Concept Maps in Middle School Mathematics

A PROPOSAL for a PROJECT in MATHEMATICS

by

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ABSTRACT

Early childhood teachers provide multiple opportunities for their students to sort and find similarities and differences among objects. Children use sorting as an organizational tool for learning. Concept maps have been used successfully as sorting tools in primary grades in subjects such as reading and science. Concept maps can provide the same sense of organization in mathematics. They can be implemented in several different ways in the mathematics classroom: introduction, teaching, review, and assessment. Similar results are expected in mathematics when concept maps are used appropriately. This project will inform teachers how to utilize this excellent tool and provide middle school mathematics sample lessons.
INTRODUCTION

Early childhood teachers provide opportunities for their students to sort and find similarities and differences among objects. Young children begin to use visuals and groupings as a learning tool. These early learning tools can be modified into sophisticated concept maps. Concept maps allow students to construct and develop patterns and meanings that can result in comprehension rather than strictly memorization.

The author will research ways to utilize concept maps in middle school mathematics. Concepts maps will be considered for use as an introduction, teaching tool, review strategy, and method of assessment. It is expected that implementing concept maps in the current middle school curriculum will help students to organize their ideas and gain a better understanding of mathematical concepts, processes, and relationships. These results in turn can positively affect student performance and self confidence in mathematics.

The purpose of this project is to gather information on concept maps in middle school mathematics and create lessons that will encourage teachers to implement the use of concept maps in their mathematics classrooms. The author's project is based on the following guiding questions:

1. What types of concept maps are appropriate to use in middle school mathematics?
2. Which mathematics topics could be supported by concept maps?
3. When is it applicable to use concept maps?
RELATED WORKS & JUSTIFICATION

Ausubel used concept maps as advanced organizers in the late 1960s (Novak, 2006). His belief was that concept maps were excellent introductory tools that allowed students to retain more knowledge than just abstract information from a lecture. He supported scaffolding and believed that concepts maps could be the bridge connecting concrete to the abstract in an organized structure (Novak & Canas, 2006). Novak (1972) conducted a study to track student understanding of scientific aspects. He first tried interviewing students but could not obtain sufficient data. It was then that he developed and implemented concept maps into his study.

Novak, along with Gowin, studied concept maps as a meta-cognitive tool. At this higher level of thinking and constructing, students realize what topics are still unclear in their minds. It is also a method for self evaluation (Novak & Canas, 2006). Hyerle (1995) published a manual on different forms of concept maps that he refers to as thinking maps. The manual is set up in sections to use concept maps in Introducing, Teaching, Transferring, Integrating, Assessing and Modules. He explains that not every concept map is appropriate for every unit in a subject. There are specific times to use specific maps. A circle map is appropriate for defining in context. The double bubble map is used to compare and contrast. A tree map is for classifying, while a brace map breaks down parts of a whole. A flow map is appropriate for keeping steps in order and a bridge map is for seeing analogies that could support vocabulary.
Researchers seem to agree that concept maps are a very powerful tool in the classroom. Students have experienced the use of concept maps in other subjects and are familiar with the method. Concepts maps have been used in science and language art classes for many years. A tool of this magnitude can be implemented into the critical subject of mathematics. This form of learning may reach the students that Gardner's (1983) multiple intelligences would classify as spatial learners. Concept maps provide a sense of organization and structure to mathematical aspects that is essential for students that are right brain learners (Medanhall, 2005).

These students may benefit by using this visual tool to connect prior knowledge to new information, in turn transferring mathematical concepts into meaningful knowledge that students can retain (Baroody & Bartels, 2000).

Teachers can use this learning tool flexibly in the classroom. Concepts maps that are used to introduce a topic will begin by scaffolding with what the students know already and can grow as the unit progresses. Teaching and reviewing with concept maps allow students to fill in the gaps that they may have missed in years past or within the unit presented. Teachers can also use concept maps as an assessment where students will have the opportunity to organize what they have learned through logical reasoning. It is important to incorporate different styles of teaching to an audience that has different styles of learning.
PLANNED ACTIONS

This project will begin by researching the use of concept maps in middle school mathematics. The author will investigate the various methods of implementing concept maps into the current mathematics curriculum through a literature review. Selected concept maps will be examined and demonstrated in lessons as an introduction and teaching tool, review strategy, or as a method of assessment. The lessons will be geared towards middle school state standards, the Texas Essential Knowledge and Skills (TEKS). The TEKS that will be incorporated will be those with the lowest performance on the state standardized exam, the Texas Assessment of Knowledge and Skills (TAKS). It is the hope of the author that the lessons will be implemented in middle school classrooms in the various forms so concept maps can benefit student understanding in mathematics.
TIMELINE

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<tr>
<th>Date Range</th>
<th>Activity Description</th>
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<tbody>
<tr>
<td>May 29- July 13, 2007</td>
<td>Prepare project proposal</td>
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<tr>
<td>July 13- July 19, 2007</td>
<td>Distribute project proposal to committee members</td>
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<tr>
<td>July 24- July 31, 2007</td>
<td>Project proposal defense</td>
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<tr>
<td>July 23- September 1, 2007</td>
<td>Research the use of concept maps in middle school mathematics</td>
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<tr>
<td>September 1- October 5, 2007</td>
<td>Create lessons incorporating concept maps with middle school TEKS</td>
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<tr>
<td>October 5- October 10, 2007</td>
<td>Distribute project to committee members</td>
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<td>October 24- November 7, 2007</td>
<td>Project defense</td>
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<td>December 2007</td>
<td>Graduation</td>
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END RESULT INTENDED

This project will produce lessons to help teachers implement concept maps in the mathematics classrooms at the middle school level by informing them what concept maps are used in mathematics, which topics could be supported by concept maps, and when it is applicable to use a concept map. The lessons will include teacher instructions, a sample map with guiding questions, and suggested topics that could be covered using each specific map.

Results may include students bridging mathematical concepts throughout the years, evaluating their own work to fill in the gaps, realizing their lack of mathematical vocabulary and engaging in conceptual learning. The project is intended to be an ongoing process in which teachers will utilize concept maps in troubled areas of mathematics within their own classrooms. The goal is to
encourage teachers and students to be comfortable with concept maps and learn when and how to use them appropriately for longer lasting knowledge.
REFERENCES


