

# Deepening Our Understanding of the LANGUAGE OF MATH

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"Paul receives his seventh-grade math instruction from his general education teacher, Ms. Suarez, and his special education teacher, Ms. Berry. Ms. Suarez teaches the class about transformations, using the terms reflections, rotations, and translations. Later in the class period, Ms. Berry works with Paul in a small group to support Ms. Suarez's teaching. Ms. Berry refers to the same transformations as flips, slides, and turns. Confused, Paul thinks reflections, rotations, and translations are different from the flips, slides, and turns that he works on with Ms. Berry. In reality, however, the math concepts are exactly the same, but the language used to describe the transformations is different"

(Powell, Stevens & Hughes, 2018, p. 287).

## What is the Language of Math?

- "The [formal] vocabulary that teachers should teach to help students develop mathematical concepts" (Monroe & Panchyshyn, 1995, p. 80)

## Words that are Exclusive to Mathematics

- New, not used in everyday language
- Context-cues do not apply
- Words either "name a new concept" (e.g. algebra), "refine a familiar concept" (e.g. parallelogram), or "rename an already-known concept" (e.g. rhombus) (Benjamin, 2011, p. 8)

## Words with Multiple Meanings

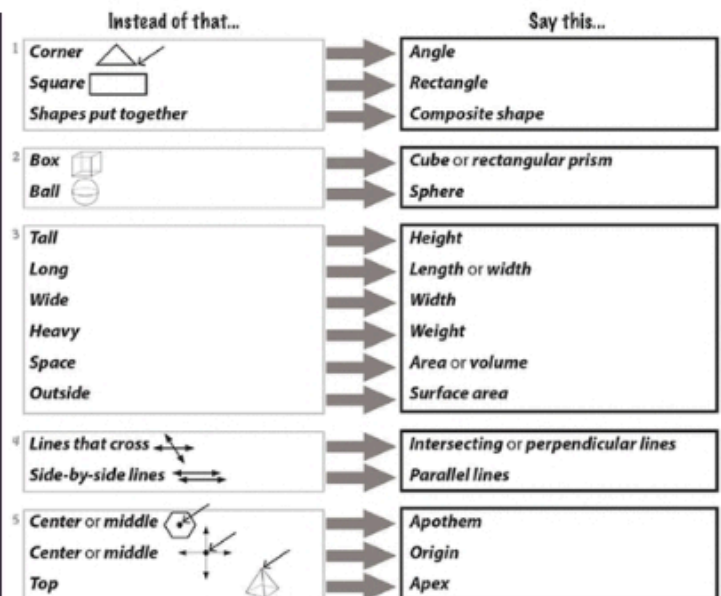
- Not new, used in everyday language
- Require instruction of mathematical meaning, while acknowledging connections to previous knowledge
- E.g. area, factor, product, volume (Benjamin, 2011)

## Phrases of Mathematics

- Words processed as a unit, not as two individual words
- Learned as sight words
- E.g. square root, supplementary angles, whole numbers, parallel lines, obtuse angle, prime numbers, proper fraction, congruent angles (Benjamin, 2011)

## Why focus on the Language of Math?

- Improves conceptual and procedural understanding
- Helps students navigate instructions and story problems (Bruun, Diaz & Dykes, 2015)
- Develops shared meanings, between teachers and students, that are essential for the construction of knowledge (Anghileri, 1995)
- "Differentiates the expert teacher in a subject area from the subject expert" (Nel, 2012, p. 18) by providing the teacher with useful instructional strategies



(Powell et al., 2018)

# Instructional Strategies

Explicit and implicit instruction both play an important role in the development of the language of math (Benjamin, 2011).

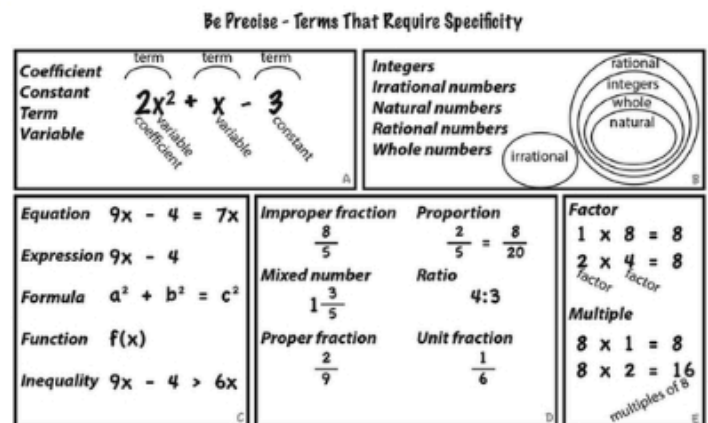
## Implicit Teaching

- "Learning words through natural exposure and opportunities for use over time" (p. 15)
- Provision of "repeated, meaningful, context-rich exposure" (p.20) to academic words to compensate for the vocabulary knowledge gap
- Examples from the Academic Word List (AWL) include: analyze, category, demonstrate, sum, substitute, explicit, insert, chart, sphere, adjacent

## Explicit Teaching

- Direct instruction of mathematical terminology, including references to etymology (e.g. triangle: *tri-* for three; *angulus-* for corner, angle)
- Requires precision with specificity (Powell, et al., 2018)
- Students are given opportunities for connecting, organizing, deep processing, and exercising (CODE) (Nel, 2012)

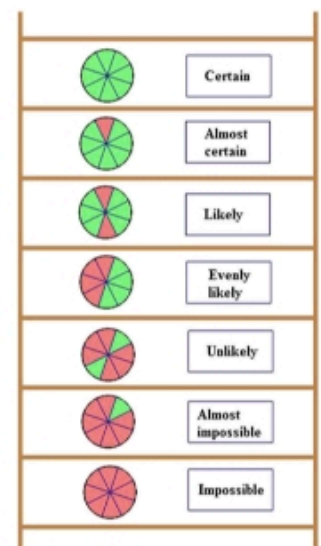
"Students who have opportunities, encouragement, and support for speaking, writing, reading, and listening in math classes benefit because 'they communicate to learn mathematics and they learn to communicate mathematically'" (Bruun, Diaz & Dykes, 2015, p. 531).



(Powell et al., 2018)

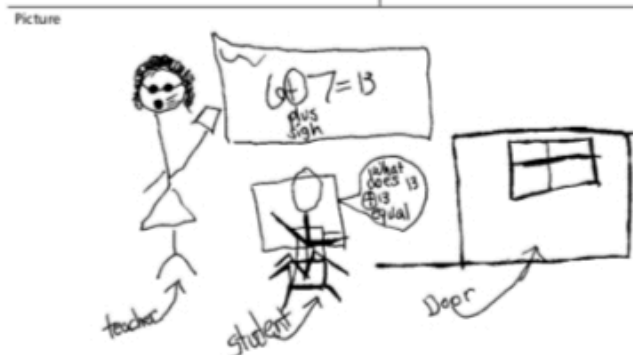
# Toolbox for the Explicit Teaching of Math Terminology

- Graphic Organizers (e.g. **Frayer Model** (Powell et al., 2018) , **Probability Ladder Organizer** (Groth, Butler & Nelson, 2016))
- Flash cards
- Word games (e.g. **sorting buckets**) (Mentoring Minds, 2019)
- K-N-W-S Strategy (Nel, 2012)
- Math journal (Nel, 2012)
- Class Discussions
- Student-created Math Glossaries (Nel, 2012)



Probability Ladder Organizer (Groth et al., 2016)

Word: <u>Addition</u>	
Definition a mathematical operation in which the sum of two numbers or more is calculated usually a plus sign (+)	Example 4+3
	Nonexample 4-3



Frayer Model (Bruun, Diaz & Dykes, 2015)