

*Teaching Reading in Mathematics*  
2ND EDITION

A Supplement to *Teaching Reading in the Content Areas Teacher's Manual* (2nd edition)

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"Once a student leaves high school, 90% of his reading will be informational reading. Only 10% of his reading will be for pleasure."  
—Willard Daggett

## Turning Research into Areas of Expertise

- [Afterschool](#)
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- [Future of Schooling](#)
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## Walk and Talk

1. Stand up, take three steps, and discuss with the person closest to you ...  
*What does reading mathematics mean?*
2. Take three more steps, and discuss with the person closest to you ...  
*Why should students learn to read mathematics?*
3. Take three more steps, and discuss with the person closest to you ...  
*What would a classroom where mathematics reading was taking place look like?*
4. Return to your seat.

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## Norms

- ◆ Respect Time
- ◆ Be Fully Present
- ◆ Be Willing to Share Expertise
- ◆ Interact Respectfully
- ◆ Engage in Active Listening
- ◆ Have the Attitude of a Learner
- ◆ Leave with Goals, New Understandings, and a Willingness to Extend what You Have Done Today

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## Mathematics Literacy Game

- ◆ The sum of a number  $n$  and 7
- ◆ 7 less than a number  $n$
- ◆ 7 times a number  $n$
- ◆ The quotient of a number  $n$  and 7
- ◆ 7 more than a number  $n$
- ◆ The difference between  $n$  and 7
- ◆ A number  $n$  increased by 7

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## Mathematics Literacy Game

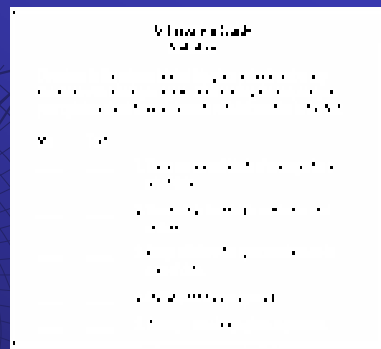
- ◆ A number  $n$  is less than 7
- ◆ A number  $n$  is decreased by 7
- ◆ 7 divided by a number  $n$
- ◆ The product of a number  $n$  and 7
- ◆ The difference between 7 and  $n$
- ◆ 7 is less than a number  $n$
- ◆ 7 subtracted from a number  $n$
- ◆ 7 is greater than a number  $n$

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## Model: Anticipation Guide



- ◆ Pages 95 – 97
- ◆ Type of Strategy: Informational Text
- ◆ Why would you use it?
  - Activate and assess prior knowledge.
  - Focus reading.
  - Motivate reluctant readers.
  - Identify misconceptions.
- ◆ How do you use it?



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### Anticipation Guide TRM Katerina

Read each statement. In the column labeled "Yes," place a Y if you believe that the statement is true and an F if you believe the statement is false. Explain your thinking in the space for explanation. Then read the background section of TRM pages 95 – 97. In the column labeled "No," place a N if the statement has a different meaning than what you believe or if you are unsure. Explain your thinking in the space for explanation. Compare your answers with information in the book.


Yes No

- Mathematics textbooks have been used for years and will continue to be used even when more quality options are available.
- You need to use different reading skills when you read a mathematics textbook than the skills you use to read textbooks in other content areas.
- Textbooks are not as helpful as other resources in mathematics, such as digital resources, because they do not include graphics, audio files, and interactive content all the information available on the page.
- Mathematics textbooks are more often written with a readability level that is below the grade level in which they are used.
- Reading in mathematics includes making connections among all kinds of graphics and reading several passages.

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## Five Premises

- ◆ Schema theory
- ◆ Prior knowledge
- ◆ Metacognition
- ◆ Reading and writing relationship
- ◆ Collaborative



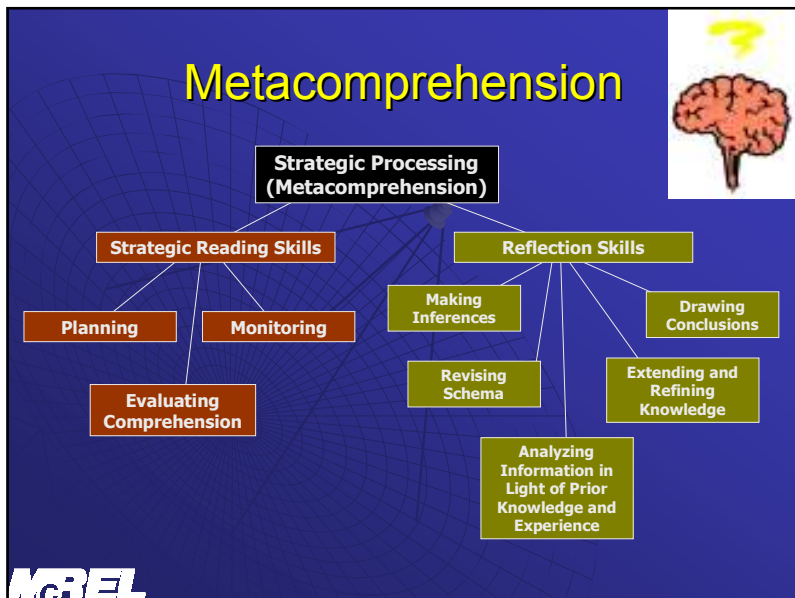
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## How's Your Schema?

Directions: Read the paragraph below and fill in the missing words.


The questions that p\_\_\_\_\_ face as they raise ch\_\_\_\_\_ from in\_\_\_\_\_ to adult life are not easy to an\_\_\_\_\_. Both fa\_\_\_\_\_ and m\_\_\_\_\_ can become concerned when health problems such as co\_\_\_\_\_ arise any time after the e\_\_\_\_\_ stage to later life. Experts recommend that young ch\_\_\_\_\_ should have plenty of s\_\_\_\_\_ and nutritious food for healthy growth. B\_\_\_\_\_ and g\_\_\_\_\_ should not share the same b\_\_\_\_\_ or even sleep in the same r\_\_\_\_\_. They may be afraid of the d\_\_\_\_\_.

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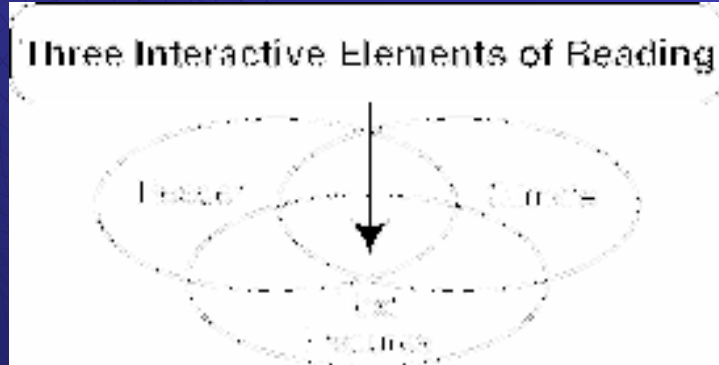
## Quick Tour of Manual

- ◆ Three Interactive Elements of Reading
- ◆ Strategic Processing
- ◆ Strategic Teaching
- ◆ Six Assumptions About Learning
- ◆ Strategies



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## Three Interactive Elements



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## Reader



In your table team, think about students/individuals that you consider successful readers. List 5–10 characteristics of these effective readers.

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## Reader



**Prior Knowledge**

- Content knowledge
- Personal experience
- Misconceptions

**Mental Disposition**

- Motivation
- Confidence
- Interest
- Attitude

Strategies that access prior knowledge

Strategies that promote productive habits of mind

TRIM, p. 3

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## Productive Habits of Mind



### Critical Thinking

- Being accurate and seeking accuracy
- Being clear and seeking clarity
- Being open-minded
- Restraining impulsivity
- Taking a position when the situation warrants it
- Being sensitive to others' feelings and level of knowledge

### Creative Thinking

- Intense engagement in tasks even when solutions are not immediately apparent
- Pushing the limits of your knowledge and abilities
- Generating, trusting, and maintaining your own standards of evaluation
- Generating new and 'outside the box' ways of viewing a situation

### Self-Regulation

- Being aware of your own thinking
- Planning
- Being aware of necessary resources
- Being sensitive to feedback
- Evaluating the effectiveness of your actions

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## Climate

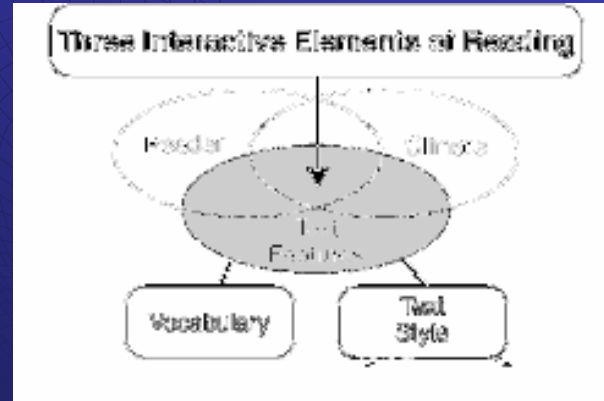
- ◆ Physical conditions
- ◆ Acceptance
- ◆ Safety and Order
- ◆ Competence and Value



TRIM, p. 11

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## Text Features



TRIM, p. 13

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## Pair and Share

Think about...

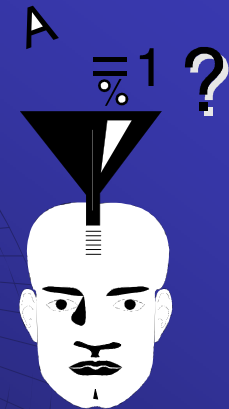
- What are three ways that mathematics content vocabulary is different than vocabulary that students deal with in narrative text?
- How should we teach (not teach) content area vocabulary?
- What are specific mathematics concerns you have and/or strategies you use to teach vocabulary?

TRIM pp. 13 – 21

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## Specific to Mathematics

- ◆ Conceptual density
- ◆ Complex overlap in term usage
- ◆ Numerous new terms and symbols
- ◆ Concepts embedded within other concepts
- ◆ No existing schema
- ◆ Different meanings outside of mathematics



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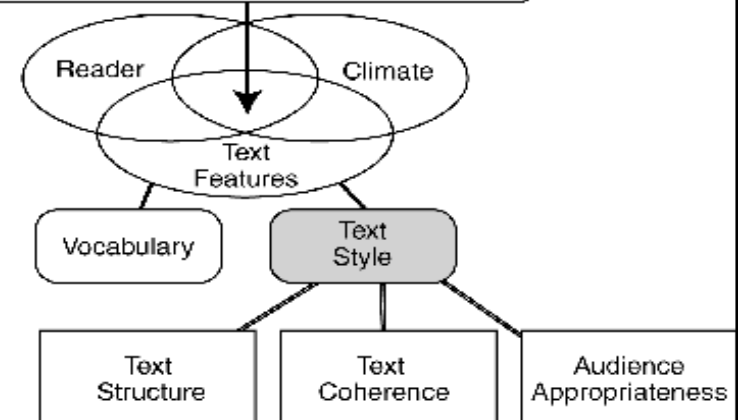
## Effective Vocabulary Instruction

- ◆ Describes and explains words
- ◆ Makes meaningful connections
- ◆ Requires repetition
- ◆ Targets learning styles
  - Nonlinguistic representations
  - Students' own explanations

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## Text Style

### Three Interactive Elements of Reading



## Text Structure - Organization

*The basic premise that learning is organizing knowledge certainly is true in mathematics.... However, we must be cautious in thinking that this organization is parallel to that in other disciplines. To try to impose generic organizational patterns upon a discipline already structured would be counterproductive.*

-Mary Lindquist

TRIM pp. 24 – 33

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## Students who understand how text is organized are better able to ...

- ◆ Locate key information.
- ◆ Distinguish between important information and its support.
- ◆ Synthesize information from different parts of a text or from several texts.
- ◆ Connect new information with what is known.
- ◆ Restructure schema accordingly.

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## Text Presentation (Reader Aids)



Review the features of a textbook and consider...

- Graphics used
- Layout of text and graphics
- Chapter/unit organization
- Concepts per page
- Reading level

Based on your review, what specific reading skills do students need to use to comprehend and learn from this particular text?

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## Strategic Teaching with the Six Assumptions

### §16 Applications: Adapt Learning

Learning to:

1. Analyze and find
2. Make links between new information to prior knowledge
3. Use organization of information
4. Use adaptability to depth and instructional strategies
5. Monitor and evaluate learning in places
6. Influence the respective classroom

TRIM, p. 57

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## Strategies



- ◆ Vocabulary Development
- ◆ Informational Text
- ◆ Reflection Strategies

TRIM, p. 61

**Warning: It's not the strategies alone, it's the THINKING!**

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	Page Number	Language Arts	Mathematics	Science	History
<b>Vocabulary Development</b>					
M-1 Concept Cards	50	X	X	X	X
M-2 Concept Definition Mapping	56	X	X	X	X
M-3 Flash Cards	58	X	X	X	X
M-4 Link-Group Labels	70	X	X	X	X
M-5 Semantic Feature Analysis	78	X	X	X	X
M-6 Semantic Mapping	77	X	X	X	X
M-7 Student-Word Strategy	86	X	X	X	X
M-8 Verbal and Visual Word Association (VWVA)	94	X	X	X	X
M-9 Word Sort	98	X	X	X	X
M-10 Comparison	98	X	X	X	X
M-11 Cue Cards	97	X	X	X	X
M-12 Number Cards	99	X	X	X	X
<b>Informational Text</b>					
M-13 Analogous Problem Cards	96	X	X	X	X
M-14 Flow Map Problem Solving	98	X	X	X	X
M-15 Graphic Organizer	100	X	X	X	X
M-16 Group Summarizing	100	X	X	X	X
M-17 Knowledge Building Chart	108	X	X	X	X
M-18 What I Know/What to Learn/Learned (WIL)	108	X	X	X	X
M-19 M-W-B (M-W-B for Word Problems)	112	X	X	X	X
M-20 Read Help	114	X	X	X	X
M-21 Paraphrasing Plan	115	X	X	X	X
M-22 Problematic Situation	116	X	X	X	X
M-23 Reciprocal Reading	118	X	X	X	X
M-24 Search Strategy	119	X	X	X	X
M-25 Semantic Mapping	121	X	X	X	X
M-26 Survey Question, Read, Summarize (SQRS)	125	X	X	X	X
M-27 SQRS/CO	128	X	X	X	X
M-28 Think-Aloud	128	X	X	X	X
M-29 Three Level Quiz	128	X	X	X	X
M-30 Word Problem Pictures	132	X	X	X	X
<b>Reflection Strategies (Questioning, Writing, Discussing)</b>					
M-31 Learning Log	132	X	X	X	X
M-32 Question Answer Relationship (QAR)	133	X	X	X	X
M-33 Questioning the Author (QTA)	137	X	X	X	X
M-34 Note/Abstract/Formal/Topic (NAFT)	139	X	X	X	X
M-35 Writing to Learn	141	X	X	X	X

TRIM, p. 61

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## Break: (15 min)

- ◆ Stretch, walk a bit, visit the restroom, get a drink...
- ◆ Boot up your computers
- ◆ Please return promptly

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## Vocabulary Strategies



- ◆ Identify goals for the unit.
- ◆ Develop vocabulary list.
- ◆ Determine the level of understanding for terms.
- ◆ Select appropriate vocabulary strategies.

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## Verbal and Visual Word Association



<b>Vocabulary Term</b>	<b>Visual Representation</b>
<b>Definition</b>	<b>Personal Association or Characteristic</b>

See <http://springfieldmath.pbwiki.com/Calculus+Metaphor>

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## Informational Text Strategies



- ◆ Engage Learners
- ◆ Access prior knowledge and current understanding
- ◆ Use problem solving strategies
- ◆ Represent concepts nonlinguistically
- ◆ Use collaboration and sense making

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## Graphic Organizer



- ◆ Pages 101-105
- ◆ Why and when would you use it?
  - Visual representation
  - See relationships
  - Make connections
  - Organize ideas
  - Store and recall information
- ◆ How do you use it?

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## Graphic Organizer Example

**Applications of Quadratic Equations**  
These equations contain variables raised to the first and second (square) power, and can be solved using factorization or the quadratic formula.

Calculations of parabolic shapes use  $y = ax^2 + bx + c$ . It works well for the bowl of a giant radio telescope, a shaving mirror and a satellite TV dish. Quadratic equations are needed for modern communications.

Auto makers and accident detectives calculate the stopping distance (s) of a car using  $s=vt + \frac{1}{2}at^2$ . This shows that doubling your speed quadruples, rather than doubles, your stopping distance.

The quadratic equation  $x^2 + x = 1$  is used in studies of animal populations and in the pattern in which the seeds of sunflowers and the leaves on the stems of plants are arranged by the Golden Ratio.



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pg. 116 Problematic Situation  
<http://www.dimensionm.com>



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## Reflection Strategies



Focus on strategic processing skills through...

- Questioning
- Writing
- Discussing



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## pg. 139 Role/Audience/Format/Topic (RAFT)



This year's reflective project is next year's advance organizer

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Surface Area



## The Last Word



Dear Mr. Kuhn:

*Today we talked a lot about quadratic equations. I understand what an equation is. I have used them many times. But I don't quite understand why a "quadratic" equation is different than other equations. I know quad means four but what does that have to do with equations? Would you please spend some time tomorrow teaching us what the word "quadratic" means and how it defines a type of equation?*

*Thanks,  
Sammy*

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## Sharing Strategies with a wiki



In order to foster greater collaboration and depth of knowledge, we will now see how we can combine our ideas on a wiki.

What is a wiki?

- ◆ Hawaiian meaning "quick"
- ◆ A collaborative webpage that anyone can easily edit
- ◆ [Video: what is a wiki?](#)



Not this. This furry guy is a Wookiee.

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## Sharing Strategies with a wiki



1. Go to <http://springfieldmath.pbwiki.com>
2. Set up an account and login with the password "math"
3. You will be adding information to your group's page in a collaborative effort with your peers.
4. Follow along with your facilitator to see how easy it is to edit the wiki and post your group's best strategy idea.



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## Jig-Saw



1. Work in table teams to become "experts" on different strategies in a jig-saw style.
2. Explain to your group how a strategy could be used with text from a class you teach. If you did not bring materials from your class, us [www.purplemath.com](http://www.purplemath.com).
3. Share your expert groups' best thinking with other groups on <http://springfieldmath.pbwiki.com>



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### 1 *Jig-Saw – Examining and Practicing Vocabulary, Informational Text, and Reflection Strategies that can Increase Reading Comprehension in Mathematics (30 min)*

Become an Expert: using M-23 on pg. 118, read, highlight, and summarize the strategies in your assigned section and prepare to teach them to the rest of the group. Please refer to pg. **61** in **TRIM** for a listing of the strategies.

- ◆ **Expert 1:** pp. **62-79** (Vocabulary Development Strategies)
- ◆ **Expert 2:** pp. **80-93** (Vocabulary Development Strategies)
- ◆ **Expert 3:** pp. **95-115** (Informational Text Strategies)
- ◆ **Expert 4:** pp. **116-130** (Informational Text Strategies)
- ◆ **Expert 5 and Computer Technician:** pp. **132-141** (Reflection Strategies)

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### 2 *Jig-Saw – Examining and Practicing Vocabulary, Informational Text, and Reflection Strategies that can Increase Reading Comprehension in Mathematics (25 min)*

Apply and Explain Your Expertise: through the "lens" of the TRIM text strategies, examine your own mathematics text.

- ◆ Determine when, why, and how you might use these strategies.
- ◆ When all "experts" are ready, briefly summarize the strategies from your section for your group. Point out your favorite strategy from your assigned section and elaborate.

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### 3 *Jig-Saw – Examining and Practicing Vocabulary, Informational Text, and Reflection Strategies that can Increase Reading Comprehension in Mathematics (25 min)*



Sharing Out:

- ◆ Follow along with your facilitator to learn the basics of sharing through a wiki.
- ◆ Go to <http://springfieldmath.pbwiki.com> and post your groups best example.
- ◆ All group members are responsible for drafting content for the "computer technician" to post.
- ◆ Share out the groups' thinking around how's, when's and why's.
- ◆ Remember norm expectations

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Thank you!

- ◆ Questions?
- ◆ Contact Information:  
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[mkuhn@mcrel.org](mailto:mkuhn@mcrel.org)

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