary school environments, characterized by constrained curriculum time, necessitating teachers to reconcile content delivery with the development of advanced competencies.

The study was carried out in two concurrent classes of a general secondary school at the lower-secondary level. One class ($n \approx 25$) was the experimental group, and the other class ($n \approx 24$) was the control group. Both groups followed the same national curriculum for math and computer science and were taught by teachers with similar levels of experience.

Over the course of one semester, the experimental group took part in a program that taught them how to solve logical problems. Some of the time in two forty-five-minute lessons each week was spent on non-standard tasks that involved classifying, drawing logical conclusions, working with conditions written in everyday language, and analyzing simple algorithms. The problems were picked so that the content was still easy to understand, but they needed clear reasoning instead of just doing math. Teachers used a PBL-inspired order: first, students looked at the problem on their own or in small groups; then, they talked about possible solutions, presented and defended their answers, and finally thought about how they came to their conclusions.

The control group continued to learn in the same way they always had, with most of the time spent explaining and then practicing standard exercises. Non-routine tasks emerged sporadically, primarily as enrichment activities.

A pre-test and post-test in logical reasoning were given to both groups to see how the intervention affected them. The test included tasks that required deduction from verbal conditions, pattern recognition, and the justification of simple conjectures. Along with the tests, structured classroom observations were done to look at how students participated, how they argued, and what kinds of questions teachers asked. At the semester's conclusion, semi-structured written reflections were gathered from students in the experimental group concerning their experiences with logical problems.

The pre-test scores showed that both the experimental and control groups started out with the same level of logical reasoning ability. After one semester, both groups improved in some ways, which is likely due to regular subject learning. The experimental group, on the other hand, showed bigger gains, especially on questions that needed justification of answers and multi-step reasoning. Students in this group more often gave full arguments, made direct references to the conditions in the problem statement, and were better at spotting contradictions in wrong answers.

Classroom observations showed that the way people interacted was different in quality. In the experimental group, lessons slowly changed from mostly teacher-centered explanations to a more conversational style. Students more frequently suggested alternative methods,

interrogated each other's logic, and endeavored to elucidate the validity of specific steps. Teachers helped this change by asking open-ended questions like, "How can we be sure?""Or "Is there another way to look at this?which pushed students to explain the logical connections behind their answers instead of just giving them.

Written reflections showed that a lot of students thought logical problems were hard and even uncomfortable at first because they couldn't use algorithms they were used to. But over time, they said they felt more confident handling new tasks and that they started using the same logic strategies in other subjects. Some students said that talking about things together helped them see where they were wrong and figure out why some solutions didn't work.

The results obtained substantiate the perspective that structured engagement with logical problems in a PBL context can significantly improve students' reasoning abilities. This finding aligns with extensive research demonstrating that inquiry-based and student-centered pedagogies cultivate profound comprehension, transferable problem-solving abilities, and enhanced classroom engagement.

A significant determinant of the intervention's success seems to be the intentional organization of the solution process according to heuristic principles. When teachers consistently guided students through stages of understanding the problem, planning, execution, and reflection, learners gradually internalized this sequence as a general method of approaching complex tasks. This kind of internalization is very important for developing metacognition because it makes implicit reasoning a conscious, controllable process.

The study also points out a number of problems. It takes time and methodological skill to come up with good logical problems. The problems shouldn't be too easy or too hard, and they should be related to what students are learning so that they don't seem like random puzzles. In addition, teachers need to learn how to facilitate learning in a way that gives students some freedom while still giving them direction. Without this kind of help, problem-solving lessons could go back to just explaining things the old way, or they could turn into unstructured exploration with little learning.

Solving problems that are specifically designed to help students think logically can be a big part of modern education when they are part of a clear teaching plan. The experience recounted in this article illustrates that, despite the limitations of a conventional secondary school schedule, meticulously chosen logical tasks, coupled with heuristic support and reflective discourse, result in significant enhancement of students' reasoning skills and their preparedness to confront novel challenges.

For long-term success, curricula should clearly state that logical thinking is a skill that applies to all subjects and should encourage teachers to regularly include problems that aren't routine in their lessons. Teacher education programs and in-service training must encompass both the formulation of such tasks and the promotion of problem-based, dialogic instruction. When these conditions are met, logical problem-solving stops being an occasional fun activity and becomes the main way that students build strong, transferable intellectual skills.

REFERENCES

1. Pólya G. How to Solve It: A New Aspect of Mathematical Method. Princeton, NJ: Princeton University Press, 1945.
2. Wood D.F. Problem-based learning // BMJ. 2003. Vol. 326, No. 7384. P. 328–330.

3. Suyunova N. Enhancing logical thinking in school students: strategies, challenges, and future directions // Science and Innovation. 2025. No. B (Special issue). P. 162–170.
4. High Speed Training. Problem-solving method of teaching [Electronic resource] // High Speed Training Hub. 2025. Available at: https://www.highspeedtraining.co.uk/hub/problem-solving-method-of-teaching/ (accessed 24.11.2025).
5. Team Codeyoung. How to nurture logical thinking for modern learning [Electronic resource] // Codeyoung Blog. 2025. Available at: https://codeyoung.com/blog/how-to-nurture-logical-thinking-for-modern-learning (accessed 24.11.2025).