Visualization of mathematics in practice

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Abstract

In this text are explained some educational toolkits that I developed in practice. Those techniques and toolkits could be used in mathematical teaching in primary school. Also, there will be shown activities for involving kids to do mathematics.

Key words: Visualization, educational toolkits, mathematics

MSC: 97U30

Time in which we live and work today could be described as a period of a rapid expansion of modern technologies, which have made our life much, much different than it was twenty years ago. Those changes are fast, but they are part of our everyday life. It is not enough to have only two programs on a TV. Mobile phone and computer are necessary and without modern home appliances we can't even imagine our life. Surely, kids have different needs then their peers before 20-30 years. Nowadays, a kid who starts school at the age of 6 successfully use a mobile phone and plays games on a computer. A pupil of a fifth grade is already overcome his parents (and often teachers too) in using of modern technologies. Could these new generations pay attention and find something interesting in a class, where formulas, exercises and calculation are written on a blackboard (or whiteboard), while they write down it orderly in their notebooks? Teachers shouldn't be surprised if they start to be nervous, uninterested and restless. Times are changing, so it extremely important to be a little more reorganized and to adapt our class to a modern and active kid. Traditional classes aren't the best way to learn math or any other subject anymore. Teacher has a great number of educative materials and he is often able to create them by himself. The production of educative software in electronic form is rich and diverse, so we have software packages, books, disks, presentations, applets and internet portals available. Development of these things is amazingly fast. We had an opportunity to find out about some of them during two Summer Schools organized within Tempus IV Project "Visuality & Mathematics: Experiential Education of Mathematics through Visual Arts, Sciences and Playful Activities": e-collection of exercises or how to use Geogebra in a process of visualization.

The use of computers and internet affect development of modern mathematics. However, didactic does not often follow this tempo of development - it is developing more slowly. That gulf needs to be overcome and this school can help achieving the goal.

Visualization is very important in a process of education, because it improves creative thinking, making it wider, more open and more versatile. Mathematics is very suitable for introducing different kinds of visual aids which can improve creative thinking. It seems that the modern student feels familiar with this way of studying.

We distinguish two types visualization:

•Symbolic: drawings, tables, graphics, schematics, diagrams, relating graphs, graphics...

•Object: model of figure in the plane, models of spatial situation, models of geometric bodies.

Symbolic models help in understanding the concepts, and present models provide insight not only models, but also the processes and interactions among them (the intersections of geometric bodies and plane, for example). All of these models can enhance verbal visualization, such as, for example, stories that should encourage memorization, or appropriate music, painting etc. In particular, the connection of mathematics and art contributes to motivation for further study mathematics contents. The effects of visualization are: creating personal experience, explaining complex things, encourages memorization, develop communication skills (linking content with real-life math problems), motivation (not achieved by just memorizing, but also creates inspiration to achieve higher cognitive goals), development of visual-spatial reasoning, developing the ability to think visually (through pictures). Visualization is a kind of mental table where the ideas can still developed and their implications can be explored. Visualization also allows displaying math in an interesting and understandable way and at the same time is a central component of many processes that makes the transition from the concrete to the abstract way of thinking. It is a tool for representing mathematical ideas and information. Making visualization more included in the learning process, we create children's ability to perceive, setup and troubleshooting, giving them an invaluable benefit for future life, and that is the ability and courage to tackle the problem and solve it.

Striving to professional advancement, we certainly try to come up with an interesting class after which the children will say, "What, it's ringing!", and we will return home satisfied and happy. I will present you some of my attempts to come up with activities that will help children to learn better and remember more durable material math in elementary school.

In the eighth grade, students first meet with spatial forms. It’s not always easy to deal with a third dimension. Here's how I tried to help them do that. During the processing topics: prism, pyramid, cylinder and cone, in order to move this topic, they filled their 3-D sketchbook (Figure 1).

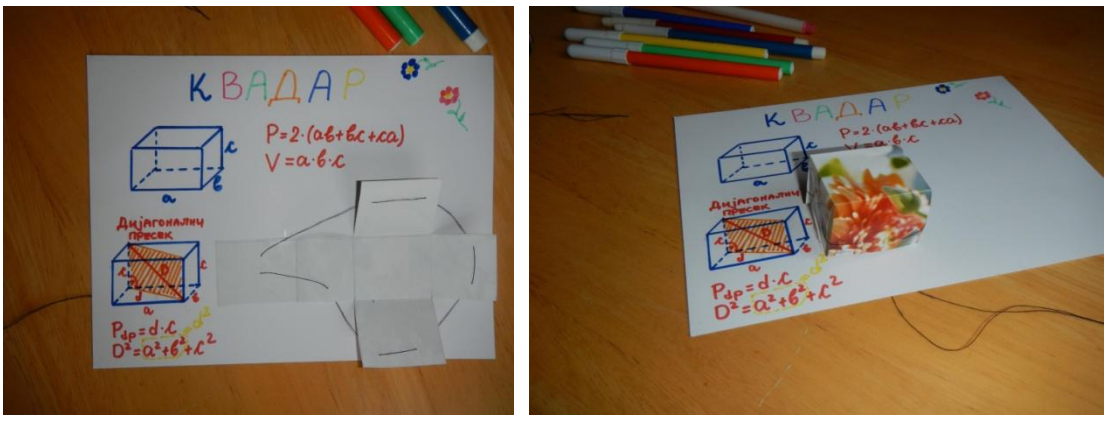

Figure 1: 3-D sketchbook

In the beginning, we do this together in class, organized in groups, so they learn the technique of making such a block. They make other geometric bodies independently at home as a homework. For this block you need to bring to class: sketch book, paper (preferably, inserted an artistic touch), drawing, scissors, glue, thread and needle. One side of the network of the body is

glued to the block, while the other sides are remained free. Each side is screened at the end, and the ends of the thread are connected to each other on the back side. Withdrawal of these regions of the network in the plane, we have the body in space. By the end of the school year they have filled the block in which are all the formulas, networks and geometric bodies. Some of the former students have told me that they had kept these blocks and used them as a reminder in high school.

We can make a model of coordinate system too. On the paper for a chat-table, on which has been already plotted a square grid, we draw coordinate axes, and with the sticker we create models of spots and glue it on the coordinate system. One coordinate system is enough for each group, or can be attached to the board when we work with the whole class. Using stickers in different colors, we stimulate the process of visualization, and at the same time we are able to quickly and efficiently show a large number of points. If we, for example, want to explain the sign of function, we use one color stickers for positive parts, the other for the negative, and the third color for zero functions. This didactic tool is good because it provides a quick way to view multiple drawings and facilitates the transition from visual to abstract thinking.

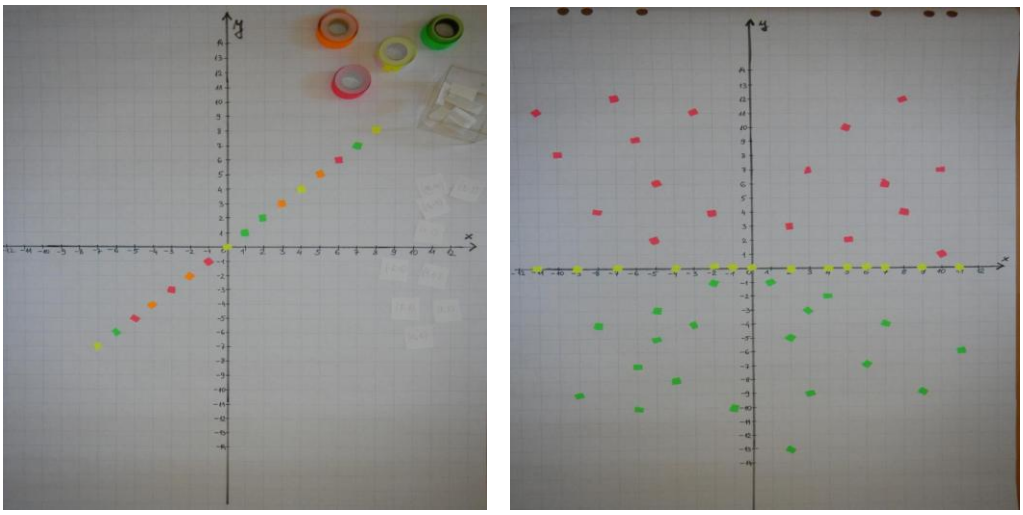

Figure 2: Model of coordinate system

This is how we use this model in the 7th grade to master a coordinate system. Motivation for the subject was the video "*Dimensions*". Below the class we were introduced to Rene Descartes and a way of introducing coordinate system through a video presentation.

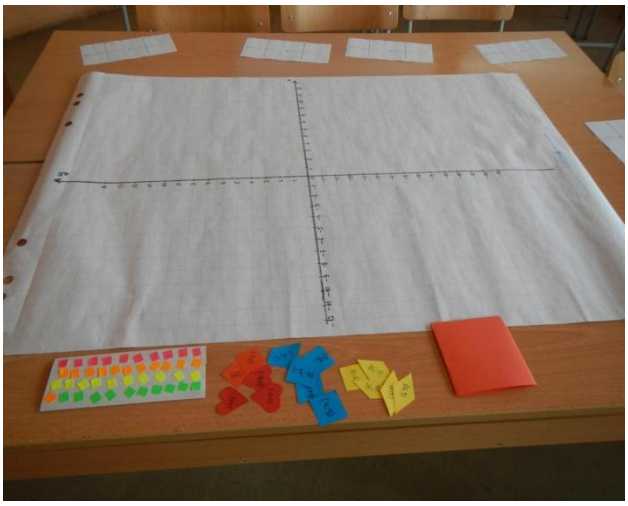

Figure 3: Coordinate system and stickers

The following class we were able to try independently to manage coordinate system by working in groups. Class was rich with visual contents and different methods and children were raised. During the class the effects of the visualization came to the fore: motivation (through movies and video presentation about the life of Rene Descartes). In this way, it is possible to clarify the complex things; the children had experience of personal experience and the opportunity for visual spatial reasoning.

Motivated by the ideas about how to connect mats and art, as we heard in Eger during the The First Summer School and, seeking to awake the interest of the children to the subject, I suggested to my pupils to do a seminar work based on Pythagoras Theorem. When works began to arrive, I realized that they have invested a lot of effort and that it should be seen by others, so I organized an exhibition in the park of Saint Sava that is awaken great interest passers-by, parents and the media, and eventually grew into a form of a Family day. In this effort, art has been the inspiration and driving force, and the effect is reflected in the strong sense of pride in praise that followed by the observers.

Figure 4: Exhibition of pupils work based on Pythagoras Theorem

Considering a great creativity of the students and a desire to continue with this way of connecting math and art, I suggested them to try with the Science Festival. We were doing on a

Golden Section. This work has been accepted and the children with great enthusiasm started developing settings. They garnered the praise of the audience and we are already coming up with a project that next year we will participate in. This project was realized in the framework of the math section, the pupils, who are not thet good mathematicians were included, but after this exhibition they significantly improved their math and increased interest in the subject.

Figure 5: On Science Festival

Literature

[1] *Dimensions, video http://www.dimensions-math.org/Dim_E.htm*
[2] Lj. Radovic *Visual Mathematics in Education, lecture, Belgrade, 2014.*
[3] Dj. Takaci *Theoretical approach to mathematical modeling in teaching, Eger 2013.*
[4] M. K. Banjanin, M.Radmilović *,Vizuelizacija u nastavi matematike,*