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Short scientific paper

Pre-service Elementary School Teachers' Perception of Rectangle

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Extended summary

The paper falls within the domain of the "Research of Mathematics Education" as a mathematical-humanistic and humanistic-mathematical activity in perceiving the paradigms "school mathematics", "mathematical knowledge necessary for teachers", "methodological knowledge necessary for teachers" and "understanding the process of teaching and student learning", in this particular case in the lower grades of primary school in our school system.

This mathematics education researcher is inclined to believe and hypothesize that there is a discrepancy between the information provided by the social and academic community regarding the literacy of the pre-service primary school teachers at the Faculty of Education in each of the mentioned paradigms and their actual success in these areas. Also, this researcher is inclined to accept the idea that the overcoming of a significant number of problems in mathematics teaching in the lower primary grades should be sought in shifting the focus from students to teachers.

This paper deals with a recently conducted research on the level of understanding of the geometric concept of rectangle among the pre-service primary school teachers at the Faculty of Education.. The conducted research was a part of a long-term research on mathematics and methodological literacy of students of faculties of education realized by the Scientific Society of Mathematicians in Banja Luka (SMBL). Student reflections have been collected on one of the simple questions in school geometry: What is a rectangle?

The results of this and analogous research projects should support the academic community in negotiating with the social community on the quality of mathematics and methodological education of future teachers teaching mathematics in the lower grades of primary school.

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In order to establish what students think about the concept of a "rectangle" and how they understand it, we tested 65 students of the Faculty of Education in Bijeljina and Bihać within the multi-year research project "Establishing the Level of Mathematical Literacy" realized by the SMBL. The testing was carried out in the period February - March 2013. Within the framework of the test, candidates were asked questions about the rectangle, how they understand it and how it should be presented to students of lower grades of primary school.

Question 1. Describe the rectangle. 2. Give a precise definition of the rectangle. 3. How are students taught the concept of the rectangle: (a) In the second grade? (b) In the fourth grade?

Test participants were instructed to respond in writing without a set time limit to complete the assignment. The concept of the rectangle was chosen for several reasons: First, it is one of the geometric objects which pupils of the lower grades of primary school learn about in the second grade. Second, the rectangle is a special case of a parallelogram and as such it is suitable for recognizing from a wider class by the creation of specific predicates. Question 1 referred to the determination of the rectangle. Thus, the sentences used to describe this geometric figure could contain more predicates than necessary to determine the figure. Question 2 asked students to provide a precise definition of the rectangle. Therefore, the sentences that the students constructed as answers to the question were supposed to contain only the necessary and sufficient predicates for the determination of the rectangle.

This paper presents some of the students' responses concerning the determination of the rectangle and the definition of the rectangle as a geometric concept. It was expected that the students would recognize the differences between the Questions 1 and 2 in this task. We expected that the students would exhibit their skills on which their teaching about these geometric concepts should be based (Question 3). In the second grade of primary school in Bosnia and Herzegovina, teachers introduce to pupils some of the rectangular models, with the mandatory use of the noun "rectangle" as the name of that model. Conversation with pupils should enable them to successfully recognize the model of the rectangle as well as to distinguish it from the model of other objects.

Below are some of the students' answers to the question about determining rectangles. The answers were classified into four clusters.

The first cluster was represented, for the sake of illustration, by the students' answers from which the researcher, despite considerable effort, failed to reconstruct the student perceptions of the rectangle.

The second cluster consists of answers in which the rectangle is defined as a three-dimensional subset of the space – "geometric body".

The third cluster contains the unacceptable answers in which the rectangular concept is described by the category "geometric figure".

The last, fourth cluster includes the acceptable answers.

The results of the students' responses to Questions 1 and 2 are shown in Table 1.

Offered answers				
Required concepts	Acceptable	Unacceptable	Without answer	
Near-definition	32 (49,23%)	28 (43,08%)	5 (7,69%)	65 (100,0%)
Definition	7 (10,77%)	48 (73,85%)	10 (15,38%)	65 (100,0%)

Table 1 Distribution of student performance relative to the first two questions

This research aimed at gaining an insight into the perceptions of students of the Faculty of Education about the rectangle. We tested 65 third and fourth year students of two faculties of education in Bosnia and Herzegovina. Based on the feedback, this researcher is inclined to conclude that this tested population has significant difficulties with determining the rectangle. This initial study suggests that the misconceptions of the lower primary pupils regarding this geometric figure are the result of their teachers' misconceptions. Therefore, the problems of teaching geometry in the lower grades of primary school should be resolved by shifting the focus from pupils to their teachers.

Key words: geometric concept of rectangle, van Hiellel's levels, students' perception of rectangle.

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