Math-Ese Workshop

Reading Strategies Applied to Mathematics

May 31, 2006

Things to ponder…

- What features of mathematics texts make reading difficult for most students?
- What responsibility do math teachers have to teach students how to read their math books?
- What do math teachers need to know about text coherence and audience appropriateness so they can select materials that students can understand?

Mathematics Textbook Features

The good, the bad, the ugly…

Text Structure

- A text that is visually laid out in a way that makes the organization of the content obvious aids in reading comprehension
- Students' awareness of text structure are highly related to reading comprehension
- Explicit instruction in the physical presentation of text and/or text structure aids in reading comprehension

Text Organization

- Saxon vs. Others (Macrostructure)
- Determine how content is organized
  - Create an outline, map or some other type of structural overview
  - Use this to aid in organizing thinking and learning when reading
- Share this information with students!

Text Presentation

- The way written material is physically laid out
- Headings, captions, bold print, italics, font size, and color
- Illustrations and graphics

- Suggestions:
  - Examine several different textbooks
  - Walk students through the text's layout at the beginning of the year

Text Coherence

- The degree to which the author's ideas are logically ordered and clearly explained
- "Inconsiderate" vs. "Considerate" texts
  - Main ideas explicitly stated
  - Relationships among events are explicitly stated
  - Displays *clarity* and *flow of meaning*

Audience Appropriateness

- Teachers should select a text that
  - Aligns with students' prior knowledge and experience
  - Develops new concepts and processes at a reasonable pace
  - Uses language, phrasing, and sentence structure that students can understand
- Again, teach students how to work with a text's organization, layout, and writing style

More things to think about…

- What reading strategies help students interact with the text and reflect on what they are reading?
- What reading contexts can engage students and challenge them to apply what they have learned?
- Where in mathematics does the teaching of reading strategies belong?

In addition to the Vocabulary Development strategies we learned about yesterday, we are going to discuss and *practice* using some Reading Informational Text and Problem Solving strategies.

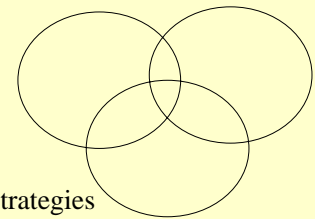These strategies can be utilized before, during, and/or after reading takes place.

Reading Informational Text Strategies

Let's Practice!

- Before Reading
- During Reading
- After Reading

- Problem Solving Strategies

Pre-Reading Activities

- Preview/Survey or Pre-Reading Plan
- Anticipation/Prediction Guide
- Graphic Organizer
- KWL Chart
- Semantic Mapping (Webbing or Clustering)
- Many others…

Example, Pre-Reading Plan

- What comes to mind when you hear the word *fractals*? Individually, write down all associations.
- Composite list:

- What made you think of {*something on the list*}?
- As a result of our discussion, can you think of any other information that you know of this topic?

Anticipation/Prediction Guide

- Identify concepts you want students to learn from reading
- Create 4-6 statements that support or challenge students' beliefs and experiences about the topic
- Prior to reading, students (individually or as a group) react to each statement, formulate a response ("Me" column), and prepare to defend their decision
- Students explain responses to each statement
- Students read the selection that supports or disconfirms each statement ("Text" column)

Ex., Anticipation/Prediction Guide

Anticipation Guide
Mathematics in Nature

Directions: In the column labeled *Me*, place a check next to any statement with which you agree. After reading the text, compare your opinions about those statements with information in the text.

Me	Text	
____	____	1. The *Fibonacci Sequence* (1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, …) has many interesting properties that have been found to occur in nature.
____	____	2. *Phyllotaxis* is the arrangement of leaves in plants and can be modeled by the *Fibonacci Sequence*.
____	____	3. The ratios of consecutive *Fibonacci Numbers* approach the *golden ratio* (approximately .618034).
____	____	4. Golden Rectangles are those whose dimensions are chosen so that the ratio of length to width is the *golden ratio*.
____	____	5. The regeneration of male bees follows the pattern found in the *Fibonacci Sequence.*

During-Reading Activities

- X Marks the Spot
- Anticipation/Prediction Guide
- 5-Step Problem Solving (or Polya's 4-Step)
- Graphic Organizers
- K-N-W-S (KWL for application problems)
- SQ3R (Survey, Question, Read, Recite, Review)
- Three-Level Guide
- Many others…

X Marks the Spot

**X** = Key Point
! = New or Interesting Info
? = Confused

INTRODUCTION. Geometry is a branch of mathematics that studies the properties of two- and three-dimensional figures such as triangles, circles, cylinders, and spheres. More than 5,000 years ago, Egyptian surveyors used geometry to measure areas of land in the flooded plains of the Nile River after heavy spring rains. Even today, engineers marvel at the Egyptians' use of geometry in the design and construction of the pyramids. History records many other practical applications of geometry made by Babylonians, Chinese, Indians, and Romans.

The classical Greeks (660–300 B.C.E.) are credited with refining years of practical use of geometry into a systematic subject of logical thought. **Pythagoras** (580?–501? B.C.E.) is generally regarded as the first of the great Greek mathematicians. Although very little is known about him personally, there is much fascinating literature about the Order of Pythagoreans—a private academic society that he established. Pythagoras and his students devoted themselves to the study of mathematics, astronomy, and philosophy, and they developed geometry into an abstract science.

Many scholars consider **Euclid** (330?–275? B.C.E.) to be the greatest of the Greek mathematicians. His book, *The Elements,* is an impressive study of geometry and number theory. It presents geometry in a highly structured form that begins with several simple assumptions and then expands on them using logical reasoning. For more than 2,000 years, *The Elements* was the textbook that students all over the world used to learn geometry.

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Example, Graphic Organizer for 5-Step Problem Solving

The Jones family has a house that is worth $85,000, but they still owe $45,000 on the mortgage. They have $2300 in credit card debt, $1500 in other debts, $1200 in savings, and two cars worth $3500 each. What is the net worth of the Jones family?
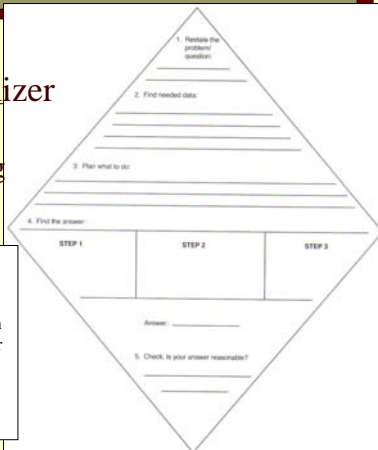
Example, Graphic Organizer Concept Definition Web
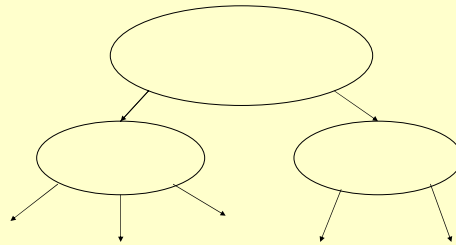
Example, Graphic Organizer
Venn Diagram of Real Number System
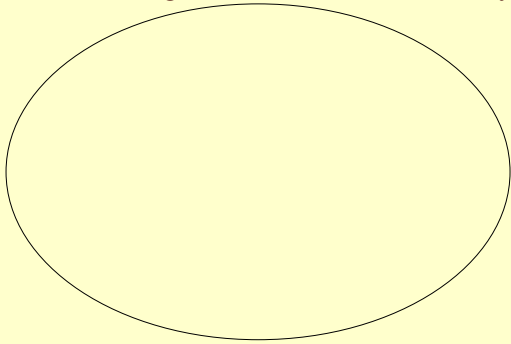
Example, Graphic Organizer
Tree Diagram

A car can be ordered in any one of 4 different colors, with 2 engine sizes, and 2 different interior designs. How many different cars are available?

Other Types of Graphic Organizers

- Factor Trees
- Multiplication Tables
- Compare/Contrast Organizers
- Many, many others!!

SQ3R
Survey, Question, Read, Recite, Review

- Survey what your are about to read
  - Skim for meaning
- Question
  - Turn title, headings, subheadings, graphics, illustrations into questions
  - Determine meaning of unfamiliar vocabulary
- Read actively
  - Search for answers to questions
- Recite
  - Look away and recall what was read
  - Answer questions
- Review
  - Organize and summarize information

After-Reading Activities

- Most of the strategies already mentioned
- Use taxonomies students created
    - Write sentences, poems
    - Use new vocabulary & concepts to tell stories
- Find the Fake
- Restate/Summarize & Generalize
- Other reflection practices (tomorrow)

Find the Fake

- Students work in groups (of 4, suggested)
- Individually, students write 3 statements
    - 2 True
    - 1 False
- Within groups, students take turns reading their cards and challenging their partners to find the fake
- Each group may select one card to challenge the class

Example, Triangles

Restate/Summarize & Generalize

- Restate/Summarize
    - What did I do?
    - What did I learn?
- Generalize
    - How can I use this process or concept to solve other problems?

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Problem Solving Strategies

K-N-W-S

K	N	W	S
What facts do I <u>KNOW</u> from the information presented in the problem?	Which information is <u>NOT</u> needed?	<u>WHAT</u> does the problem ask me to find?	What <u>STRATEGY</u>/ Operation/Tools will I use to solve this problem?

K-N-W-S

Problem: The ends of a rope are tied to two trees, 500 feet apart. Every 10 feet an 8-foot post is set 2 feet into the ground to support the rope. How many support posts are needed?

K	N	W	S
What facts do I <u>KNOW</u> from the information presented in the problem?	Which information is <u>NOT</u> needed?	<u>WHAT</u> does the problem ask me to find?	What <u>STRATEGY</u>/ Operation/Tools will I use to solve this problem?

10 Problem Solving Strategies

- Working Backwards
- Finding a Pattern
- Adopting a Different Point of View
- Solving a Simpler Analogous Problem
- Considering Extreme Cases
- Making a Drawing
- Intelligent Guessing and Testing
- Accounting for All Possibilities
- Organizing Data
- Logical Reasoning