Gifted and talented in mathematics do not only need hard work, but smart work as well

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Abstract *- Nowadays technical and scientific progress is associated with the mathematization of knowledge in all fields of science. For this reason, we need to create an elite group of deep-rooted students in the field of mathematics. These students constitute a resource for the renewal and continuous empowerment of the intellectual potential of each country.*

In this paper, we will discuss what the characteristics they present, are in the learning process. Are albanian school-math teachers capable of identifying and working with gifted students? If they are able to identify them, are they able to work with the talented students in classes full of students with different studying and understanding levels. What are the issues that the teachers face in the teaching process to identify and work with them? We will also discuss which the ways a teacher should use them to identify are and which the techniques that should be used in order for the students not to lose their interest and let their talent go to waste are.
We also make some proposals to be taken by the relevant institutions for the careful, systematic and scientifically studied cultivation of the students

Keywords *- talented in math, characteristics of students gifted in math, mathematical olympiad.*

I. INTRODUCTION

Many of the talented students in mathematics have significant differences from the rest of the students with relatively good grades in mathematics. These differences relate mostly to two aspects:

- the speed of reaction to a seemingly difficult situation.
- flexibility to use the appropriate strategy in any problem situation.

When I first started working as a math teacher, the first lesson I taught was about fractions (grade5).Some of the "good math" students quickly finished the exercises I had given to work in the classroom. So I asked the group that was done to solve this problem:

When Alban's father is asked how old he was, he replied: I am 35 years old if you do not count the Saturdays and Sundays. Find out how old Alban's father is.

The students started their work on solving the problem that I gave them, and while some of them were looking for additional information about the year of birth or the leap years that had passed since the birth of the father of Alban, it did not take long and one of the students responded. - *49 years old.* Stunned by the quickness of his answer, I listened to the reasoning.

It was profound. *He thought that without the Saturdays and Sundays his 35 years make up only 5/7 of age. So 7/7 of the age will be 49 years.*

These are the talented students in math, brilliant in what they express and justify.

Are they treated properly in albanian schools? Do they, in any case, have the right guidance of teachers and the cooperation of their parents? What are the strategies taken by the state? All of these concerns have been the motivation for the study we will present below.

When can it be told that a student is gifted?

To define a talented student in a particular field, we should not just base on the definition on his constant results with the maximum points, but we should also appreciate some special aspects of his talent. Creativity,

adaptability, curiosity, perseverance, motivation, communication and leadership skills are worth mentioning here. A talented student may not have all these features, but there present a lot of them.

What are the qualities of a student who is gifted in math?

During our schooling time, our students develop in the physical, cognitive, social and emotional sphere. At the same time, they show the characteristics that make them separate from the others in the mathematical talent plan.

Fig. 1 When can one say that a student is gifted?

Talented students in mathematics are quick and straight, oriented; sharply smash the problems requires a high degree of reasoning, arguing humbly the steps for further solving in a problem, and even developing an aesthetic sensation.

The talented in math are students who have high scores in standardized tests and different Math Olympiads.

It is important to note that these characteristics are not at the same level all the time, but talented students develop them continuously.

Talented students in math appear in our classes with these features:

- They are extremely sharp and show a constant curiosity around the world of numbers.
- Learn very quickly and just as quickly they understand and apply newly-encountered mathematical concepts.
- Think and work abstractly with high precision.
- They always have original ideas to work on, out of the stereotypical way of solving a certain problem.
- They impress you with the way they transfer learning to new mathematical situations very comfortably.
- They perceive, visualize and generalize patterns and numerical and non-numerical relationships.
- They reason quickly by analysing, deducing and inducing, according to the conditions of the problem that requires solution.
- They formulate mathematical questions that apply concepts, related to them directly or indirectly.
- They do not give up in their quest to solve complex, non-standardized tasks.
- They can organize in-depth the information provided while simultaneously scratching off unnecessary information, and quickly discover hidden information to solve multiple-choice problems.
- They possess techniques of well thought actions and often impress with the speed of their performance.

But, are our math teachers able to discover these qualities and how can they contribute in helping these talented students to carefully develop their intellectual capacity in overcrowded classrooms?

This was the purpose of a two-stage study, conducted last spring, about identifying and working with new math talents in several cities in Albania.

In the *first stage* we asked the teachers to make the selection of the talented in math and, in the *second stage*, we tested through a Mathematical Olympiad the students chosen by them.

The first stage aimed to identify whether teachers are able to identify talents in overcrowded classrooms and heterogeneous about their ability to learn.

Believing in the importance and values of recognizing and working with new talents in mathematics for the development of a society, we asked the teachers of pre-university education to mark their talented students in math.

The selected students underwent a standardized Math Olympiad test, which was carefully prepared for each of the age groups by specialists in the field of mathematics. The test we organized had the character of a math-mastering Olympiad whose exercises possessed the elements of mathematical fine logic.

The aim of the Olympiad was to answer the questions:

1. Are talented students mathematically accurately identified or are the perhaps confused with hard-working students who also have high scores in math?

2. Do the teachers of our schools know how to make this distinction?

The Math Olympiad was attended by 250 selected by math teachers students as talented. The Olympiad included pupils between ages of 6 and 14.

(pre-primary lower secondary education and upper secondary education).

The reason for which pre-schooling was also studied was certainly to identify whether kindergarten educators are able to identify talent in math?

We thought we would include pre-school children in this Math Olympiad , because as soon as they are identified and oriented toward mathematics, the higher the expectations will be in this subject area.

On the other hand, many of the qualities of talented children in math emerge during the years of preschool age. At about this age, they understand the connection of numbers in math with those in the real life.

Out of the pre-school children's group were tested 50 children, of whom 10 passed the test with over 90% of the scores and clearly displayed their talent in mathematics.

12 others received from 70% to 90% of the test scores. Others accumulated under 70% of the points.

For children who accumulated over 90% of the points, educators expressed that they showed a special interest in the simple mathematical concepts they had learned so far and viewed math as their preferred part in the global education they take in kindergarten.

Some of them even told us that their favorite games, were games where numbers were included.

What we noticed was that some of the educators were enthusiastic about the skills these kids showed in math, they even felt like hypnotized sometimes, but few of them knew about the importance of early detection of their math talent. This is shown by the number of students who collected over 90% of the points in the test.

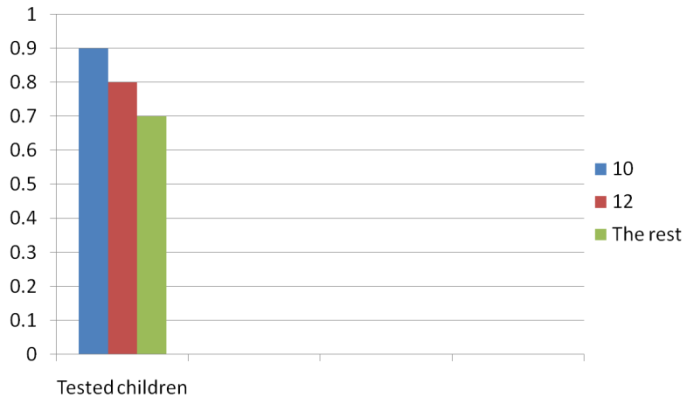


Fig. 2 Kindergarten results

In fact, apart from the fact that kindergarten educators are not able to distinguish and then work in a differentiated way with a talented child in mathematics, there is another jolt about them on the way to school. These children, who know the numbers, one-to-one correspondence, counts, and simple collection and rebuke actions within the first ten numbers, have little or no interest in the same knowledge they will learn again in the first grade. This leads to the discontent of desire to do math and loss of interest. Let's cite here *Sheffield, 1994*, who says that *talented students need a broader range of topics and open opportunities for solving complex problems.*

The other group of students tested was the group of 1-9 grade students. For 1-9 classroom students of the Olympiad, there were 4 sections.

The first and second part of the test aimed to measure the time the students needed to solve problems that required dexterity and deductive reasoning.

Here are some examples of types of problems for each parts of the Olympiad test.

Part 1.

The numbers a, b, c and d are such that: $a = \frac{2}{0{,}01}$; $b = \frac{2}{0{,}4}$; $c = \frac{2}{0{,}03}$; $d = \frac{2}{0{,}5}$;

Find out the largest possible amount:

A) a + b B) c + d C) a + c D) b + d

Part 2.

27 workers perform a job for 12 days. How many days will this work do 36 workers?

A) 18 days B) 24 days C) 9 days D) 20 days

What was noted was that talented students in mathematics responded to them at an unusual speed. About 95% of them responded much faster than the deadline. The rest gave answers within the time limit.

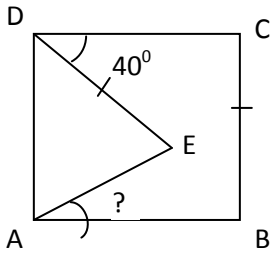
In the third part of the test, the degree of difficulty was slightly higher and required the students to be more considerate regarding the information they provided and to logically link all kinds of relationships ranging from quantitative, spatial, and abstract relationships.

Example of the types of problems in the Olympiad (6 grade) (3)

Part 3.

In the figure, ABCD is a square with DE= CB and m $\angle$ CDE = 40^0.

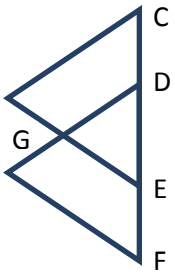
What is m($\angle$ BAE)?



Example of the types of problems in the Olympiad (6 grade) (4)

*Part 4.*The following figure is formed by overlapping two equilateral triangles.

CD = DE = EF = 14 cm.
How cm is the circumference of the DGE triangle?



It was noticed that the ones with higher scores in the first part were successful in this part of the test. Of the 200 tested students,172 studentssuccessfully passed this part of the test, which means 85% of the competitors.

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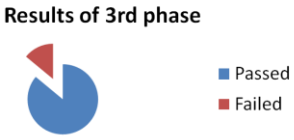

Fig. 3 The Olympiad and the group of 1-9 grade students (2)

The last part of the test, the fourth part, which was specifically designed to look for explanations of exercise solutions, was intended to firstly investigate the originality of the solutions provided by each of the competitors, the flexibility of the solutions and the clarity of the expression of mathematical concepts. They successfully passed this test phase to only 30 students, which means on average three students per level or 15% of all testers.

Although the chosen student's set consisted of students who teachers identified as the most talented in math, it was observed that only few of them met most of the criteria that gifted students in math have. These results have shed light on the fact that in our schools often we are confused between the students who have good math achievements as a result of their hard work with those who are gifted in mathematics.

Do teachers have time within the 45 minutes of a limited lesson, considering they also have to take in consideration the students with learning disabilities and middle-aged students, find time to cope with the rhythmic pace that talented math students work with?

Should we just add the volume of exercises that need to be given to them or need to be wise enough to choose the material they have to work with?

Do our teachers have the right training to successfully deal with talented young people?

What has been observed from the study is not simply a problem of not revealing the most talented or mismanagement of this intellectual property that needs extraordinary care.

There were many problems that, if eliminated, would enable the flourishing of these elite talented students in mathematics.

Here are some of them:

1. The space that math subject programs for each level leave to talented students.
2. The content of mathematics textbooks does not show talented students many ongoing challenges.
3. The spiral curriculum that is often found in math texts is a barrier for talented math students who would be more suited to a linear spread of concepts.
4. Many teachers work with talents sporadically, when they have some little time remaining from engaging with the rest of the class.
5. Often, teachers working with talented students are training specifically for working on differentiated work, often moderating the teaching, thus diminishing the desire of the talented to deal with math.
6. Lack of proper teacher training, partly due to the lack of specific subjects in curricula of university programs and then the themes of qualifications offered during the years of their experience as teachers.
7. The absence of a specialized teacher to work with talented students on the basis of special curricula drawn up by expert groups in this field where there are no spiral cycle restrictions.
8. The lack of qualifications in the field of technology and the lack of software programs by teachers negatively affect the provision of opportunities to cope with high-level problems for talented students.

What is actually observed in our country is a job that is done privately by licensed professional teachers who are paid by the parents of gifted and talented students.

This situation creates another problem, because not all talented children in math have socioeconomic conditions that enable them to attend such special courses privately.

II. CONCLUSIONS

Below are some suggestions on how this problem, that honestly said has been ignored for years by the relevant institutions, can be solved.

1. Plan the curriculum of universities that prepare teachers from preschools to high schools and a subject that will enable them to identify, prepare and work with the talented in math. (the inner light to specify different ways of developing critical thinking in solving the problems that pertain to each of the themes)
2. Accompanying the annual curricula that come out of the Ministry of Education with a special curriculum, which also foresees the level of achievement for talented students.
3. Fullfill a whole legal framework that includes not only curriculum schemes for the talented, but also the literature used up to the criteria that teachers must use as complementary to work with talents in mathematics. (The important criterion will be the qualification in the field of technology as a golden opportunity to increase the quality of work with them.)
4. Provide each school with a special teacher that will cover the work with talented students.

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