This session will cover:
- language structures used in math and science
- vocabulary challenges in math and science texts
- importance of orally expressing concepts and procedures
- forms of written language required in math and science
- strategies

Vocabulary Challenges in Math:
- Unfamiliar vocabulary and proper names
  - identical boxes, laps swam, Pancho...
- Vocabulary specific to math
  - estimate, product, quotient, place value...
- Vocabulary of directions
  - list, align, identify, find, complete...
Vocabulary challenges...

- Vocabulary with multiple meanings
  - table, quarter, operation, complete

- Vocabulary is cumulative – it builds each year

Use the new vocabulary often 😊

Language Challenges in Math:

Question forms
- Who paid more? How many are not...?

Multi-step problems
- Making like units; more than one calculation
- Using information from a previous question

Graphing questions (analyze/draw conclusions)
- Between which two is there the greatest increase?
- What is the trend?
- Compare/contrast ________________.

Language of graphs...
- Which _______ was twice the number of _______
- Which _______ was half the total of _______
- Which was least preferred?
Strategies for Solving Word Problems:

1. Read the problem entirely. Try to get a feel for the whole problem.
2. Look at the question being asked. What do I need to find?
3. Underline or highlight the facts. What information do I need to use?
4. Circle the **clue words**.
5. Draw a picture, make a chart, use a model.

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Look at the **clue** words...

- **Add**
  - Sum, plus, together, added to, increased by, total of, combined

- **Multiply**
  - Product of, times, of, multiplied by

- **Subtract**
  - Difference, minus, take away, fewer than, less than, decreased by

- **Divide**
  - Quotient of, per, divided by, into, out of, ratio of, percent (÷ 100)
Opportunities to Elicit Oral Language:
• Say the word name: two hundred four thousand, thirty-nine
• Say the process aloud: two plus three equals five
• Explain how to solve a problem: work through the steps
• Explain everyday math activities: consumer mathematics, restaurant role play

Activities for Eliciting Oral Language:
• Giant word problems displayed around the room.
• Quiz-quiz-trade or think-pair-share with a partner.
• Math stories (math problems embedded in story)
• Create a “sentence frame” and post it on board
  The polygon is a _____ because it has _____ sides
• Real-world contexts

Real Life Applications:
• Restaurant role-play
  Use real menus and play money
• Consumer math
  What will you get for “free” if you buy _____?
  Not valid on Friday and Saturday
  Expiration date
Opportunities for Written Language:

• Explain the steps for solving a math problem.
• Write your own word problem.
• Keep a weekly math journal.
  – Ex: What I've learned...
    I'm still confused about...
    All the ways you use math at home...
    An example when you used math outside class...

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Story Problem Pattern

(1st character) (action word) (number) (object) (where)

also

(2nd character) (action word) (new number) (object)

How many ____________ did they ____________ in all?

(1st character) (action word) (number) (object) (where)

(2nd character) (action word) (new number) (object)

How many ____________ did they ____________ in all?

Answer:

They ____________ ____________ ____________ in all.

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Story Problem Pattern

Bob throws 4 apples in the basket. (1st character) (action word) (number) (object) (where)

Jane also throws 5 apples in the basket. (2nd character) (action word) (new #) (object)

How many apples did they throw in all?

Answer:

They threw 9 apples in all.

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Vocabulary Challenges in Science

- Vocabulary pertinent to the area of science being studied:
  - life science, physical science, earth science, etc.
- Vocabulary of experiments:
  - hypothesis, variables, data, results, conclusions, etc.
- Vocabulary of directions:
  - measure, pour, combine, stir, find the mass, record, etc.
- Units of measurement and tools of science:
  - milliliters, grams, millimeters, graduated cylinder, balance, etc.

Language Challenges in Science

- The language of procedures:
  - “Hold the string tight as you pull the washers to one side until the distance between the bottom of the washers and the floor is 10cm. Have your partner place a paper cup on the marked spot.” (4th gr.)
  - “Keep the yeast tube at about 35 degrees Celsius for about 5 minutes. Then use the straw-tipped air piston to transfer 2 milliliters of warm distilled water to a small test tube. Label the tube y. Add 1 drop of phenol red solution to the small test tube.” (7th gr.)

Language of Questions

Sample questions from texts:
- Based on your data, describe the relationship between the height of the washers and how the cup moved. (E)
- What relationships, if any, are there between the mass of an object and the volume of water displaced? (MS)
Additional sample questions:
- Does the shape of the Cartesian diver affect the volume of water it displaces? If so, how? If not, why not? (MS)
- How do the densities of sinking objects compare with the densities of floating objects? (MS)

Multiple Meaning Words
- “Solution” used in math and in science
  - an answer to a problem
  - a liquid with a solid or gas dissolved in it
- “Common” used in science
  - What are some uses of water not common 50 years ago but are common today?
  - What features do all of the inner planets have in common?

Strategies to Meet These Challenges
- The use of post-notes to take notes
- Teach students the clue words in a text:
  - Clue words for examples
    - ____________ is a type of ____________
    - ____________ is a kind of ____________
    - ____________ is in the category of ____________
  - Two types of ____________ are ____________
    - ____________ such as ____________
    - ____________ is an example of ____________
More Clue Words

- Clue words for **characteristics**
  - _________ has ___________
  - _________ is characterized by _________
  - One feature of _________ is _________
  - A property of _________ is _________
  - An aspect of _________ is _________
  - _________ is a characteristic of _________

Oral Language in Science

- Group discussions in small groups and in class
- Oral report about a topic
- Reporting from a group
- Presenting explanations and observations
- Asking and answering questions
- Debating about an environmental issue

Oral Language Structures

- I wonder what would happen if _________.
- I have a question about _________.
- We want to test _________ to find out if _________.
- If I change _________, then I think _________ will happen because _________.
- I disagree with _________ because _________.
- The reason I believe _________ is _________.
- The facts that support my idea are _________.
Examples of Written Language in Science

**Expository Writing**: experiment reports, explanation of events, research papers, writing procedures, explanation of a model or invention, pros and cons of a science issue

**Descriptive Writing**: observation journals, listing properties, describing a habitat, describing an invented animal

**Creative Writing**: imagining: life on Planet Oobleck, a drop of water traversing the water cycle, a water droplet navigating the Water Company, an insect going through metamorphosis

**References**


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White, Phyllis, and David Mavin (2000) “Math is Language Too: Talking and Writing in the Mathematics Classroom”, Urbana, IL: NCTE.

Tactics for “Networking to Increase Reading Comprehension” presented by NTID at an ASL Conference during the 1990’s.

Sample questions and tests taken from various science and math textbooks by the following publishers:

- Holt, Rinehart and Winston
- Houghton Mifflin
- McMillan/McGraw-Hill
- McDougal Littell
- Pearson Hall
- PBIS (Project-Based Inquiry Science)
- Sadler Oxford