Equitable Mathematics:

Integrating Language and Mathematics

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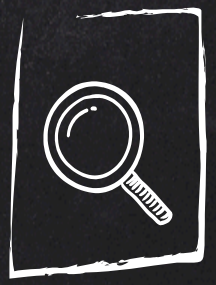
#EaMML or #NTCMAnnual

Professional Learning Goals

- ✗ Understand the role that **language** and **literacy** plays in mathematics learning.
- ✗ Learn to provide the space, time and scaffolds for **deep** mathematics learning.

Why a dual focus on mathematics and language?



Who is an Academic English Learner?

Source: 2015/16 ODE State Report Card	English Learners	Economically Disadvantaged Students	Students with Disabilities
Elementary Schools	41%	81%	12%
Middle Schools	46%	80%	13%
High Schools	47%	72%	12%

ELLs, Economically Disadvantaged, and Students with Disabilities are all **ACADEMIC ENGLISH LEARNERS** who deserve sheltered instructional strategies in math.

“Language is not merely a tool for describing what one already knows. It is a pervasive process through which we learn about our world and develop our creative and problem solving skills.” (Smith, 2001).

“Human intelligence is primarily developed through speaking and listening. The quality of our lives depends on the quality of our thinking and on our ability to communicate and discuss what we think with others. Talk is intrinsic to literacy and to our ability to form relationships with others. It is the foundation of both verbal and emotional intelligence” (Fisher, 2007).

A/B Partner - Sentence Frames to Share

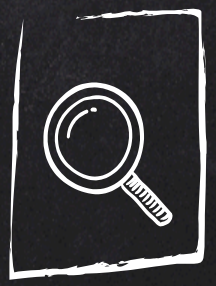
- ✘ Find a partner. Decide who is A and who is B.
- ✘ Together, summarize what you just heard about our student demographics.
- ✘ **What argument was made?**

What argument was just made?

Use these sentence frames:

A: The presenter just proposed _____.

B: _____ support(s) this position because _____.



What makes for good Mathematics instruction?

"And we'd replace those memories with intentional instruction, punctuated with collaborative learning opportunities, rich discussions about mathematical concepts, excitement over persisting through complex problem solving, and the application of ideas to situations and problems that matter."

Hattie, J., Fisher, D., & Frey, N. (2017). *Visible learning for mathematics, grades K-12: what works best to optimize student learning*. Thousand Oaks, CA: Corwin Mathematics, p. 14-15.

Direct Instruction

0.59

Dialogic Instruction

0.82

So, what makes for good instruction?

PRECISION TEACHING

Knowing *what* strategies to implement *when* for maximum impact.

THE BALANCE OF LEARNING

Give One - Get One

- ✘ Write up to 3 important ideas you have learned about language and mathematics.
- ✘ Stand up, find a partner.
- ✘ Each person will give one idea to their partner, and get one idea from their partner.
- ✘ When done, repeat with one more partner.
- ✘ Return to your seat.

What Strategies can we use to Increase Student Discourse?

The Power of Practicing Out Loud

"Without a solid grounding in oral language development, English learners will be greatly disadvantaged in their quest for full language proficiency. Students who have extended opportunities to develop oral language skills are positioned to achieve academic success."

Williams, C., Stathis, R, & Gotsch, P. (2009)

The Peer to Peer Student Talk Conundrum

"In linguistically diverse classrooms, unstructured small-group and partnering activities continually fail to produce substantive oral language growth. Merely increasing student interaction without **explicit, coached language instruction and accountability for application** leads to discussions with minimal cognitive or linguistic challenge and negligible academic content."

Gertsen & Baker, 2001
Saunders & Goldenberg, 2010

Student Discourse Needs

Language Learning

- ✘ General Academic Vocabulary
- ✘ Domain-specific Vocabulary
- ✘ Cognitive Tasks/ Language Functions

Social Learning

- ✘ Skills that foster effective collaboration
- ✘ Skills that foster effective communication
- ✘ Skills for intentional listening
- ✘ Norms for doing mathematics

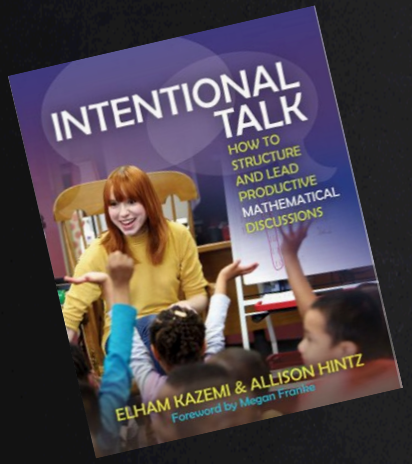
Vocabulary Analogy - Bricks & Mortar

Bricks:
Content specific vocabulary & concepts

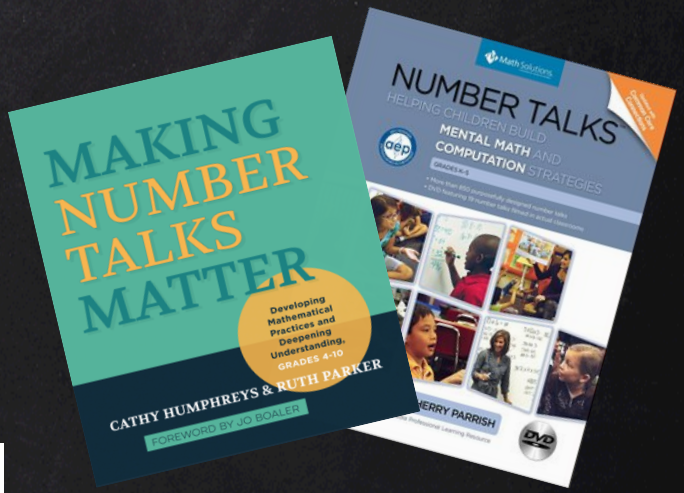
Mortar:
Functional academic language

Bricks & Mortar:
Expression of complete, coherent thought and understanding

Planning Tools and Resources for Student Talk



- ✘ Open Strategy Share
- ✘ Compare and Connect
- ✘ Why? Let's Justify



- ✘ Number Talk Routines
- ✘ Teacher Talk Moves

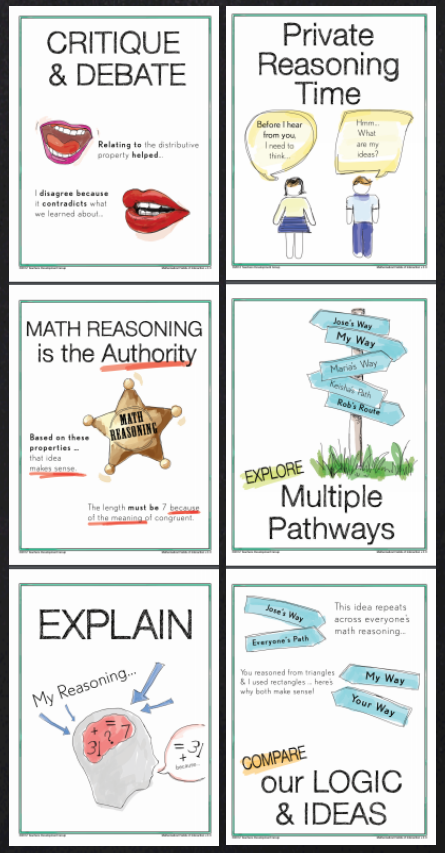
- ✘ Cognitive Functions
- ✘ Structured Student Talk Routines

Student Scaffolds for Math Talk

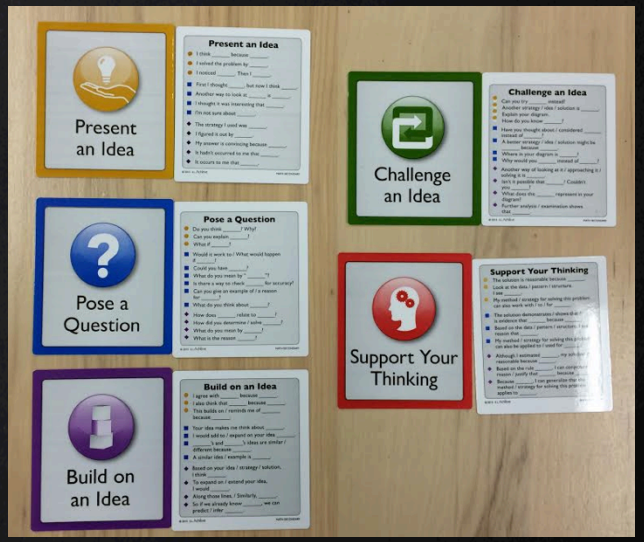
Talk Moves

Math TALK	
Clarify	✪ What ___ stated is ___, is that accurate? ✪ In other words, you think ___. ✪ If I understand you correctly, your suggestion is ___. ✪ So that means ___.
Share	✪ My method for solving ___ is accurate because ___. ✪ Since I know ___, I chose to ___, as a result ___. ✪ Based on ___, I can infer that ___, so ___.
Discuss	✪ I came to the same conclusion as ___ by ___. ✪ I tried ___ and found ___ instead. ✪ Based on ___'s response, ___.
Extend	✪ To expand that idea, I think ___. ✪ Since we know ___, we can also ___. ✪ Based on ___, we can also apply this strategy to ___.
Revise Your Thinking	✪ My first reaction was to ___, but ___. Then I ___. ✪ At first I considered ___ and found that ___, so ___. ✪ After realizing ___, I decided to ___ instead and ___.
Think Time	✪ One moment please, I'd like to consider ___. ✪ I understand ___, but I'd like to ponder on ___.

Habits of Mind & Interaction



Constructing Meaning Discussion Cards



Think-Write-Pair-Share

What are ways you plan for student discourse in the mathematics classroom?

- ✘ Silent think time to jot your response.
- ✘ At the signal, find an eyeball partner and discuss your response.

How do we Support Teachers with the Implementation of new Strategies?

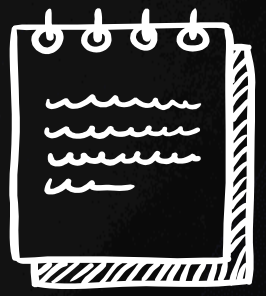
Math Language Support Days

Professional Learning Goals

- ✘ What: We are learning to create time and space in our mathematics classroom for student discourse.
- ✘ How: Through a Mathematically Speaking Activity
- ✘ Why: To move students from surface learning to deep learning.

Solve the following problems.
Draw a **model** to support your solution.
Be ready to explain your solution pathway.

4 x 6 = _____ x 3	12 x 5 = 4 x _____



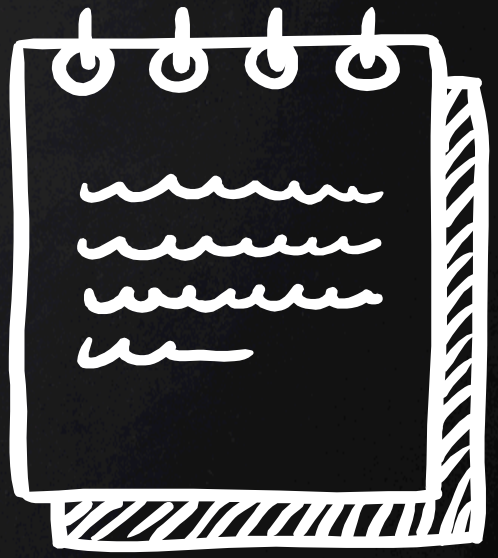
Task Reflection

- What strategies did you use to solve the problems?
- What do you notice about your models?
- What do you notice about the relationships between the numbers in the problems?
- What do you notice about the solutions?
- Will this always be true?

Video of Mathematically Speaking in Action

Watch/Listen For and Report On:

- **Mathematics Strategies: How are students solving the problems?**
- **Mathematical Language**:
  - content specific vocabulary
  - general academic language
- **Structured Student Talk**:
  - whole class talk
  - peer to peer talk
- **MP #3:** Construct viable arguments and critique the reasoning of others.



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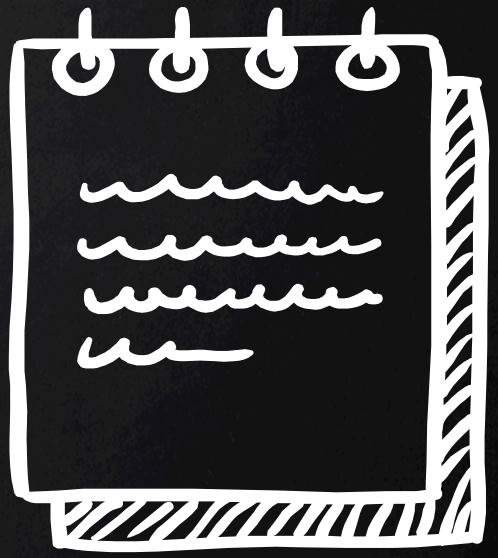


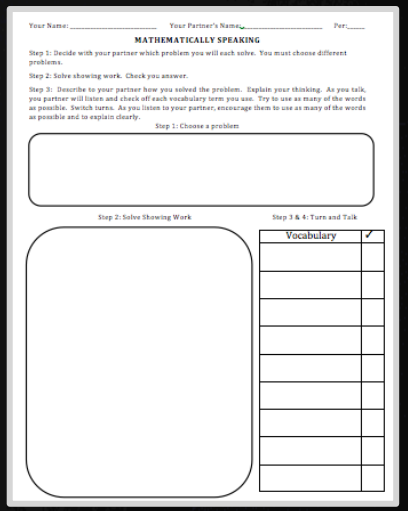
Mathematically Speaking

Prepared Template: 1 or 2 problems and a vocabulary list

Work Time: Students complete their problem

Talk & Track Time: 1 student explains the problem solving process to a peer while the peers keeps track of which vocabulary is used. Partners switch roles.

Optional Cold Call Fishbowl


Your Name: _____ Your Partner's Name: _____ Per: ____

MATHEMATICALLY SPEAKING

Step 1: Decide with your partner which problem you will each solve. You must choose different problems.

Step 2: Solve showing work. Check you answer.

Step 3: Describe to your partner how you solved the problem. Explain your thinking. As you talk, you partner will listen and check off each vocabulary term you use. Try to use as many of the words as possible. Switch turns. As you listen to your partner, encourage them to use as many of the words as possible and to explain clearly.

Step 1: Choose a problem

Step 2: Solve Showing Work

Step 3 & 4: Turn and Talk

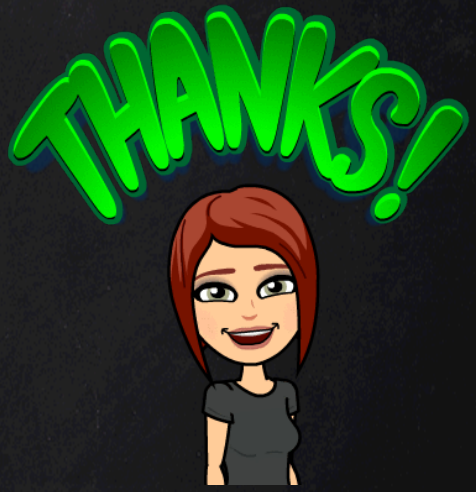
Vocabulary	✓

Mathematically Speaking Reflection

Discuss:

- ✘ What variation and modifications could make this routine better fit your classroom?
- ✘ How could you see using a routine like this?
- ✘ Which content would align with this routine?

Questions?



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Credits

Special thanks to all the people who made and released these awesome resources for free:

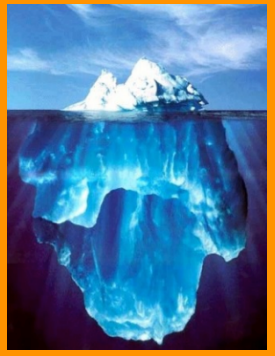
- ✘ Presentation template by SlidesCarnival

Surface Learning

1. Initial learning of concepts and skills.
2. Time and space to consolidate new learning.

"Through developing surface learning, students can take action to develop initial conceptual understanding, build mathematical habits of mind, hone their strategic thinking, and begin to develop fluency in skills." (p. 29)


More on top,
No need to stop.
More on the floor,
Go next door and get 10 more.
Numbers the same,
Zero's the game!



Deep Learning

Accomplished when students:

1. Work collaboratively with their peers
2. Use academic language
3. Interact in richer ways with ideas and information.

"Provides students with opportunities to consolidate their understanding of mathematical concepts and procedures and make deeper connections among ideas." (p. 30)