

# The Language IN Math:

## Strategies for Developing Math Vocabulary

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# Outcomes for Session

- Discuss research and rationale for developing math vocabulary
- Experience strategies & activities for developing math vocabulary in grades K-6



# What does "2" mean in each example?

- 2
- To
- Too
- Two
- 24
- $\frac{1}{2}$
- $10^2$
- $\text{ft}^2$



# Relevant Research

Classroom Instruction That Works by Robert Marzano:

- "...systematic vocabulary instruction is **one of the most important instructional interventions** that teachers can use, particularly with low-achieving students." (Becker, 1977)
- "...systematic vocabulary instruction is **rare** in U.S. schools." (McKeown & Curtis, 1987)
- "...**student achievement will increase** by 33 percentile points when vocabulary instruction focuses on **specific words that are important** to what students are learning." (Stahl and Fairbanks, 1986)



# Relevant Research

## Building Background Knowledge for Student Achievement by Robert Marzano

- "...direct vocabulary instruction has an impressive track record of improving students' **background knowledge** and the **comprehension of academic content.**" (p. 69)
- "...when people first learn words, they understand [word definitions] more as **descriptions** of words as opposed to definitions." (Kucan, 2002)
- "...Stahl and Fairbanks (1986) demonstrated the effectiveness of both **language-based strategies...and nonlinguistically based strategies.**" (p. 72)



# Relevant Research

- “Vocabulary knowledge also appears to **deepen over time...**” (Stahl, 1999)
- “Students should **play with words.**” (Covington, 1992; Johnson, von Hoff Johnson, and Schlichting, 2004).



# Relevant Research

Bringing Words to Life: Robust Vocabulary Instruction by Isabel Beck, Margaret G. McKeown, Linda Kucan

- "...it is **precarious to believe that naturally occurring contexts are sufficient**, or even generally helpful, in providing clues to promote initial acquisition of a word's meaning." (p. 6)
- "...students become interested and enthusiastic about words when instruction is **rich and lively...**" (p. 13)



# Evidence of Success

- Research from Marzano and Beck's works
- Student achievement at Echo Mountain Primary School in Phoenix, AZ, in the area of mathematics rose from **48% to 90%** based on state testing (AIMS - Arizona's Instrument for Measuring Success) after implementing several of these strategies



# What should students know & be able to do?

- Define
- Pronounce
- Draw
- Give examples
- Use in writing
- Use verbally
- Recognize as sight words
- Identify in real-life
- Compare/contrast
- Visualize
- Integrate



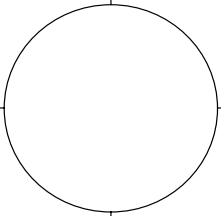
# Developing Math Vocabulary

- Read, write, speak, listen
- Language vs. math vocabulary development
- First lesson - 4-6 different uses
- Within a few days - 30 uses
- Pictorial examples!!! - 80% of people are visual learners
- Graphic Organizers



# Frayer Model

What it is	Characteristics
Examples	Non-Examples



# Research and Theory\*

- Strong relationship between vocabulary...
  - and intelligence
  - and one's ability to comprehend new information
  - and one's level of income
- Systematic vocabulary instruction -
  - One of most important interventions
  - Especially with low-achieving students
  - Rare in U.S. schools



\*Robert Marzano - Classroom Instruction That Works

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# Research and Theory\*

## Generalizations

1. Students must encounter words in context more than once to learn them.
2. Instruction of new words enhances learning those words in context.
3. One of the best ways to learn a new word is to associate an image with it.
4. Direct vocabulary instruction works.
5. Direct instruction on words that are critical to new content produces the most powerful learning.



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# Suggestions from Marzano

- Limit vocabulary lists (e.g., only focus on 5-7 key words for a 3-week unit)
- Process for Teaching New Terms and Phrases:
  1. Present explanation or description
  2. Present nonlinguistic representation
  3. Students generate explanations or descriptions
  4. Students create nonlinguistic representations
  5. Periodically ask students to review accuracy of their own explanations, definitions, and/or representations



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# Techniques from SEI

- Sing or chant words
- Use physical gesture and/or act out
  - Kids make up gestures
  - You act it out & they verbalize
  - You verbalize & they act it out
- Illustrate words
- Create posters using student representations
- Systematic review
  - Popsicle stick game - "Snap!"



# Goals of using Math Word Banks

- **Student achievement** in mathematics will improve since they have a better grasp of the vocabulary, both written and oral.
- **Teachers** will use math vocabulary more consciously
- **Consistency** from room to room, grade to grade, and school to school



# Types of Math Word Banks

- Bulletin boards
- Magnetic boards
- Charts
- Portable word banks

If you wish to color code:

- Number Sense - pink
- Data Analysis, Probability, & Discrete Math - yellow
- Patterns, Algebra, & Functions - white
- Geometry - green
- Measurement - blue
- Logic - goldenrod



# Classroom Activities

- Commercial Books, class books, & vocabulary journals/dictionaries
  - Stuart Murphy books
  - Student-Made Books
  - Vocabulary dictionaries/journals



# Classroom Activities

- Math Bingo/WORDO
- Write each of these words in a different box:
  - mile      foot      yard      inch      cup      quart
  - gallon      ounce      pound



# Classroom Activities

- Vocabulary Riddles



# Measurement Word Bank

Attribute	U.S. Customary	Metric
<b>Length</b>	inches feet yards miles	millimeters centimeters meters kilometers
<b>Weight</b>	ounces pounds	grams kilograms
<b>Capacity</b>	cups pints quarts gallons	milliliters liters



# Classroom Activities

- Word Sorts
  - Word type
  - Vowels
  - Initial Consonants
  - Concepts
  - Categories



# Classroom Activities

- Group Solutions from GEMS
  - Cooperative activities
  - Heavy on vocabulary development
  
- Also see United We Solve for older students



# Classroom Activities

- Portable Word Banks
  - Individualize the word banks for a closer view
  - Use a format that kid can take with them when they go to special classes



# Classroom Activities

- Vocabulary “Tests”
  - Leave word bank visible
  - Give definitions, illustrations, or clues
  - Have kids list the words



# Measurement Word Bank

Attribute	U.S. Customary	Metric
<b>Length</b>	inches feet yards miles	millimeters centimeters meters kilometers
<b>Weight</b>	ounces pounds	grams kilograms
<b>Capacity</b>	cups pints quarts gallons	milliliters liters



# Vocabulary Journals

- Spiral notebooks/steno pads
- 3-ring binders
  - Allows for organization
  - Personal favorite - organize by strand
- Simple - 4 boxes
- Graphic organizer - Frayer model
- Commercial - grid paper & lines

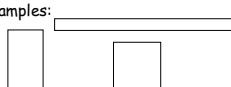



# Sample Journal Pages

digit	place
value	hundred's place

Strand: Geometry

Rectangle: A four-sided shape with 4 right angles.

Examples:	Non-Examples:
	
Square:	
Examples:	Non-Examples:
Rhombus:	
Examples:	Non-Examples:
Quadrilateral:	
Examples:	Non-Examples:



# In closing...

- **Direct instruction** of vocabulary is highly supported by research as one of the most effective interventions
- For more information, see books by **Robert Marzano**
  - Classroom Instruction That Works
  - Building Background Knowledge for Student Achievement
- **Borrow** ideas from Language Arts programs





**Remember... “talk the talk as  
you walk the walk”**



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# Contacts

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# Implementation Activities

- Select one activity you learned during this presentation to use with students in the next week...

