

Mathematical Workshops, Learning and Popularization of Mathematics

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Abstract

On the example of mathematical workshop launched for pupils of upper grades of primary school, we discuss the benefits of workshops related to the improvement of teaching methods and students' knowledge and understanding of mathematics. Through illustrative examples from the workshops we have shown different techniques and possibilities for realization of teaching process in the upper grades of primary schools mathematics. Also, the concept of mathematical workshops is described in detail and the effects of the workshops on pupils knowledge of mathematics, the reactions of mathematics teachers and the popularization of mathematics, are analyzed.

Key words: mathematical workshop, teaching methods, teaching process

MSC: 97U30, 97A80

1. Introduction

Teaching of mathematics, and in particular its modernization and improvement, always presents a challenge not only for teachers of mathematics, but also for people from other professions where mathematics is used. Mathematics is often characterized as complicated science, and something that only a small percentage of people understand. Also, mathematics is rarely viewed from the perspective of science applicable in every aspect of real life, which is the main reason for its low popularity.

In order to popularize mathematics and present it in better light as interesting and applied science, and to get closer to primary school pupils at the beginning of their development path, a mathematical workshop has been designed.

The paper introduces and describes activities conducted on a mathematical workshop launched in Zrenjanin, by the author of the paper, in cooperation and with the support of the Cultural Centre of Zrenjanin.

2. Mathematical workshop

Workshops of various types and purposes have been present for a long time with us, and they generally encounter with positive reactions from participants. By examining the types of workshops which take place in our area, it was determined that the contents of these workshops are related to various topics and sciences, but there was not one dedicated to mathematics. Each type of extracurricular activities in

mathematics is related to the practicing of problems solving, preparing for graduation and entrance exams, and they include the application of traditional teaching methods (black board, oral presentations...). The idea of the author of this paper, for the establishment of the mathematical workshop, has just emerged from these results.

Mathematical workshop, as devised by the author of the paper, should have some basic objectives. The first objective relates to the popularization of mathematics as a science, since it is a widespread attitude by children, and most of adults, that mathematics is something that is incomprehensible and difficult. Providing opportunities for children to socialize, play and get acquainted with mathematics in a new light, to learn something new, repeat materials, is also one of the goals of mathematical workshop. The third objective is to demonstrate new teaching methods such as active learning and mathematical modeling, learning on real world examples and throughout the games, which results in another objective of mathematical workshop: presentation of mathematics as interesting science applicable on situations from real world environment.

Considering all set objectives, it was designed a mathematical workshop for pupils of upper grades of primary school, called - *Matemationica*.

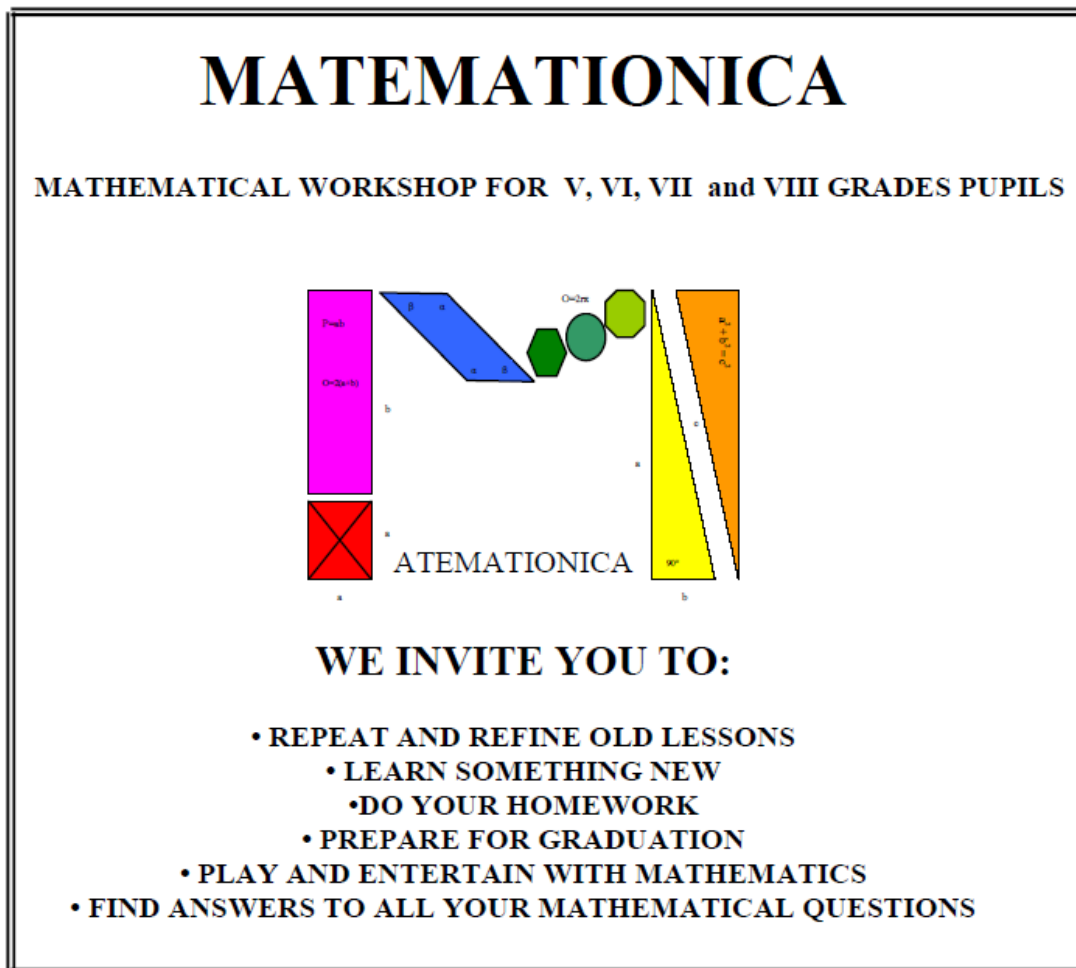


Figure 1: Poster with Matemationica logo

3. Matematicionica

Matematicionica is the result of many years of work and the aspirations of author to enclose, popularize and present mathematics in whole new light to pupils. It is designed for pupils of upper grades of primary school, and for the teachers and professors of mathematics.

3.1. Organization of Matematicionica

Matematicionica is completely no charge workshop, and pupils attend the workshop at their free choice. It is designed for all pupils in upper grades of primary school, regardless of the score, and math skills. *Matematicionica* was held weekly, in duration of 90 minutes.

Also, *Matematicionica* processes contents connected with themes of regular mathematics classes, at the time. Due to continuous work and dedication to the topics to be covered, each week one grade attended the workshop. So, *Matematicionica* began working with the fifth grade, the next week attended sixth grade, ... By this kind of organization dedication to each senior grade separately can be achieved.

Although *Matematicionica* primarily was designed only for pupils, it changes orientation also towards teachers and professors, thru demonstration of new teaching methods and techniques that can be used in mathematics education.

3.2. Contents

Matematicionica was conducted in cycles, where one cycle consisted of four weeks in a row. Thus, one cycle attended respectively pupils of V, VI, VII and VIII grade. This organization is deliberately created, because of the contents devoted to each cycle.

I Cycle

The first cycle included topics that were connected with topics student were learning at that time at mathematics classes at school, separately for each grade, except that each subject was treated in a different way - through games.

The pupils were presented with a variety of popular games, but with the mathematical content. Thus, fifth grade pupils solved crossword puzzles where the issues horizontally and vertically were related to divisibility of numbers, least common multiple and greatest common divisor, which they were learning at the time in school. Sixth graders were offered the game *Discover the picture*, where everyone reveals a new box, with the task on integers, which when properly resolved, reveals one part of the big picture. Seventh graders had also played the game *Discover the picture*, but on algebraic expressions. For eighth graders has been designed popular game *Sorry!*, but with slight modifications. In fact, when someone puts a figurine, automatically raises the question connected with the field. If you answer correctly, you stay on the field, otherwise the figure is moved one field back and respond to a new question ... This game contained questions concerning the area of plane figures and surface area and volume of prisms, since the pupils that day at school had the control task with topics: area and volume of prisms.

Pupils have reacted very positively to these games. During each game they were divided into groups, usually those were teams of pupils from one school, so each game had also a competitive character. It was very interesting to watch their reactions throughout the games, their dedication to the tasks, and their impressions that they are not dealing with mathematics, but with something that is very fun.

Teachers have also had very positive impressions of the workshop, and were especially enthusiastic about the teaching methods used in the workshop. Active learning, learning through games and real world examples were very highly rated.

This cycle of *Matemationica* can perhaps be best described by the comment of one of the fifth graders: "*Teacher, in my life I have never had a more beautiful lesson in math!*".

II Cycle

The second cycle of *Matemationica* was dedicated to making posters on selected topics. Pupils from each grade made posters with topics related to the content of the regular school mathematics lessons.

Pupils by themselves created posters from collage paper, painted them with crayons and markers ... They were split into teams, one team pro poster, and it was very cute and nice to look at them how they jointly agreed upon look of their poster, how they shared responsibilities related to the creation of posters, ... This type of work inspires team spirit in children. Also, the poster art provided a different approach to learning mathematics, learning thru visualization, because all formulas, theorems and concepts with which the students encountered in teaching process revived and get its visual form on posters.

For even greater popularization of mathematics, at the end of the school year was held an exhibition of posters created by the pupils. The exhibition was attended by media, and that made pupils, authors of posters, even happier.

III Cycle

Each workshop of third cycle was devoted to origami. Pupils were introduced to the world of origami, but with an emphasis on creation of geometric figures such as cube, cuboid ... This was very interesting to students, because they were extremely attracted to origami as an art, and on the other hand, they tend to reveal mathematics itself in origami. Constructing an origami figure pupils master the basics of geometry, they easily detected characteristics of figures, and most important, they could see figures in three dimensions, and thus better understand the formulas related to the surface area, volume, ... Also, pupils practiced precision thru origami, saw the dependencies associated with angles, properties of line, various geometric figures, which in the teaching process is generally avoided, and pupils learn without understanding because they do not have a real sense how geometric figures looks like in reality.



Figure 2: Games, posters and Origami

IV Cycle

Since the fourth cycle of *Matemationica* was held during April and May, this cycle has been designed as a summary of all previous activities with intention to present to wider public what knowledge students acquired on *Matemationica*. Therefore was designed a mathematical fashion show with the theme "*Fashionmatics*". During the fourth cycle pupils were making their models, which they will present to the whole city at the fashion show to be held at the end of the school year. All the models were in the spirit of mathematics, each pupil chose a geometric figure that his/her model will represent. Thus, we had models of kite, circles, cubes, squares, coupe, sphere, ... Each pupil had task to wear his/her model on the stage, and to present it by saying something about this geometrical figure, its size, area, perimeter, volume, ...

Children approached this cycle of *Matemationica* very seriously, and they were very interested for making models. Particularly pleasant surprise was their research of geometric figures and imagination with which they fitted research data into their models.

3.3 Impressions

Although originally designed for groups of fifteen pupils per workshop, *Matemationica* already at beginning attracted between twenty and thirty interested pupils per workshop, which was a pleasant surprise considering the popularity of mathematics among pupils.

The atmosphere at each workshop was active and positive, pupils were happy to participate in all planned activities. Teachers attended workshops gladly, justifying their interest with interesting content, ideas and presentation of new teaching methods with an emphasis on active learning.

Effects of *Matemationica* were reflected thru further activities of pupils who attended workshops. In collaboration with their teachers, they visited pupils of other grades in their schools and they presented some interesting features that were processed on *Matemationica*, which confirms pupils interest for this kind of work, especially for learning through games and real-life examples.

4. New Years Matematiconica

Following interest of pupils for *Matematiconica*, emerged the idea for special edition of workshop, which resulted in the *New Years Matematiconica*, held in last working week of the first semester. Topic of the *New Years Matematiconica* was QUEST FOR LOST FORMULA, a game designed in the form of mathematical associations.

New Year's Matematiconica involved pupils of most primary schools in Zrenjanin. In accordance with the theme of the special edition of *Matematiconica*, the association game was designed which consisted of different tasks, selected to equally represent mathematical contents covered in the V, VI, VII and VIII grade. Each school chose its team of pupils to represent it, following condition that each team must have at least four members, one from each class (V, VI, VII and VIII), so that everyone is given the opportunity to demonstrate their knowledge. Also, all school participants had equal opportunities in answering.

Association contained a total of nine tasks. First, pupils opened slide with the task and they were given time to solve the task. Team which would solve the problem first, represented their solution. If the solution is correct, the team gets one point and opens a slide with a detailed solution of the task and slide of the trail. After solving all tasks, we opened all traces and pupils solved the association. Winning team was the team of the school with the highest number of points.

New Years Matematiconica began with the arrival of Santa Claus, who introduced himself as a mathematical Santa Claus, and said to the students that he had lost a very important formula, without which he can not find holiday gifts he brought, and therefore prays to pupils to use their knowledge and help him find the formula and hidden presents. This was followed by solving problems and the quest for the lost formula.

New Years Matematiconica gathered about 300 pupils of upper grades of the primary schools in Zrenjanin, which was, by the comments of present parents and teachers of mathematics, unexpectedly much. Pupils demonstrated great interest in mathematics, represented in this way. Atmosphere of *New Years Matematiconica* was more than positive, students competed, cheered for their teams, and even asked their teachers to prepare them for this special edition of *Matematiconica* after regular lessons in school.

Succes of *New Years Matematiconica* was confirmed by the words of a parent of one pupil who participated in the competition: "*I can not believe that you gathered children in such great number, and that the reason is - MATHEMATICS.*"

5. Conclusions

The effects produced by *Matematiconica* have met the objectives set as guiding idea for creating mathematical workshop.

Popularization of mathematics as a science has been largely fulfilled through *Matematiconica*, and confirmed by pupils interest for this extracurricular activity. Also, students are given the opportunity to gather on *Matematiconica*, teamwork and use full spend of free time was encouraged. New teaching methods were demonstrated, with an emphasis on active learning and teaching through examples from real life. That way mathematics was presented as a dynamic, interesting and applicable science.

Matematiconica continues its work, with always fresh ideas, effective, interesting examples, and new special editions of *Matematiconica* that are yet to come. Future directions that will lead *Matematiconica*

tend to further improvement of the mathematical knowledge of pupils and modernization of mathematics teaching techniques in schools.

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