Hooked on Math: Engaging LEP Students in Mathematics through Practical Application and Language Enrichment

Judy Kinley
Des Moines Public Schools

Outcomes for Session

- Discuss multiple math strategies that assist in the success of LEP learners.
- Practice and take away useful techniques rooted in a firm understanding of the language acquisition process.
- Explain how language rich instruction and hands-on experiences empower LEP students with skills to be successful in mathematics.

Relevant Research

- **In a study of 221 middle school students in California, students without a strong command of both everyday language and specialized mathematical language, LEP students scored significantly lower than non-LEP students.**
  (Lager, C.A.,2006)
  Retrieved from "Types of Mathematics-Language Reading Interactions that Unnecessarily Hinder Algebra Learning and Assessment", Reading Psychology, Apr. 2006, Vol.27 on November 15, 2006

- **254 bilingual and monolingual 5th grade students in California, Virginia, and Massachussets, were found to have increased vocabulary knowledge and content understanding with direct vocabulary instruction** (*Carlo, M.S.; August, D.; McLaughlin, B.; Snow,C.; Dressler, C.;Lippman, D.N; Lively, T.; White,C.E., 2004*)
  Retrieved from "Closing the gap: Addressing the vocabulary needs of English-language learners in bilingual and mainstream classrooms", Reading Research Quarterly, Volume 39, No.2 on November 15, 2006

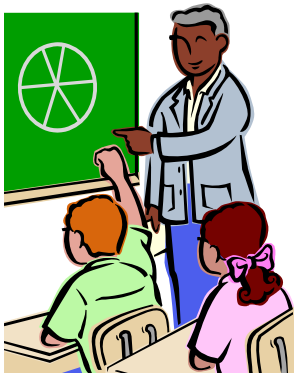
Evidence of Success

Objective: Seventy-five percent (75%) of LEP students will make gains in math achievement annually as measured on district Math Criterion Referenced Tests	Actual Performance Data for Lovejoy Elementary School			
	2003-04	2004-05	2005-06	2006-07
Kindergarten	95%	100%	100%	100%
First Grade	94%	100%	100%	100%
Second Grade	100%	100%	100%	100%
Third Grade	100%	100%	100%	100%
Fourth Grade	100%	100%	100%	100%
Fifth Grade	100%	100%	100%	100%

Recommendations for LEP Students

- High Expectations
- Language Rich Environment
- Mixed-ability Groups (as often as possible)
- Higher Order Thinking Skills: A Basic Skill for All Students

Two Unknowns…



If new concepts are introduced in unfamiliar language, students must struggle with two unknowns:

the language and the concept

The Language-Concept Connection

Language	Concept	Learning
Unknown	Unknown	Limited learning opportunity; modify instruction
Known	Unknown	Concept Development
Unknown	Known	Language Development
Known	Known	Concept and language mastery; advance to next conceptual or linguistic level

Adapted from L. Garrison, J. Mora, "Adapting Mathematics Instruction for English Language Learners The Language-Concept Connection"

What is the animal that eats shoots and leaves?

What is a face?

face (ā) n. **1**. The front of the head. The eyes, nose, and mouth are parts of the face. **2**. A look or expression countenance: The winners all had happy faces. **3**. A queer or twisted look or expression; grimace: to make faces in the mirror. **4**. Informal. Boldness; impudence: I can't believe you had the face to say that in front of everybody at the party. **5**. Dignity; self-respect: to lose face, to save face. **6**. The front, main, or outward surface of something: the face of a cliff, the face of a clock. **7**. Appearance; look: On its face it was a quiet town. **8**. Geometry. One of the surfaces or slides of a solid: the six faces of a cube. **9**. Printing. **a**. the surface of a piece of type, on which the letter or character to be printed is cut. **b**. the style or design of this surface. --v., **faced**, **fac• ing**. --v.t. **1**. To have or turn the face toward: Please face the camera. The house faces the park. **2**. To cause to turn in a particular direction: Face the plant toward the light. **3**. To meet openly; confront: to face a problem. **4**. To realize and admit; accept: to face the facts. **5**. To cover or line (a surface): to face the collar of a coat with fur, to face the walls of a room with paneling. --v.i. To be turned or placed with the face in a particular direction: The house faced west.

Pablo has 21 socks in his drawer. There are 11 green socks, and the rest are black. How many complete pairs of green socks and black socks does he have?

Building Comprehensibility for LEP Students

- Prior Knowledge
- Vocabulary Development
- Visual Clues
- Concrete Objects
- Cooperative Learning

Krashens' Four Quadrants and Mathematical Questioning

Early Beginning

Point to…
Find the…
Put the___next to the ___.
Give the___to___.
Who has the___?
Do you have a___?
Who wants the___?

Beginning

Yes/No questions (Is Jimmy the tallest?)
Either/Or questions (Is this larger or smaller?)
One word responses to questions
(What is 3 x 2?)
General questions which encourage lists (What are all the shapes you see?)
Two word responses

Intermediate

Why?
How?
Tell me about…Talk about…
What do you think about…?
Describe…
How would you change this part of the answer?
Compare (different/similar)

Early Advanced

What would you recommend/suggest we do next?
How do you think this problem will be solved?
What would happen if…?
Which do you think…?

Comparison Words for Quantitative Relationships

- More
- Less
- Greatest
- Least
- Greater than
- Less than
- Equal
- Not equal
- Larger
- Smaller
- Most
- Fewer
- Half as Much
- Twice as Much
- Highest
- Lowest
- Longer
- Shorter
- Taller
- Heavier
- Lighter
- Younger
- Older
- Farther
- Closer

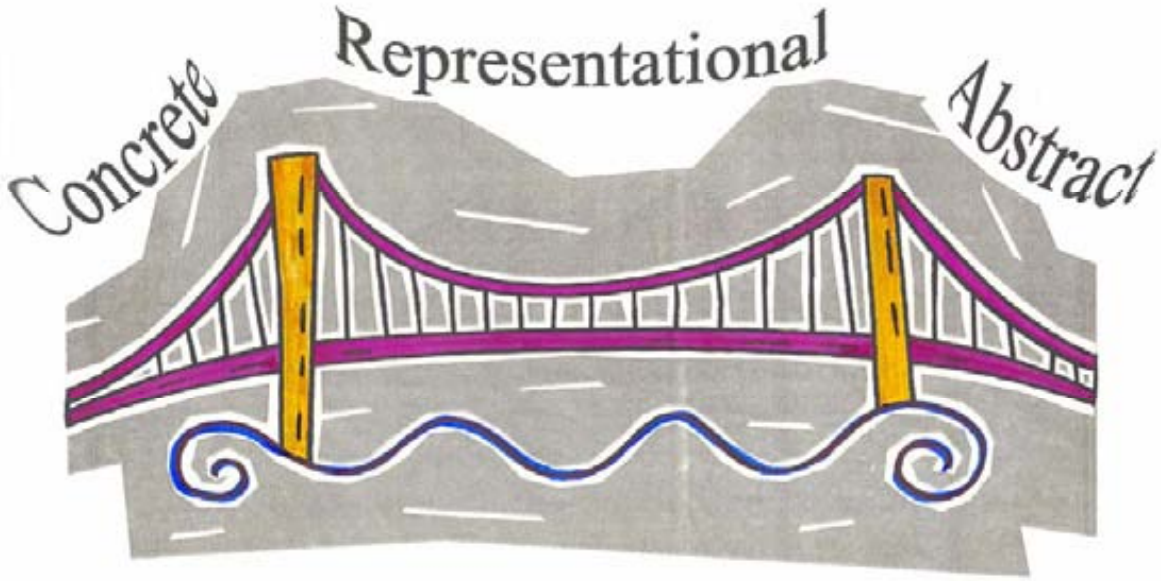
Spatial Relationship Words

- Top
- Bottom
- Next to
- In front of
- Behind
- Between
- Below
- Over
- Under
- Above
- Before
- After
- First
- Last
- Beginning
- End
- Right
- Left
- Around
- On

To develop mathematical understanding:

- Begin each new concept with concrete examples and experiences
- Provide opportunities for students to make connections among:
  - **Concrete experiences**
  - **Representational depictions**
  - **Abstract symbolic representations**
  - **Verbal language**
  - **Written expression**

The Bridge to Understanding



Geometry Journal

Create geometry journal to bridge the understanding from concrete to abstract.

GEOMETRY

Name_____

Geometry Exploration of Shapes

Gumdrops and Toothpicks (to create 2 dimensional and 3 dimensional shapes)

Geometry Exploration of Lines

Creating model for point, line, ray, line segment, parallel lines, intersecting lines, perpendicular lines.

Geometry Exploration of Angles

Create angle maker to model right angle, acute angle, obtuse angle and straight angle.

Puzzling Perimeters Investigation

Use color tiles to investigate the relationship between area and perimeter

Implementation Plan

- Consider your students' needs and success in understanding mathematics
- Determine the strategies discussed today that would benefit your students
- Create a plan for instruction that would give your students additional support and opportunities for increasing their achievement in mathematics

Geometry Literature to Support Instruction

The Fly on the Ceiling	Dr. Julie Glass
What's your Angle	Julie Ellis
Let's Fly a Kite	Stuart J. Murphy
Racing Around	Stuart J. Murphy
Sir Cumference and the Sword in the Cone	Cindy Neuschwander
Sir Cumference and the Dragon of Pi	Cindy Neuschwander
Sir Cumference and the First Round Table	Cindy Neuschwander
Twizzlers	Jerry Pallotta
Grandfather Tang's Story	Ann Tompert
Greedy Triangle	Marilyn Burns

Contacts

- Judy Kinley
  Lovejoy Elementary School
  801 SE Kenyon Avenue
  Des Moines, Iowa 50315
  515-242-8419

  judy.kinley@dmps.k12.ia.us