Making Math Meaningful:

Strategies for Developing
Academic Vocabulary

Kimberly Rimbey, Ph.D
National Board Certified Teacher

Why I Love Kids…

Kids are Awesome!

Session Agenda

- Research and rationale for developing math vocabulary
- Strategies & activities for developing math vocabulary

What does “2” mean in each example?

- 2
- To
- Too
- Two
- 24
- 1/2
- 10^2
- ft^2

Common Core Connections

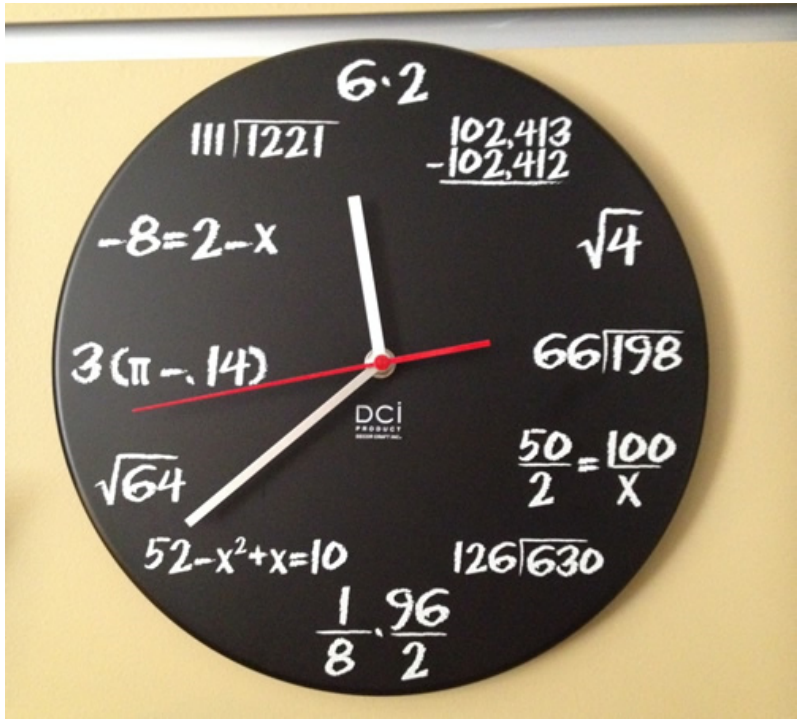
Content Standards

- Counting & Cardinality
- Operations & Algebraic Thinking
- Number and Operations in Base Ten
- Number and Operations – Fractions
- Measurement & Data
- Geometry

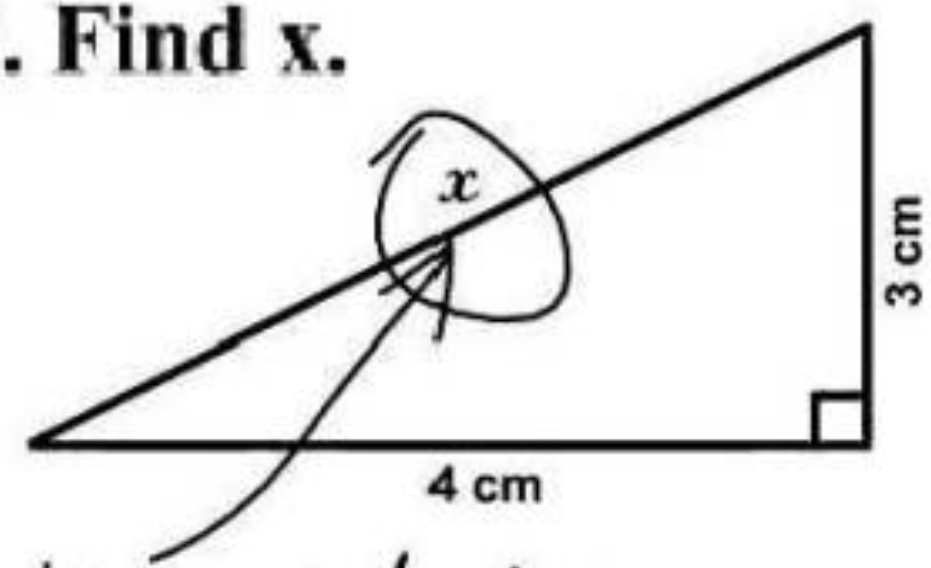
Mathematical Practices

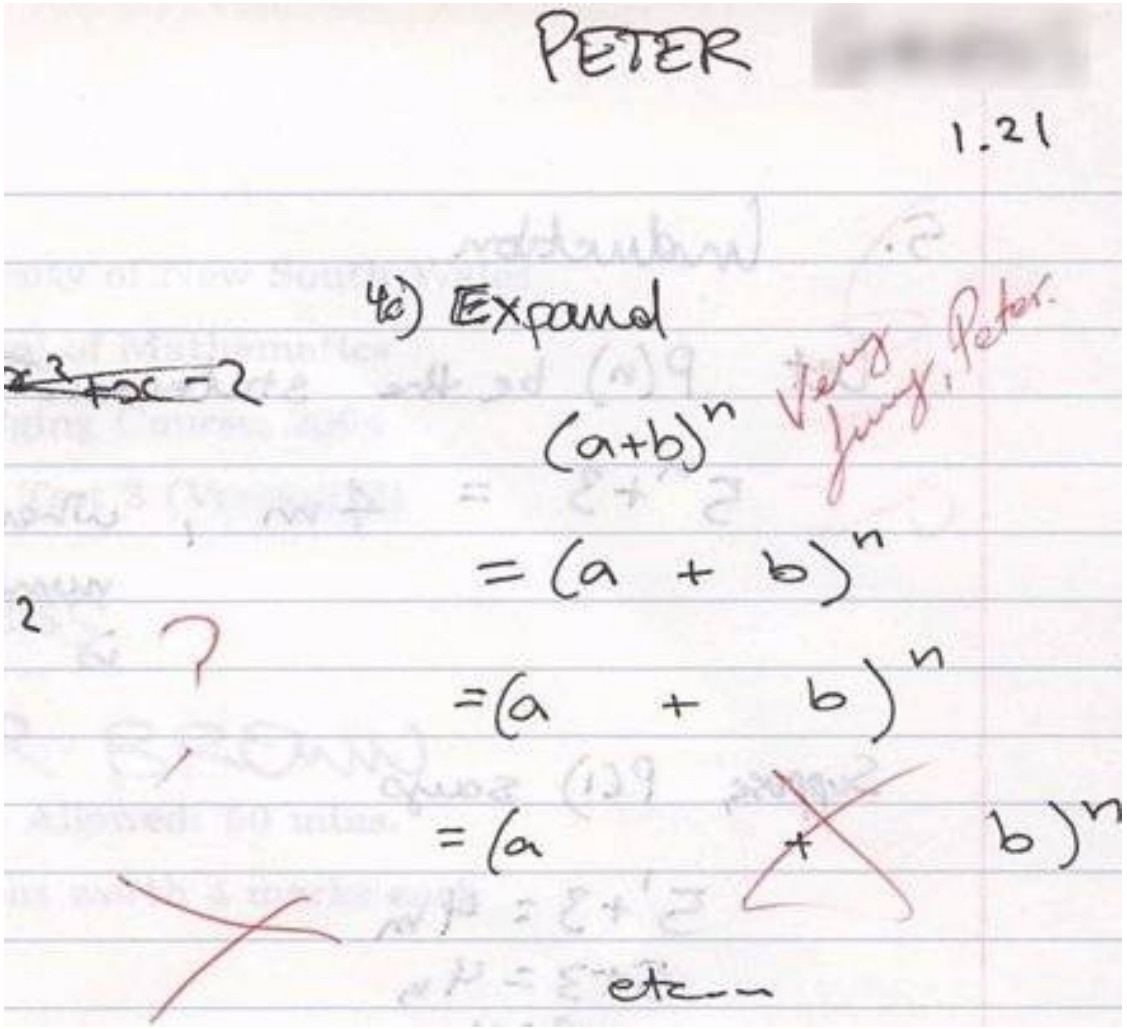
- MP2 – Reasoning
- MP3 – Argumentation
- MP4 – Mathematical Models
- **MP6 - Precision**

Speaking of Precision…



3. Find x.




PETER

1.21

4c) Expand

~~$x^3 + 8x - 2$~~

$(a+b)^n$ Very funny, Peter.

$= (a + b)^n$

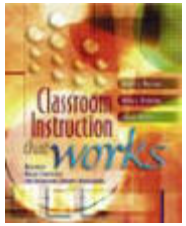
2 ?

$= (a + b)^n$

$= (a + b)^n$

etc...

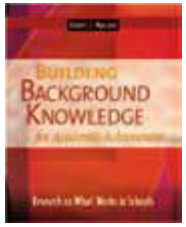
Relevant Literature



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."
- "…systematic vocabulary instruction is **rare** in U.S. schools."
- "…**student achievement will increase** by 33 percentile points when vocabulary instruction focuses on **specific words that are important** to what students are learning."

Relevant Literature



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**."
- "…when people first learn words, they understand [word definitions] more as **descriptions** of words as opposed to definitions."
- "…Stahl and Fairbanks demonstrated the effectiveness of both **language-based strategies**…and **nonlinguistically based strategies**."

Relevant Literature

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."
- "…students become interested and enthusiastic about words when instruction is **rich and lively**…"

Developing Math Vocabulary

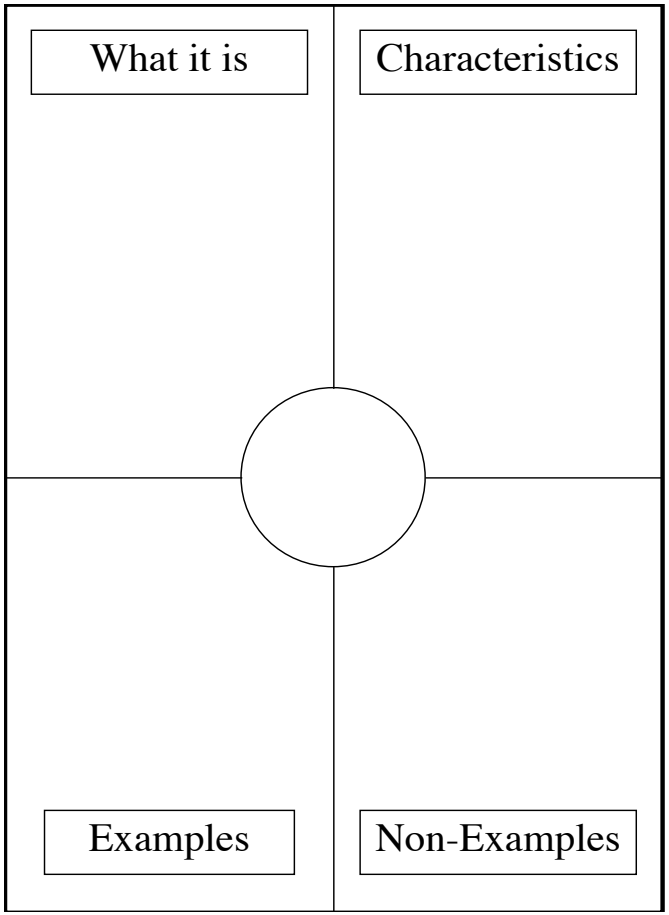
- Read, write, speak, listen
- Language vs. math vocabulary development
- First lesson - 4-6 different uses
- Within a few days - 30 uses
- Pictorial examples!!! - 80% of people are visual learners
- Graphic Organizers

Using Graphic Organizers

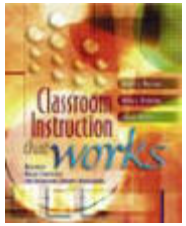
What should students know & be able to do?

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

Frayer Model



Relevant Literature

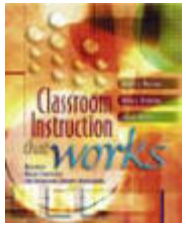


- Strong relationship between vocabulary…
  - and intelligence
  - and one's ability to comprehend new information
  - and one's level of income

- Systematic vocabulary instruction -
  - One of most important interventions
  - Especially with low-achieving students
  - Rare in U.S. schools

*Robert Marzano - Classroom Instruction That Works

Relevant Literature

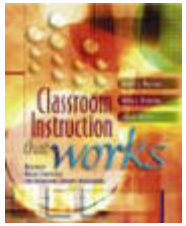


Generalizations

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.

*Robert Marzano - Classroom Instruction That Works

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

*Robert Marzano - Classroom Instruction That Works

Techniques from SEI Classrooms

- 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 – “Snap!”

Using Games

Snap!

Using Games

WORDO (Math BINGO)

Using Games

WORDO (Math BINGO)

Write each of these words in a different space:

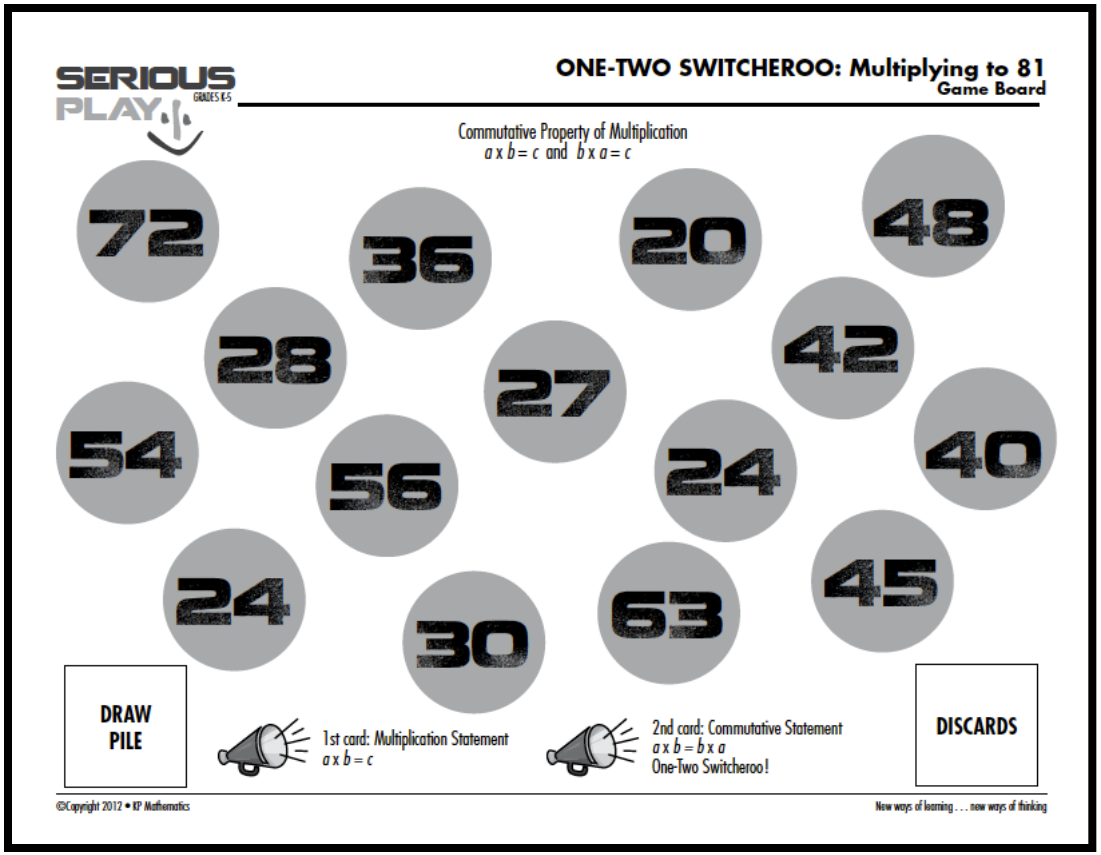
mile foot yard inch cup quart gallon ounce pound

Using Games

Card Games – Christopher

Using Games

Board Games – Language Expectations



SERIOUS PLAY GRADES K-5

ONE-TWO SWITCHEROO: Multiplying to 81

Cards

8 x 9	9 x 8	7 x 4	4 x 7	9 x 6	6 x 9
6 x 4	4 x 6	5 x 6	6 x 5	7 x 8	8 x 7
4 x 9	9 x 4	9 x 3	3 x 9	9 x 7	7 x 9
9 x 5	5 x 9	8 x 3	3 x 8	7 x 6	6 x 7
5 x 4	4 x 5	6 x 8	8 x 6	5 x 8	8 x 5
CHANCE Discard and pick	CHANCE Discard and pick	CHANCE Take a card	CHANCE Take a card	CHANCE Take a card	

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

Using Math 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

Using Math Word Banks

Types of Math Word Banks

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

Using Math Word Banks

Portable Word Banks

- 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

Using Vocabulary Riddles

Using Vocabulary Riddles

Word Bank – Measurement Example

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

Using Word Sorts

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

Using Vocabulary "Tests"

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

Using Vocabulary "Tests"

Measurement Word Bank

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

Using 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

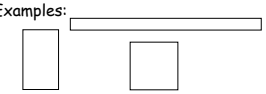
Using Vocabulary Journals

Simple Journal Page

digit	place
value	hundred's place

Innovative Journal Page

Strand: Geometry

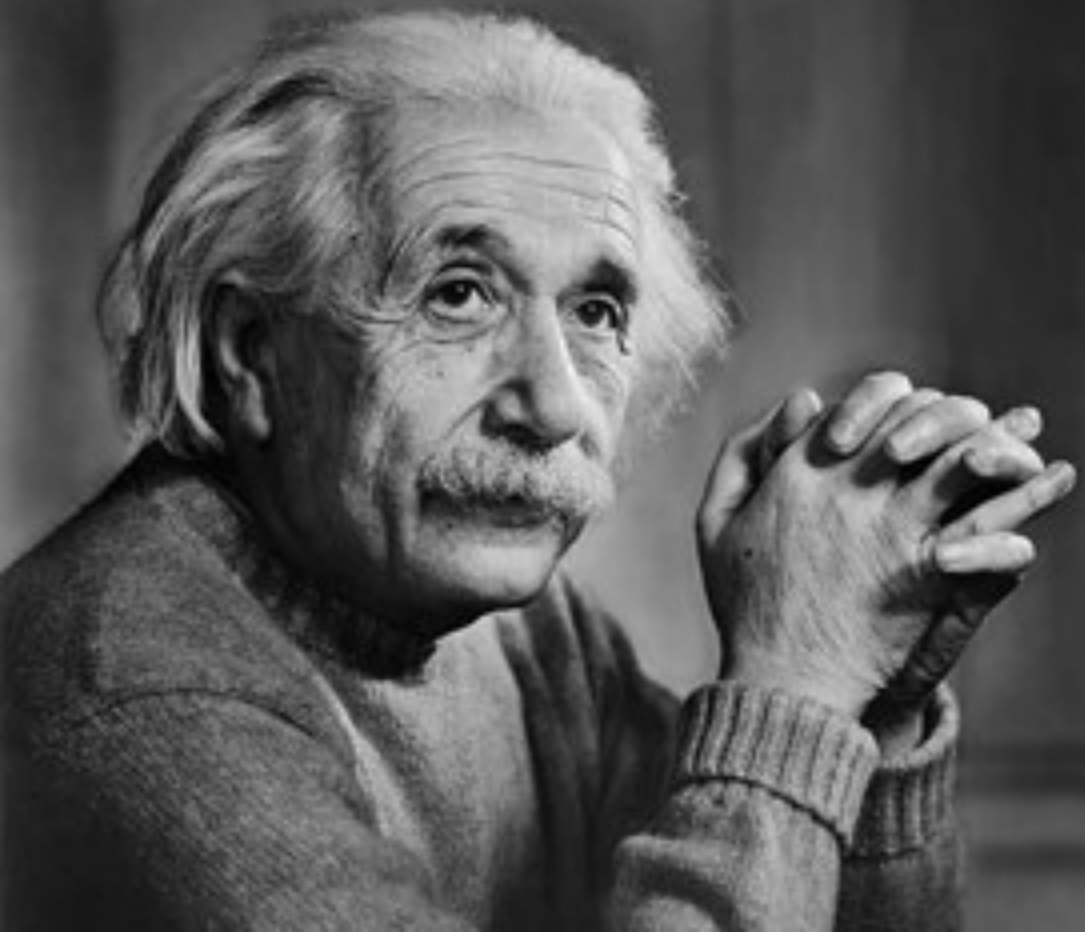
Rectangle: A four-sided shape with 4 right angles.	
Examples: 	Non-Examples: 
Square:	
Examples:	Non-Examples:
Rhombus:	
Examples:	Non-Examples:
Quadrilateral:	
Examples:	Non-Examples:

A Note on Teacher Talk

Ones…Tens…Hundreds

If you can't explain it **simply**, you don't understand it well enough.

– Albert Einstein



“Hey mom, look at the kitties!”

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 & SEI programs

Remember… “talk the talk as you walk the walk”

Committed Action Step

Select one activity you learned during this presentation to use with students in the first week of school…


You don't have
to See the
Whole Staircase,
just take the
FIRST STEP

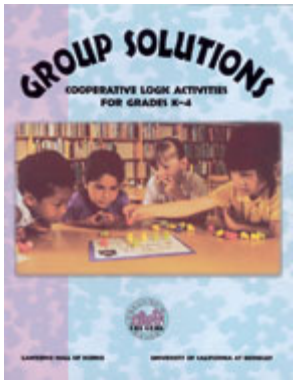
Contact Info

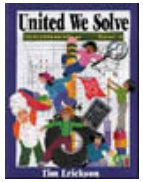
Kimberly Rimbey, Ph.D.

kim@kpmathematics.com

Group Solutions

- Group Solutions from GEMS
  - Cooperative activities
  - Heavy on vocabulary development





  - Also see United We Solve for older students