

KNOWLEDGE OF QUADRILATERAL AT ELEMENTARY SCHOOL

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Abstract. Quadrilaterals are more difficult than triangles for some students of elementary schools. This pilot study compares knowledge of quadrilateral of pupils of elementary schools and pupils of the same age at grammar schools. Some students prefer algebra to geometry, because it includes practical problems. The aim of this pre-research is to find out differences in knowledge of quadrilaterals between pupils of elementary and grammar schools.

1. Prologue

This pre-research decided to compare the knowledge of the quadrilaterals of the elementary school pupils with pupils of the same age at a grammar school. Knowledge was tested by a didactic test, which is less common form of testing knowledge of mathematics and very unusual form of testing of knowledge of geometry. Pupils usually meet with the tasks, where they construct some object but the test to understand the definitions of objects is unusual. Good understanding and knowledge of these terms may help pupils to solve common types of problems.

2. The objectives of the research

The research was carried out on pupils in the eighth and ninth grade of elementary school and compared with existing research on pupils in the same age of a grammar school [4]. The aim was to compare how the curriculum of

quadrilaterals managed pupils at an elementary school and a grammar school. Pupils got an unstandardized didactic test (see Appendix) which contains 9 questions with multiple choice form of answers.

3. Respondents

Testing was carried out in school year 2010/2011 at an elementary school in Letohrad (34 pupils from the eighth grade, 18 pupils from the ninth grade) and compared it with the research conducted in school year 2008/2009 at a grammar school with 159 pupils [4].

4. Analysis of data

The relative frequency of responses was summarized in the following Table, and we compared it with data already obtained from testing pupils at a grammar school.

The frequency of correct answers is comparable for pupils of both school for many questions.

Almost the same ratio of pupils of both schools correctly answered the question No. 1. Pupils of the elementary school know that three elements are not enough for the construction of a quadrilateral. But only 21% of pupils know that they need five elements.

The question No. 2 was about the basic terminology and the majority of pupils answered it correctly.

The number of correct answers for the question No. 3 was comparable for pupils of both types of schools.

The question No. 4 was the major success of grammar school pupils. The number of response B of elementary school pupils was interesting. The pupils meet squares and rectangles very often in school and life. It is very surprising ignorance of a rectangle.

Elementary school pupils are a bit better in question No. 5. The question No. 6 is similar to the previous question. The balanced answers of primary school pupils could be caused because the most pupils only guessed. When we compare this question with the previous one, we can see that a rhombus is more understood than a parallelogram.

Results of question No. 7 were balanced, and pupils mastered a rectangular trapezoid similarly.

Deplorable results of question No. 8 for pupils of elementary schools show scant knowledge of trapezium and its properties. The most surprising answer is D (of the primary school pupils).

The question No. 9 was balanced again. We can only mention the frequency of response C.

Question No.	Answer	Pupils of elementary school	Pupils of grammar school
1	A	15 %	42 %
	B	45 %	34 %
	C	21 %	21 %
	D	19 %	7 %
2	A	11 %	13 %
	B	81 %	85 %
	C	4 %	2 %
	D	2 %	0 %
	Didn't solve	2 %	0 %
3	A	9 %	0 %
	B	17 %	23 %
	C	15 %	8 %
	D	59 %	69 %
4	A	4 %	6 %
	B	68 %	36 %
	C	26 %	51 %
	D	2 %	7 %
5	A	17 %	17 %
	B	9 %	25 %
	C	47 %	32 %
	D	25 %	26 %
	Didn't solve	2 %	0 %
6	A	23 %	34 %
	B	32 %	38 %
	C	21 %	4 %
	D	24 %	24 %
7	A	19 %	32 %
	B	38 %	40 %
	C	17 %	9 %
	D	26 %	19 %
8	A	11 %	26 %
	B	19 %	17 %
	C	23 %	34 %
	D	43 %	23 %
	Didn't solve	4 %	0 %
9	A	40 %	32 %
	B	17 %	21 %
	C	24 %	32 %
	D	15 %	15 %
	Didn't solve	4 %	0 %

Table 1: The relative frequency of responses of elementary and grammar school pupils.

5. Conclusion

The test proved that the knowledge of pupils from both types of schools is for the most part the same. Some errors could be caused by inattention. Some pupils could be surprised with an unusual form of testing. Moreover, the test was carried out at a substitute lesson and not immediately after discussing the subject matter. The results of both types of school show that pupils are not sure in definitions and relations of trapezoids and common quadrilaterals. After studying triangles, the problematics of quadrilaterals may be less discussed, and some concepts may not be adequately explained.

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Appendix

Question 1: How many components are needed to construct a general quadrilateral?

- a) 3
- b) 4
- c) 5
- d) 6

Question 2: Convex quadrilaterals can be divided into common quadrilaterals, parallelograms and

- a) rhombuses
- b) trapezoids
- c) squares
- d) rectangles

Question 3: The diagonals of a rhombus are:

- a) of the same length but do not bisect each other
- b) of the same length and bisect each other
- c) perpendicular but do not bisect each other
- d) perpendicular and bisect each other

Question 4: In which quadrilaterals are the diagonals the axes of the internal angles at the same time?

- a) only in a square and in a rhomboid
- b) only in a square and in a rectangle
- c) only in a square and in a rhombus
- c) only in a square and in a trapezoid

Question 5: Two diagonals divide a rhombus into:

- a) four equilateral triangles
- b) four identical isosceles triangles
- c) four identical right triangles
- d) two isosceles triangles and two identical equilateral triangles

Question 6: Diagonals always divide a rhomboid into:

- a) two pairs of identical triangles
- b) two pairs of isosceles triangles
- c) four identical triangles
- d) a pair of right triangles and a pair of isosceles triangles

Question 7: A right-angle trapezoid has four interior angles:

- a) two acute angles, one obtuse angle, one right angle
- b) one acute angle, one obtuse angle, two right angles
- c) one acute angle, two obtuse angles, one right angle
- d) two acute angles, two right angles

Question 8: Select a claim for any isosceles trapezoid:

- a) we can draw the circumscribed circle
- b) we can inscribe the circle
- c) we can draw the circumscribed circle and also inscribe the circle
- d) each of its diagonals divides it into two isosceles triangles

Question 9: Which of the following statements do not apply to any rhombus:

- a) we can draw the circumscribed circle and also inscribe the circle
- b) the intersection of the diagonals has the same distance from all the sides
- c) its content is less than a square of the side length
- d) the total size of every two adjacent interior angles has a size of 180°