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A teacher has often to choose what group of pupils to pay larger attention – clever pupils or backward ones. The paper is dealing with importance and need of work with pupils interested more in mathematics. Solving unusual mathematical problems help not only develop mathematical abilities of pupils, but it motivates pupils toward mathematics. On the other hand creation and solving problems improve both teacher's work and educational process, too. In this sense, the preparation of the future teacher is important already.

Key words: mathematics, elementary school, unusual mathematical problems, teacher and student of primary education.

Učiteľ si často musí vybrať, či bude na hodine venovať väčšiu pozornosť šikovnejším žiakom v triede alebo zaostávajúcim. Článok sa zaoberá dôležitosťou a potrebou práce so žiakmi zaujímavými sa o matematiku. Riešenie nestandardných matematických úloh pomaha rozvíjať nielen schopnosti žiakov, ale motivuje a zvyšuje záujem žiakov o matematiku. Na druhej strane tvorba a riešenie úloh zdokonaľuje tak učiteľovu prácu ako aj vzdelávací proces. V tomto zmysle je dôležitá už príprava budúceho učiteľa.

Kľúčové slová: matematika, 1. stupeň základnej školy, nestandardné matematické úlohy, učiteľ a študent primárneho vzdelávania.

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## PREPARATION OF PUPILS WITH INTEREST IN MATHEMATICS AT ELEMENTARY SCHOOL

### PRÍPRAVA ŽIAKOV SO ZÁUJMOM O MATEMATIKU NA 1. STUPNI ZÁKLADNEJ ŠKOLY

**Introduction.** Mathematical problems are one of the sources, which influences interest of pupils in mathematics. Some pupils give solving up after reading text of problems. They don't believe that they can be successful. The task of teacher is to convince them by individual access, that they may be successful and then belief of pupils in own abilities will grow. The mathematical problem motivates other pupils toward activity, they want to experience a victory. An attitude of other pupils can also be neutral. Now we are going to mention about pupils interested more in mathematics in the 4<sup>th</sup> grade at elementary school and their future teachers.

We can consist mathematical problems into two groups: usual and unusual problems. The *usual (standard) mathematical problems* lay stress upon memory, knowledge of formulas. We use known algorithms. *Unusual (non-standard) mathematical problems* require creation, originality, sagacity and contrivance. We stress thinking. We introduce the example of these problems for pupils in the 4<sup>th</sup> grade at elementary school:

- the usual problem: *Determine a perimeter of a square PQRS, if length of its side is 4 cm.*
- the unusual problem: *Svätopluk gave 4 sticks with length 6 dm, 5 dm, 8 dm, 4 dm to each of his sons and said: "Each of these sticks you can saw only once. Do it so that you will get required lengths by sawing the sticks:*

1. *You, the oldest son, bring the sticks of lengths 2, 2, 3, 4, 4, 4, 5 (dm).*

2. You, the secondary son, bring the sticks of lengths 1, 2, 2, 3, 4, 5, 6 (dm).
  3. You, the youngest son, bring the sticks of lengths 1, 1, 1, 2, 3, 3, 4, 4, 4 (dm).
- Is every son able to fulfill this task? Choose all solutions. [2, p. 72]

Consistent application of individual solving steps of the unusual mathematical problems is very important. We have gone out from G. Polya's ideas. He has determined four steps: to understand the problems; to devise a plan; to carry out the plan; to look back. We can use several suitable solving strategies in the 4<sup>th</sup> grade at elementary school (like guess and systematical test, look for a pattern, make a list, use a model, draw a picture, draw a diagram, use properties of numbers, work backward, solve a simpler problem, use direct reasoning). Sometimes we can use several various strategies in the same problem.

**Conditions for work with pupils interested in the mathematics.** We realized several researches focussed on work with pupils interested in mathematics at Department of mathematics at Faculty of Education and Faculty of Natural Sciences at Matej Bel University in Banská Bystrica during 1994 – 2014. *The aim* was to find out an actual situation of care about pupils more interested in mathematics at the 4<sup>th</sup> grade at elementary schools and the abilities of future teachers to work with these pupils. The results should help to more effective work of teachers at elementary school with pupils who could have larger interest in mathematics. We can insert gifted pupils in mathematics to this group, too.

Educational process in mathematics at elementary school gradually changed. The table 1 shows the number of hours in subject:

Table 1 – The number of hours in mathematics at elementary school

	Grade			
	1 <sup>st</sup> grade	2 <sup>nd</sup> grade	3 <sup>th</sup> grade	4 <sup>th</sup> grade
<b>Till 2008</b>	4	5	5	5
<b>2008 – 2015</b>	4	4	3	3
<b>After 2015</b>	4	4	4	4

It is clear from this that, it was created more space for the teaching of mathematics till 2008, and thus also the possibility to devote more attention to pupils interested in mathematics directly on the lessons. In 2008, as part of the reform of education, the State Education Program was adopted. It limited the teaching of the subject of mathematics. The limitation also concerned the mathematical content. In view of international and national pupils testing (TIMSS, Testing 5), where pupils' results were only average or bellow average in the Slovak Republic, State Education Program was innovated in 2015. The number of hours for teaching mathematics changed, but the content not. The number of math hours has increased but has not reached the original state.

In addition to the lessons of mathematics, a mathematical hobby-group was organized more often than today for pupils in the 4<sup>th</sup> year of elementary school. The content included topics that expanded the compulsory mathematics curriculum and topics that did not relate to it. Pupils gained more experience in solving with non-standard tasks. At the same time, all activities led to their preparation for various mathematical competitions (Mathematical Olympiad, Pythagoriad, Mathematical Correspondent Seminar, Kangaroo).

The mathematical preparation of future teachers for primary education at the Faculties of Education in Slovakia lasted 7 semesters from the eight before 2008. In the context of the

reform of university education, there has been a change which, at this level of education, has limited the preparation of students. For example at the Faculty of Education in Banská Bystrica, in the 1999/2000 study program, the student had to attend at least 21 hours of mathematics, since 2009 only 12 (not more), since the school year 2015/2016 only 14 hours, while the study extended to 10 semesters. At the same time, attention in the bachelor study is more oriented to pre-school mathematics than to mathematics for primary education. The temporal distribution of mathematical disciplines does not offer systematic continuous preparation of the student, it is concentrated in the 1<sup>st</sup> year of bachelor and master study. All this influences the possibilities to prepare a student for work with pupils interested in mathematics.

**Our finding out and experience in educational process.** Based on the solving strategies of various non-standard tasks by pupils of the 4<sup>th</sup> grade (883 pupils) till r. 2008 we deduced in which activities a teacher should help pupils to improve:

- *in connectivity with understanding to mathematical problem*
  - a) to improve basis of reading literacy of pupils with connection of unusual problems,
  - b) to develop attention and concentration of pupils during solving, to limit sketchy reading a text,
  - c) to develop endurance and the will to overcome difficulties during solving,
  - d) to fix formulations and meaning of notions two and only two, the most one, at least one,
  - e) to care about using of correct mathematical terminology,
  - f) to require pupils to explain words and associations, which are elemental in text for solving problems,
- *in connectivity with notations*
  - a) to draw attention pupils to necessity of notation and to teach them to arrange it clearly,
  - b) to care about completeness,
- *in connectivity with solving strategy*
  - a) to acquaint pupils with various strategies suitable for solving unusual problems at elementary school,
  - b) to teach them to choose effective ones for solving,
  - c) to give pupils opportunities enough to check individual strategies and use them,
- *in connectivity with correctness of solving problem*
  - a) to choose all results, don't be satisfied with one only,
  - b) to carry pupils to appreciation that problem need not have suitable results,
  - c) if problem has not result, it does not mean that problem is unsolved,
- *in connectivity with check of work*
  - a) to carry pupils to appreciation that check is a part of solving problem,
  - b) to carry pupils to more exhaustive check, to check of calculus so that it would be in agreement with reality,
- *in connectivity with answer of problem*
  - a) to improve abilities of pupils so that every pupil will be able to describe achieved results exactly and to formulate answer.

We can say, that at present, these recommendations continue to exist, since the compulsory mathematical preparation of primary school pupils is more limited compared to

the previous period (before 2008). It also influences pupils with a greater interest in mathematics. The pupils have less opportunities to solve unusual problems.

However, the preparation of future teachers is also related to the current with pupils. We observe that in solving the non-standard tasks assigned to pupils of the 4<sup>th</sup> grade, the students themselves have underdeveloped skills and need to improve their abilities in all of the mentioned connectivity. Only by this way they will be able to help their future pupils competently. A more targeted selection of students for teaching branches would help improve the situation.

Before 2008, only 8.15 % of teachers (sample 135 teachers) in the 4<sup>th</sup> grade of the elementary schools (79) led the mathematical hobby-group in the Central Slovakia region. The most frequent reasons were lack of time (27.42 %), lack of financial evaluation (23.39 %), or other reasons (35.48 % – eg. leading another hobby-group as mathematical, lack of time of pupils, or lacking mathematical hobby-group tradition at school). The mathematical hobby-group had a stronger tradition rather at primary school. After 2008 situation has not been better. For example a mathematical hobby-group is not organized at any elementary school in Banská Bystrica (77,786 inhabitants). It is pity that the voluntary activity of teachers and pupils in this field is low.

We can state that the changes made in both elementary and university education were not made to support pupils with a greater interest in mathematics.

**Conclusion.** By means of this paper we wanted to point at importance of regular and systematic work with pupils interested more in mathematics, including gifted pupils, to point at meaning of establishment and realization mathematical appointments in the 4<sup>th</sup> grade at elementary school the whole school year. The teachers have more possibilities to make basic subject matter more attractive and to complete it with unusual mathematical problems during educational process of pupils interested more in mathematics. Differentiated access to these pupils is the basis of their work, mainly on lessons and mathematical hobby-group, too.

The situation in teaching mathematics at elementary school also influence future teachers in it. At present, students who completed mathematics at elementary school after 2008, are already in the teacher study. Therefore, their possibilities for acquiring mathematical knowledge, developing skills and mathematical competencies are essential. It is necessary to review the mathematical preparation of future teachers at elementary schools in terms of their work with pupils with a greater interest in mathematics.

Our intention is to carry out a project that will provide further information in this area in connection with the innovative State Education Program (2015). It will be valid in the 4<sup>th</sup> grade at elementary school since the next school year.

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