CONCEPT MAPS IN MATHEMATICAL EDUCATION OF PRIMARY SCHOOL STUDENTS

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Abstract

This article discusses the use of concept maps in the mathematics teaching and learning in primary school. The purpose of this paper is to investigate students' attitudes about the importance of concept mapping. The results of the survey among students that reflects their views on the use of concept maps in mathematics teaching have been analyzed. The studies carried out indicate that the use of these graphical tools helps better understanding of mathematics and improves skills and other cognitive processes.

Key words: concept maps, mind maps, mathematics, students' attitudes

INTRODUCTION

Requests for new approaches to mathematics teaching and learning are becoming stronger. Precisely concept maps have the option of an interesting way to visualize information and knowledge. They are increasingly being used in the teaching of mathematics, as evidenced by numerous studies, published papers and books. They are well accepted by students and teachers at all levels of education. Concept maps are graphical tools suitable for visualization, presentation and transfer of knowledge. They include concepts, usually framed, and connections between concepts presented by lines. Words on the line are linking words or linking phrases defining connection between the two concepts. Linking words can be, for example: consists of, includes, represents, etc. Concept mapping technique is developed by Joseph Novak and his team at Cornell University in 70's as a mean of effective presentation skills. Novak's work is based on constructivists learning who believe that students gradually build and expand their knowledge. They emphasize the importance of previous knowledge to possibly master new material. Novak believes that meaningful learning involves the assimilation of new concepts and integration into the existing structure. An important feature of concept maps is that the concepts are represented hierarchically, with the most involved and the most general concepts at the top and with specific and less general concepts hierarchically below. Mind maps are a kind of concept maps developed by Tony Buzan, with the following features: central concept, idea or focus is shown in the center of the picture, the main topic branch out like the branches from the center, and branches include key image or keyword that is written on the extended line. Topics of lesser importance are presented as the offshoots of the major branches, and the branches form a linked tree structure.

MATHERIALS AND METHODS

Participants

The sample in this action research is a group of 45 elementary school students from the Elementary school 'Davorina Trstenjaka' from Zagreb. In previous years (in second and third grades), students have already used mind maps in several subjects, including mathematics. Their teachers were trained to use mind maps in the classroom during the professional training of teachers. The authors of this article were partially engaged in the teaching of

mathematics in the fourth-grade classes where the survey was conducted, and used both mind and concept maps in teaching. Students are taught how to develop a concept (mind) map and how the terms in them are hierarchically organized. As a part of repetition and systematization of mathematics material, students were given the task of creating a concept map, and when doing it they had the freedom to choose the model. When creating concept maps, the students kept the instructions that were given, and they tried hardly to do the task. In most cases, the linking words on the connecting lines were missing and maps were generally not complete. Although they had some small oversights, students showed a high ability to represent their knowledge using concept maps.

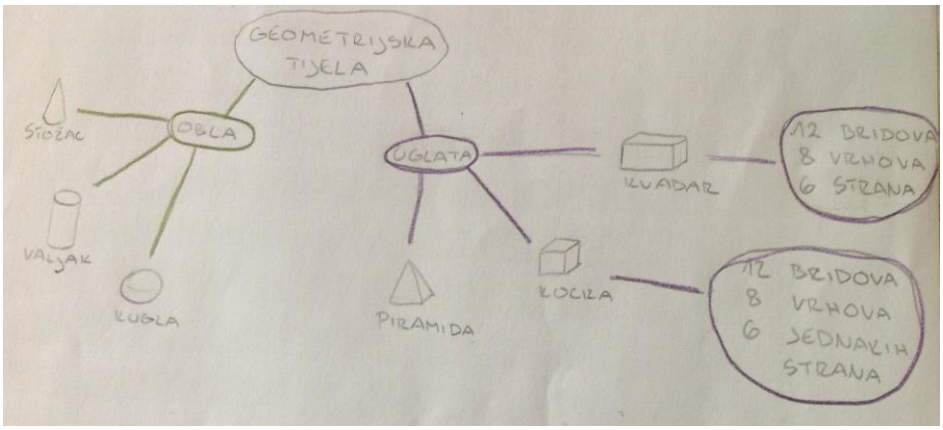

Figure 1. A typical example of students' concept map.

Instruments

A special questionnaire has been made for this research. The survey collected general information such as: name of student, class and grade in mathematics. In addition to the questionnaire, six statements taken from work of Laura Scagnelli (available at: http://chiron.valdosta.edu/are/vol1no2/PDF%20article%20manuscript/Scagnelli.pdf)
were adapted to our needs. From Scagnelli's questionnaire there are omitted issues relating to the application of computers in the development of concept maps because in our schools they are not sufficiently practiced. The questionnaire consists of six questions that students should judge by the Likert scale with five responses of to which extent they agree with certain statements. The questionnaire is shown in Table 1. Regardless of the adjustment of the questionnaire, a certain comparison of our results with the results of some other country is possible.

Table 1: The questionnaire.

(Name and class) 1. I enjoy making concept maps. ____ 2. Concept maps help me understand the information better. ____ 3. Concept maps help me organize my thoughts. ____ 4. Concept maps help me study for tests. ____ 5. At the end of a unit, I would rather make a concept map showing what I know rather than take a test. ____ 6. I would like to use concept maps more often. ____ 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree

RESULTS AND DISCUSSION

The results of the survey are shown in Table 2 below.

Table 2: Results of students' attitudinal survey.

No.	Statement	Mean	Min. score	Max. score	Range	Standard Deviation
1.	I enjoy making concept maps	3.88	2	5	3	0.76
2.	Concept maps help me understand the information better.	4.37	2	5	3	0.82
3.	Concept maps help me organize my thoughts.	4,28	2	5	3	0.88
4.	Concept maps help me study for tests.	4.30	3	5	2	0.83
5.	At the end of a unit, I would rather make a concept map showing what I know rather than take a test.	3.71	1	5	4	1.26
6.	I would like to use concept maps more often.	3.98	2	5	3	0.96

As can be seen from Table 2, the arithmetic mean score of all attitudes is approximately equal to 4, and sometimes even higher. This indicates that students' use of concept maps in mathematics is considered very necessary.

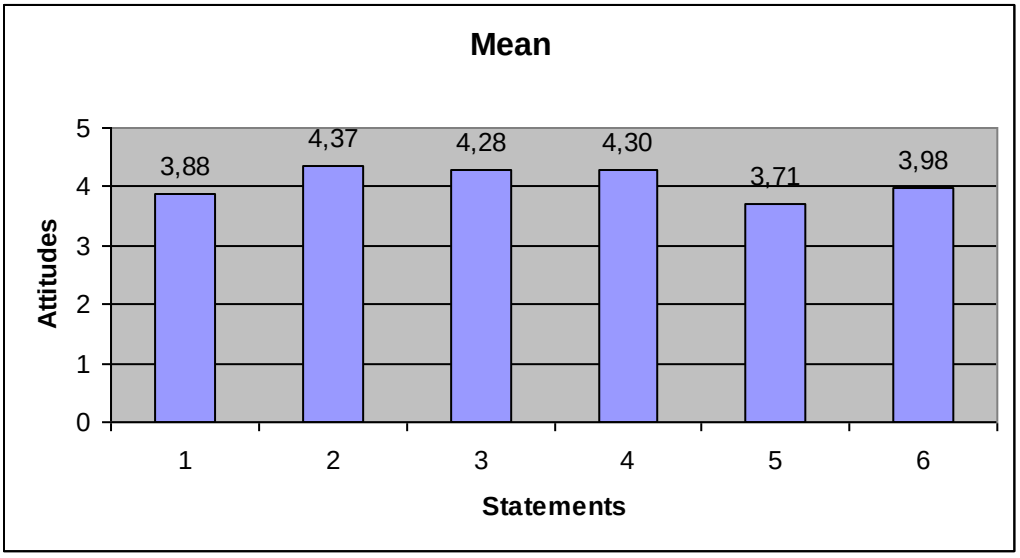

Figure 2. Graphical representation of students' attitudinal survey.

The lowest standard deviation is found at the first and the second statement. This means that students prefer to use concept maps, and that the use of concept maps helps them in learning. The biggest difference in attitudes appears at the fifth statement, which refers to the use of concept maps in the evaluation of mathematical knowledge. It should be noted that teachers have not practiced the use of concept maps in the evaluation of students' knowledge. This fact influenced a huge difference in attitudes, as well as the highest standard deviation, which in this case is **1.26**. Individually, at this statement most students had a neutral attitude (Neutral = 3), which resulted in the lowest mean value, which is **3.71**. There was no impact by the math scores on the attitudes of students in this survey.

CONCLUSION

The aim of this paper is to emphasize the need for the introduction of concept maps in the mathematics teaching, as a useful auxiliary tool for successful learning. Results indicate that the teaching is still largely traditional, and the visualized approach to a topic, with the purpose to get a comprehensive content more conceptual, and also to highlight the relevant in it, is not

still sufficiently used. In order to successfully organize information using the tools for knowledge visualization, teachers must involve themselves in professional training. If they have a positive attitude, teachers can achieve this independently. For more noticeable results it is essential to organize the forms of acquisition of professional knowledge and skills needed for working with students.

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