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The Quality of Problem-Oriented Teaching and Student Achievement²

Extended summary

The paper analyzes the possibilities and ways of applying problem-oriented teaching in school practice. The aim of the research was to expand the current knowledge about the extent of representation, the quality of the application and characteristics of the realization of problem-oriented teaching, and the effect that such organized teaching has on the level and quality of students' achievement in teaching mathematics and biology. The research involved 97 teachers of mathematics, 99 biology teachers and a total of 1,117 students. Of the total sample of students, 552 respondents (49.42%) filled the questionnaire for teaching mathematics, and 565 respondents (51.58%) for the teaching of biology. Every fifth student in the alphabetical order was selected for the procedure of the respondents, from one department of mathematics or biology teachers, who formed a sub-group. The descriptive-analytical method was used, and the data was collected by means of surveying, scaling and testing techniques.

The research results indicate that problem-oriented teaching is the most frequently used teaching approach in mathematics classroom, while it is used to a lesser extent in teaching biology. According to students' assessments (31.58%) and teachers (34.44%), the problem-oriented teaching in mathematics classes is most often applied once a week, while, according to the assessment of the majority of students (29.96%) and teachers (31.87%) in biology classes, it is realized once a month or rarely. The students whose teachers frequently use problem-oriented teaching achieve better results than students who are rarely exposed to this type of teaching and learning. Accordingly, the findings show that a group of students, whose teachers ap-

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ply problem-oriented teaching two or more times a week, score 10 points more on the mathematics test in comparison to the group of students whose teachers use this type of teaching and learning once a month or less often, while this difference in biology teaching is lower and amounts to 4 points. As far as the type of the problem is concerned, students mostly have to solve problems containing more information in the text, while the problems with several correct solutions are rarely used. Students generally realise that problem solving process involves the activities pertaining to the problem-oriented teaching and learning. The analysis of the quality of implementation showed that students do not pay enough attention to initial activities in the problem-solving process and to the evaluation of the achieved results. Positive correlations between the tested properties of the problems and achievements of students, as well as between the frequency and the quality of the realization of the activities of the problem-oriented teaching and achievements of students were determined. The results show that students generally achieve an average or below the average level of autonomy in the realization of the problem-oriented teaching activities. The low level of independence in the teaching of both subjects is expressed by the students when they get to know the problem, as well as during the evaluation of the problem solution. In the teaching of mathematics and biology, the methods of applying the problem-oriented teaching are ranked according to the same order of frequency of application, as follows: (1) problem dialogue, (2) model of independent activity, (3) creative model of activity, and (4) problem monologue. The problem-oriented teaching is mostly realized at revision lessons, through the dialect method and applying the individual form of work in the teaching of mathematics, and through the frontal form of work in the teaching of biology.

The obtained data could potentially provide teachers with guidance for a more successful organization and implementation of the problem-oriented teaching. It seems that the findings speak in favor of a more frequent realization of this mode of work in practice. This is suggested by the results of the effects of this mode on students' achievement. It should be emphasized that the curricula which are problem-oriented, as well as the textbooks based on the problem-based principles, would more strongly support teachers to make problem-oriented work an integral part of their practice. Without a systemic support for teachers at different levels, the problem-oriented mode of work will continue to be a way of work that is sporadically introduced and presented as an innovation.

Keywords: problem-oriented teaching, problem-based learning, student achievement, problem, problem-oriented teaching activities.

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