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CONCEPT MAPPING IN 7TH GRADE MATHEMATICS : AN EXPLORATORY STUDY

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Abstract

The objective of this study was to introduce concept mapping as an instructional strategy in 7th grade mathematics in a Brazilian public school. Since students did not have the concept of "concept" and were not familiar with concept mapping, we started out with a fairy tale, "Snow White and the Seven Dwarfs". In groups, they identified concepts such as "good", "evil", "vanity" and "revenge", and organized them in a concept map. Moving on to 7th grade mathematics, we had good results in terms of the students' acceptance of the new strategy. We alternated concept mapping in mathematics and in other areas of study : a chapter of a book and the lyrics of a song. In addition to achieving our objective, we got the feeling that students from the experimental group were more able to build the equations of a mathematical problem and to find relevant data in problems. The computational ability of experimental and control groups seemed to be the same. The study is continuing in 8th grade mathematics.

INTRODUCTION

This is not a research paper. It just describes an exploratory study on the use of concept mapping in 7th grade mathematics in a Brazilian public school. The teaching of mathematics in our setting is usually based on rote learning strategies. The emphasis is on rules, theorems, algorithms and, of course, on drilling. It seems that mathematical concepts do not exist, or that students are not able to learn them.

Thus, the introduction of concept mapping in such a setting would represent a major instructional innovation. Although concept mapping is becoming almost routine in some quarters, it certainly is not the case in Brazil, specially in junior high school mathematics.

In addition to the fact that we would introduce an instructional strategy stressing meaningful learning in a basically rote learning environment, we faced the problem that students probably had never heard the word 'concept'. How could one teach them how to draw a concept map for some mathematical concepts?

A hint came from Ileana Greca, an Argentinian high school physics teacher, who participated in a concept mapping workshop that we directed in Mendoza, Argentina, in 1991. She started using concept maps with their students

not in physics, but with fairy tales. After a few successful exercises she moved quite smoothly into concept mapping in physics. (Ileana is now a graduate student in physics education at UFRGS.)

Thus, based on this previous experience, we decided to start with the story of "Snow White and the Seven Dwarfs". The objective of this activity was to familiarize students with a conceptual approach to a given subject, and with the concept mapping technique. The whole class of some 50 students was divided into groups of 4 to 5 students. Initially, they were briefly instructed about the meaning of the word concept, that is, about what was meant by "concept". Then, they were asked to identify relevant concepts in the "Snow White" story and to make a drawing using these concepts. In such a drawing, concepts could be placed inside geometrical shapes; in addition, they should be connected to each other and on the connecting lines some key words should be written, in order to give an idea about why they were connected. Finally, the concepts should be organized in some kind of hierarchy, in which the most important concepts should be in the upper part of the drawing. Most groups worked enthusiastically and, at the end of the class period, each group presented, on a wall chart, his/her map (drawing) to the whole group. At that opportunity an exciting negotiation of meanings took place.

This activity was extremely successful and paved the way to a similar one concerning mathematical concepts in the area of geometry, which was also quite successful as a classroom activity. The strategy of alternating concept mapping in mathematics and in other areas like the reading/understanding of texts, such as a fragment of "The Little Prince" or the lyrics of a popular song, was used throughout the school year. Concept mapping became a pleasurable task for the students.

One of the authors was the teacher who used this technique during the whole year of 1992 in 7th grade mathematics. According to her observations, concept mapping helped students to learn how to identify relevant aspects of the subject matter and, apparently, this ability was transferred to non mathematical subjects, as reported by her fellow teachers.

We did have a control group but no "hard" comparisons were made. Both groups are now in 8th grade with the same teacher. It seems that the experimental group has more "readiness" to work and is more able to relate the new content with the previous one (that is, last year's mathematics). Given these differences, she decided to use concept mapping with both groups this year. She also tried concept mapping in 5th grade mathematics using the same strategy (fairy tales & mathematics). In this case, it seems that students who worked with concept maps were more able to understand the wording of the problems and translate them into equations. Computational abilities were practically the same in both groups.

EXAMPLES

In figures 1 to 6 we show sample concept maps drawn by the students during this exploratory study.

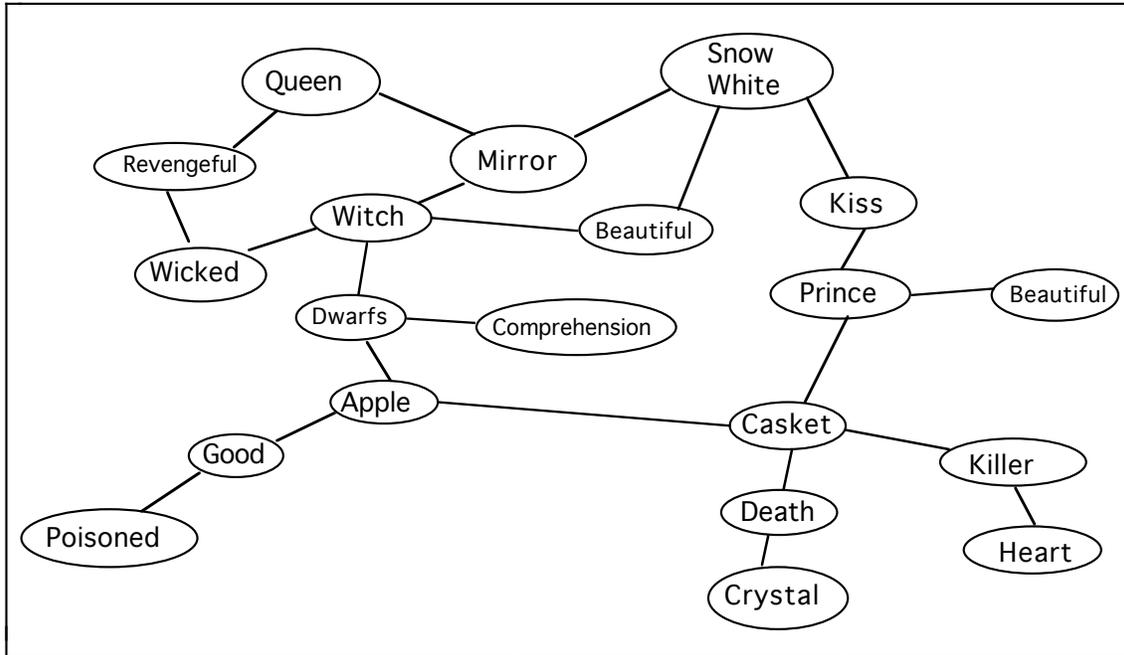


Figure 1. Concept map for the "Snow White", made by 7th grade students (13/14 years) working in small groups (4 to 5 students).

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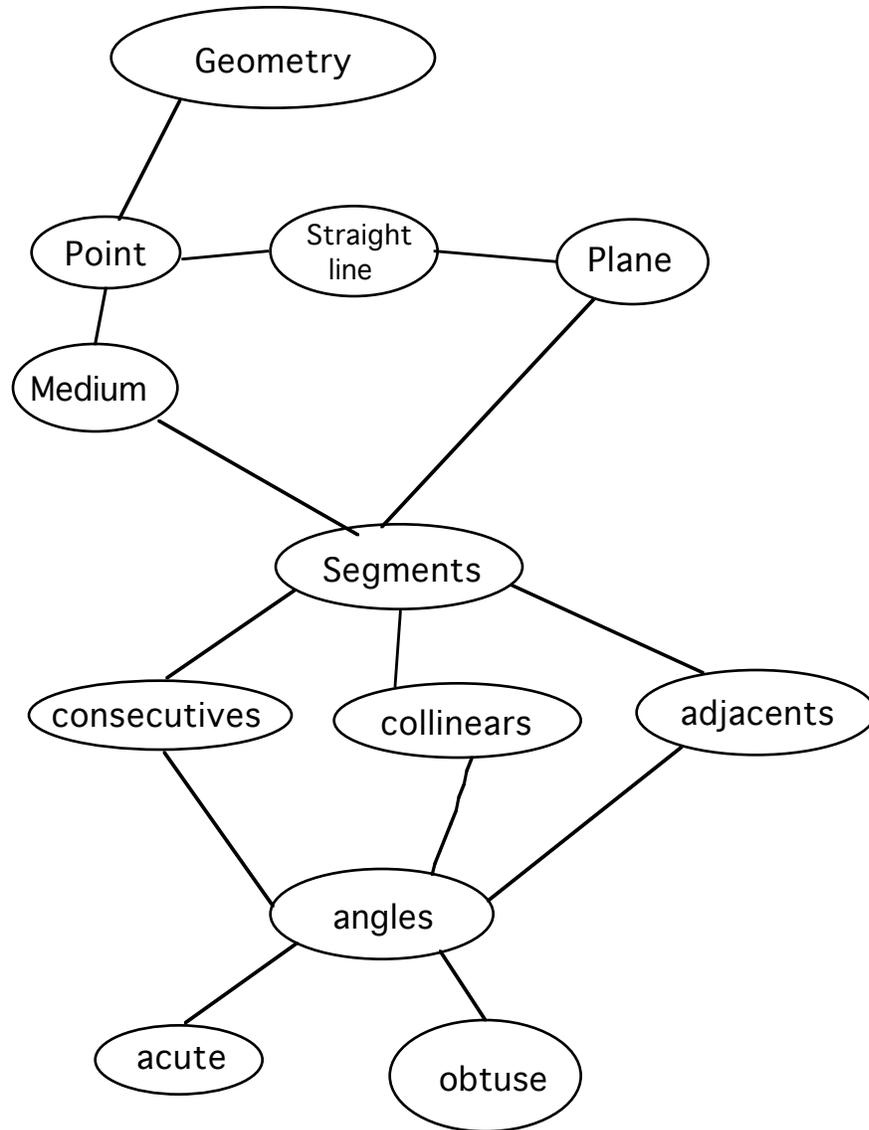


Figure 2. Concept map made by a 7th grade student (13/14 anos) in Mathematics (Geometry), in real classroom situation.

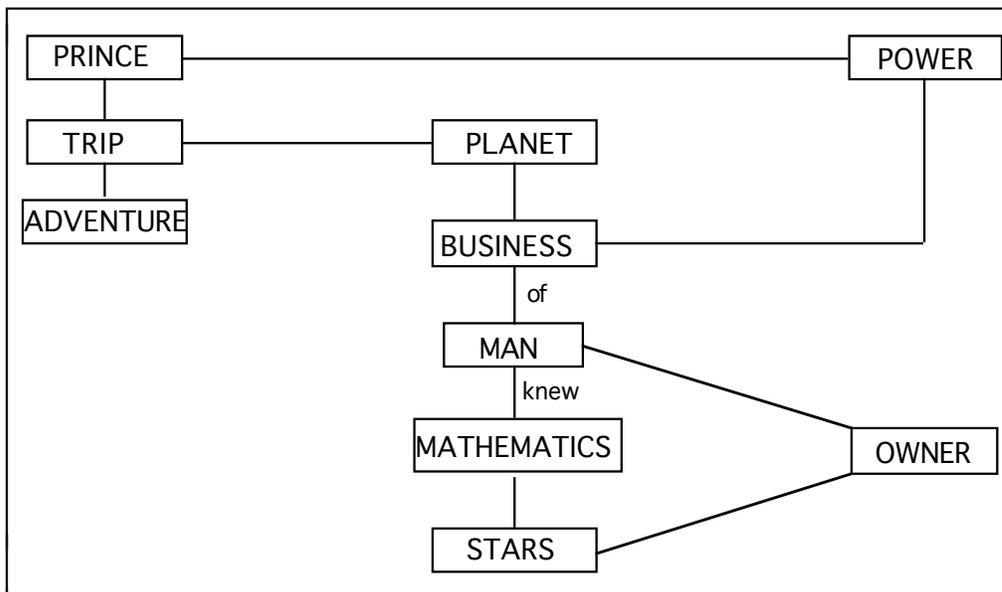
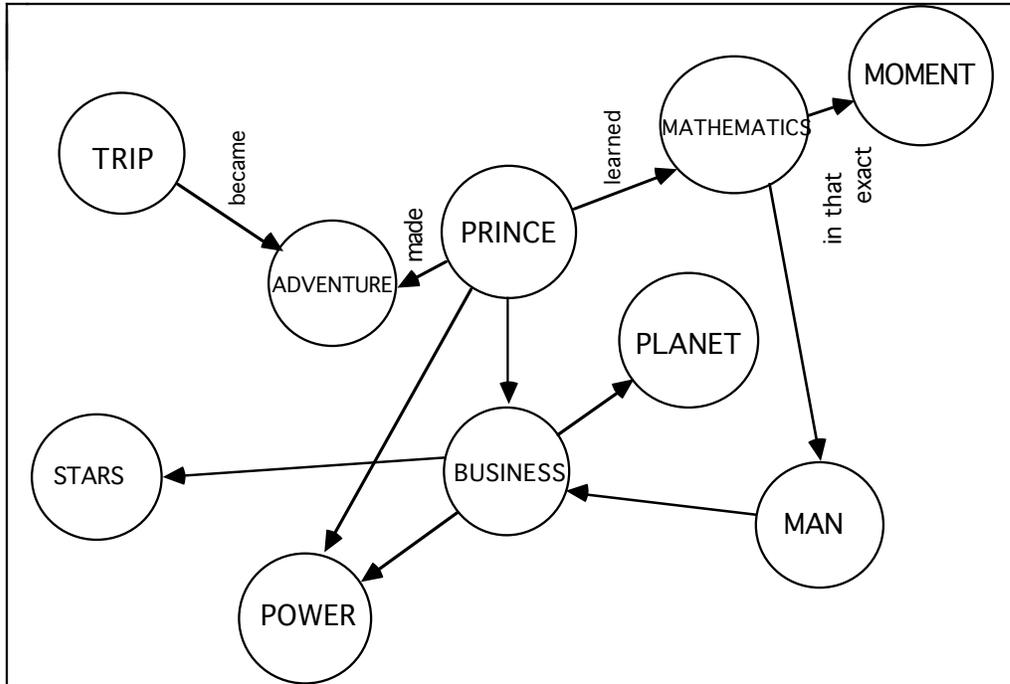


Figure 3. Concept maps made by 7th graders (13/14 years) for a fragment of "The Little Prince". The second map was made after the first was discussed with the teacher.

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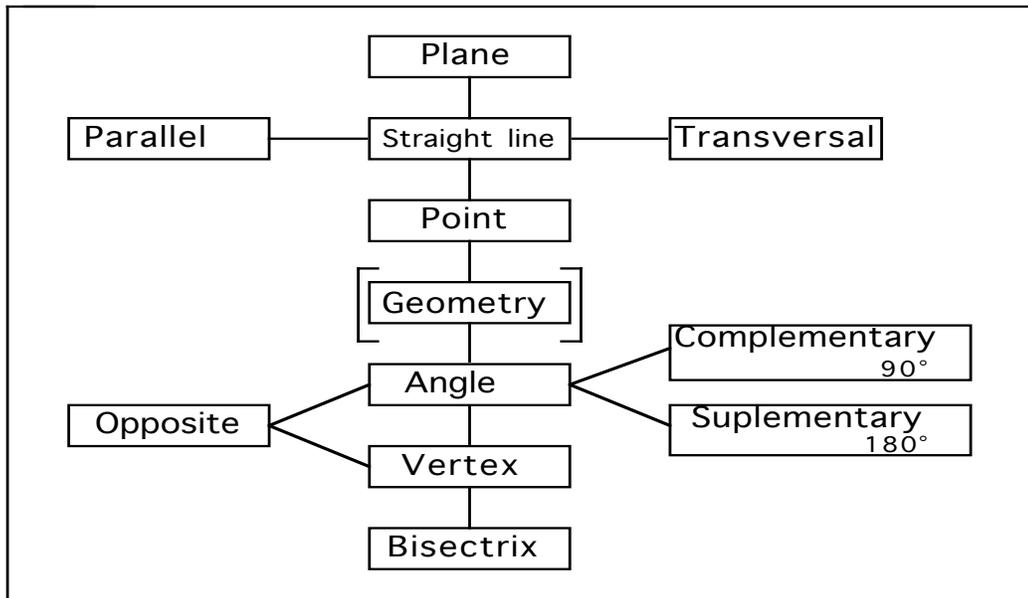
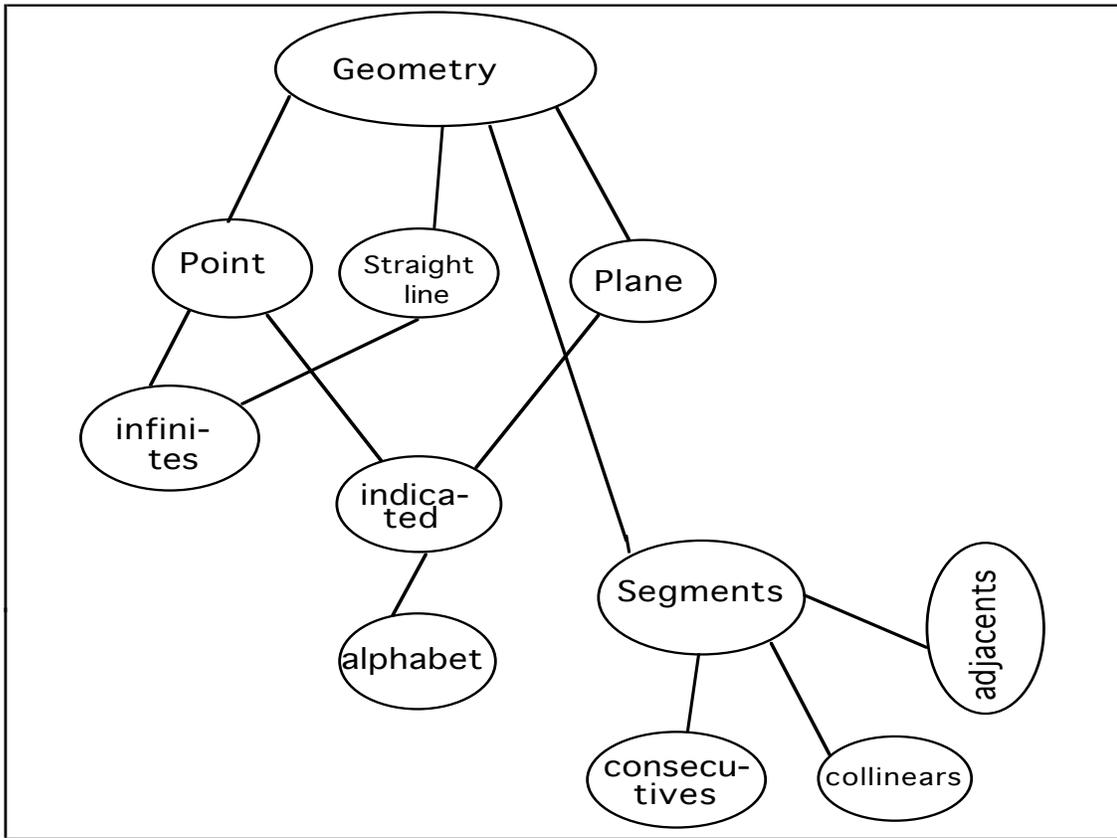


Figure 4. Concept maps made by 7th graders (13/14 years) in Mathematics (Geometry), in real classroom situation.

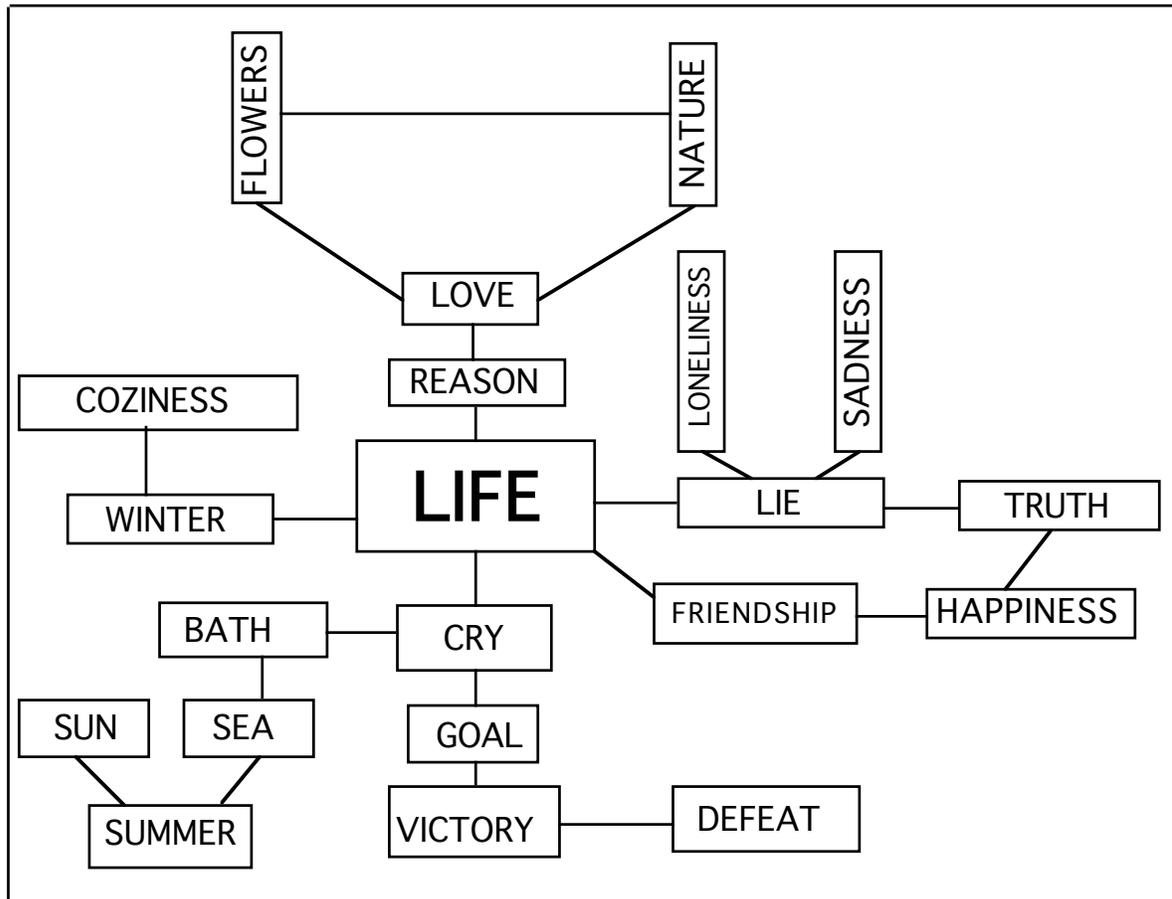


Figure 5. Concept map of a popular song made by 7th graders (13/14 years), working in small groups (4 to 5 students).

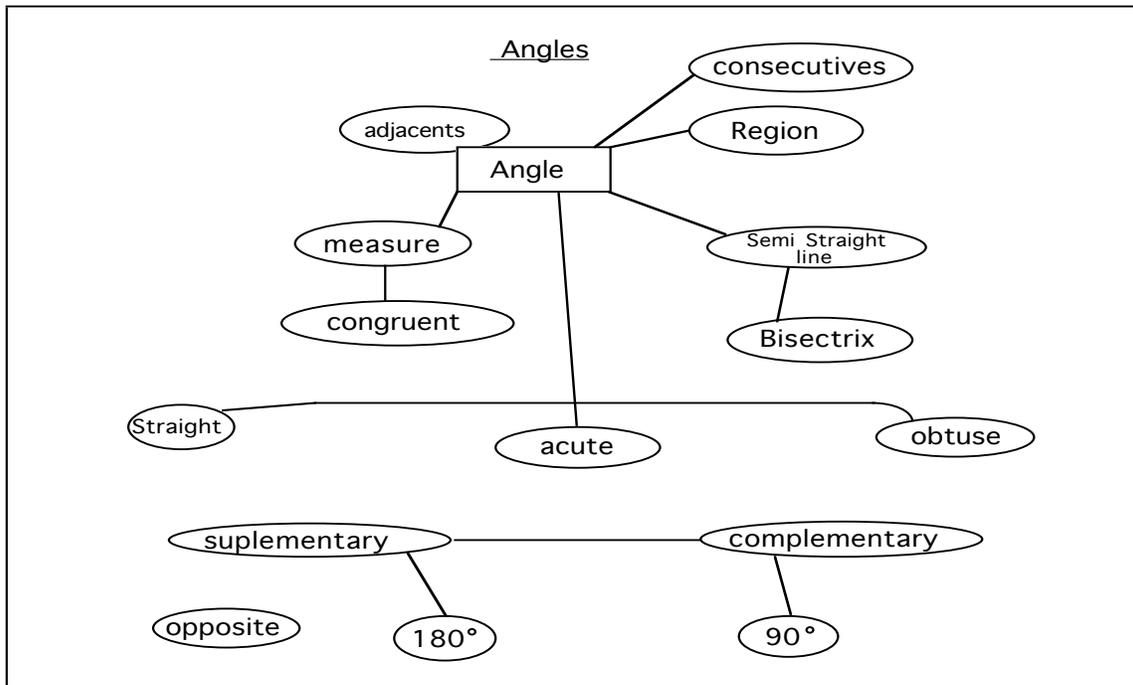
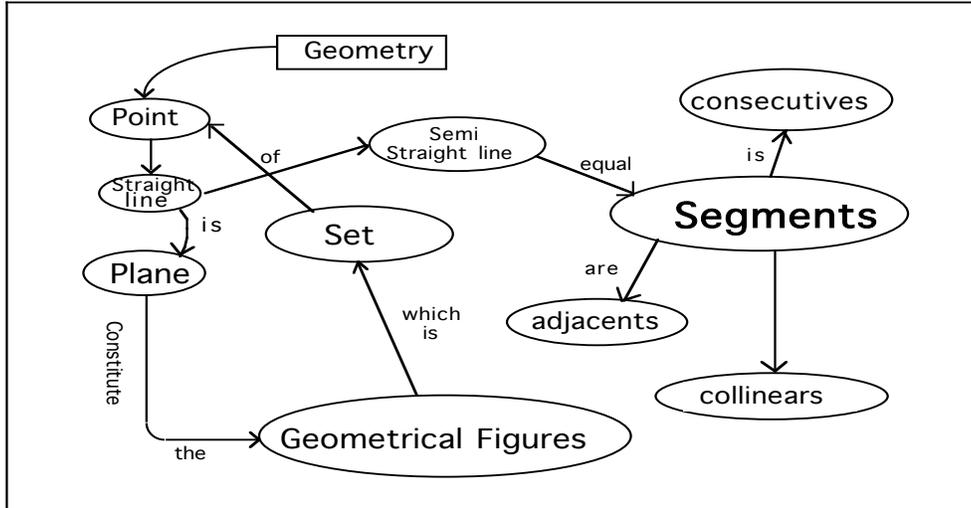


Figure 6. Concept maps made by 7th graders (13/14 years) in Mathematics (Geometry), working in small groups.

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CONCLUSION

We don't have any hard data. We don't have any empirical evidence of meaningful learning which could result from concept mapping. However, using this technique in 7th grade (as well as in 5th, and now in 8th grade) mathematics, alternating with fairy tales and other 'soft' subjects, was fun for all of us (teacher and students) and probably provided some drops of meaningful learning in a highly rote learning environment.

The strategy we used to familiarize our students with concept mapping is likely to work in other settings as well. We strongly recommend the use of the concept mapping technique, but we also recommend that it should not be overused. Students must enjoy doing concept maps.

As can be inferred from the examples we gave, the use of key words to link concepts is quite poor and the conceptual hierarchies are not well defined. In fact, students have difficulties in using linking words and in establishing a clear conceptual hierarchy. We think that these two features of concept mapping are very important in promoting meaningful learning and we are now emphasizing these features in 8th grade mathematics.

In addition, we are trying to get some evidence about the following possible effects of concept mapping on students' learning in mathematics:

Does concept enhance students' ability to understand the wording of mathematical problems and to translate them into mathematical equations ?

Does concept mapping enhance students' ability to identify relevant aspects of the subject matter ? Is this ability transferred to non-math subjects ?

As we said before, in this exploratory study we got the feeling that the answers to these questions might be positive. That' s why we are now seeing them as telling questions in the continuation of the study.

In our view, this kind of findings would be much more relevant than any statistically significant difference in achievement which could be detected as resulting from the use of concept mapping. Concept mapping is a metacognitive strategy and, as such, it is likely to have effects on learning which go beyond achievement as measured by the usual tests of knowledge acquisition.