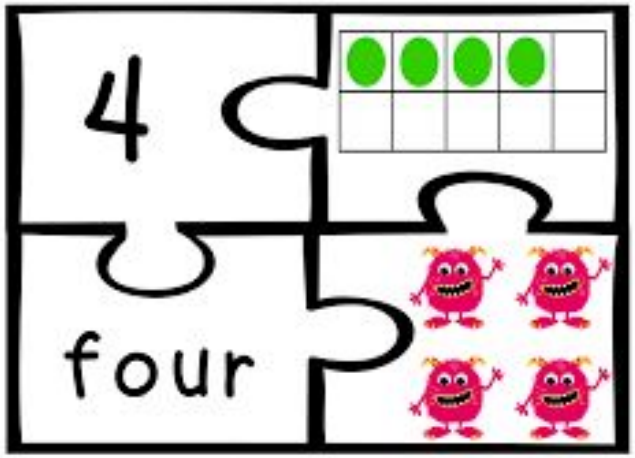
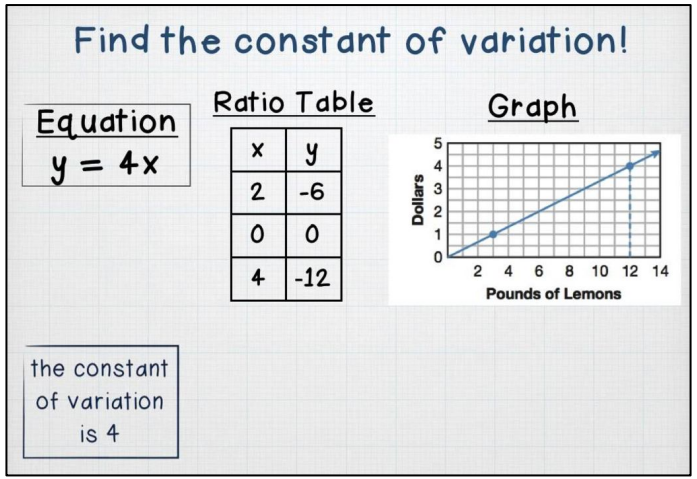
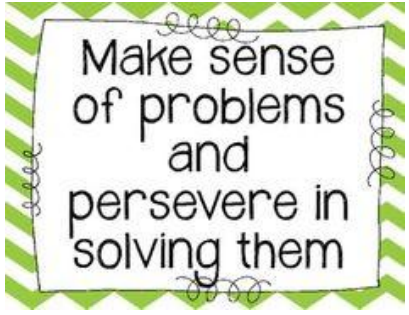
Math Strategies to Support Language Learners



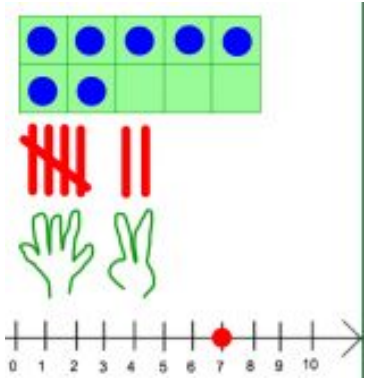


Jane Osborne
K-12 Math Coach
Hood River County School District

Today's Agenda...

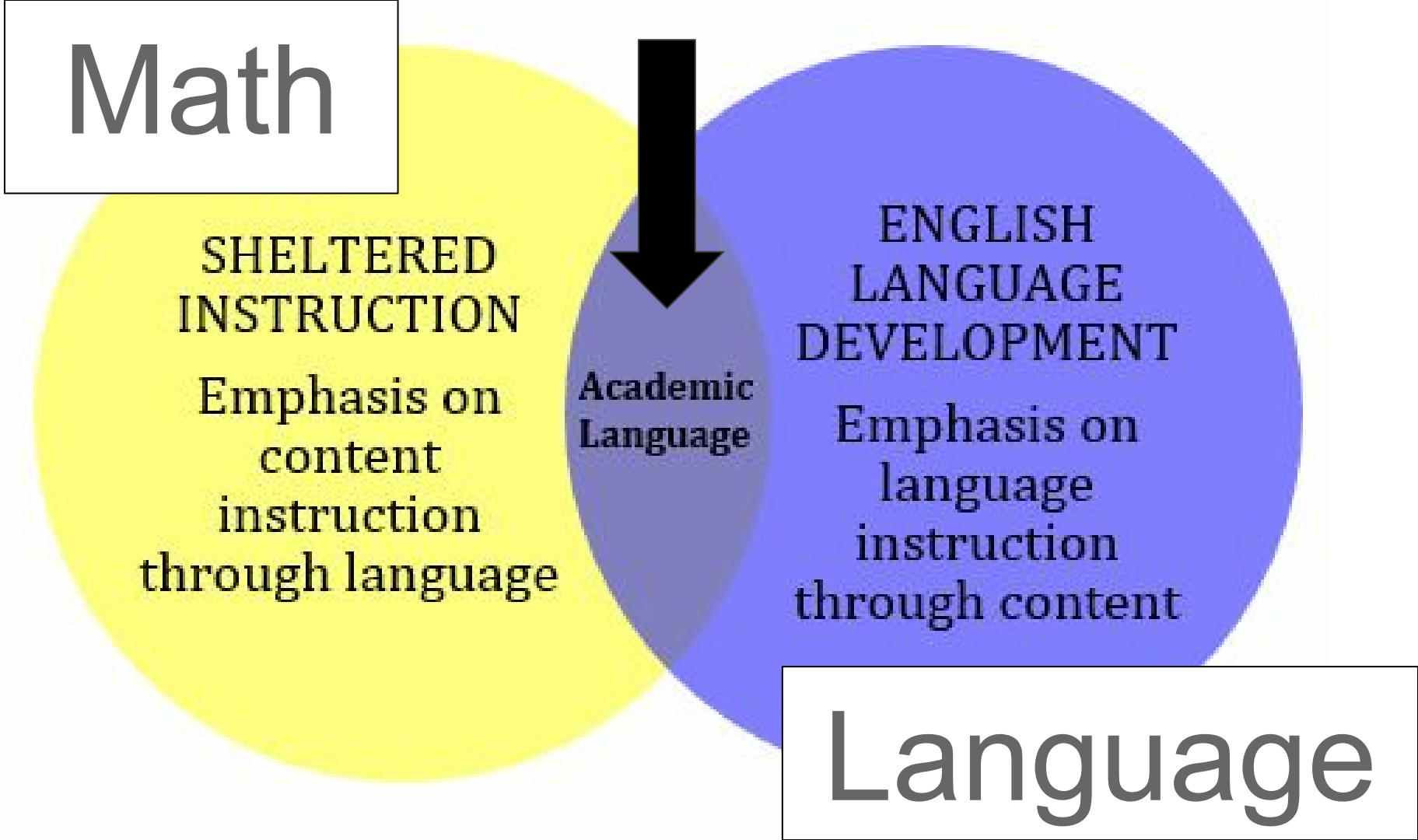


- Understanding Language Learners' Needs
- Strategies for Math Talk
- Videos and resources



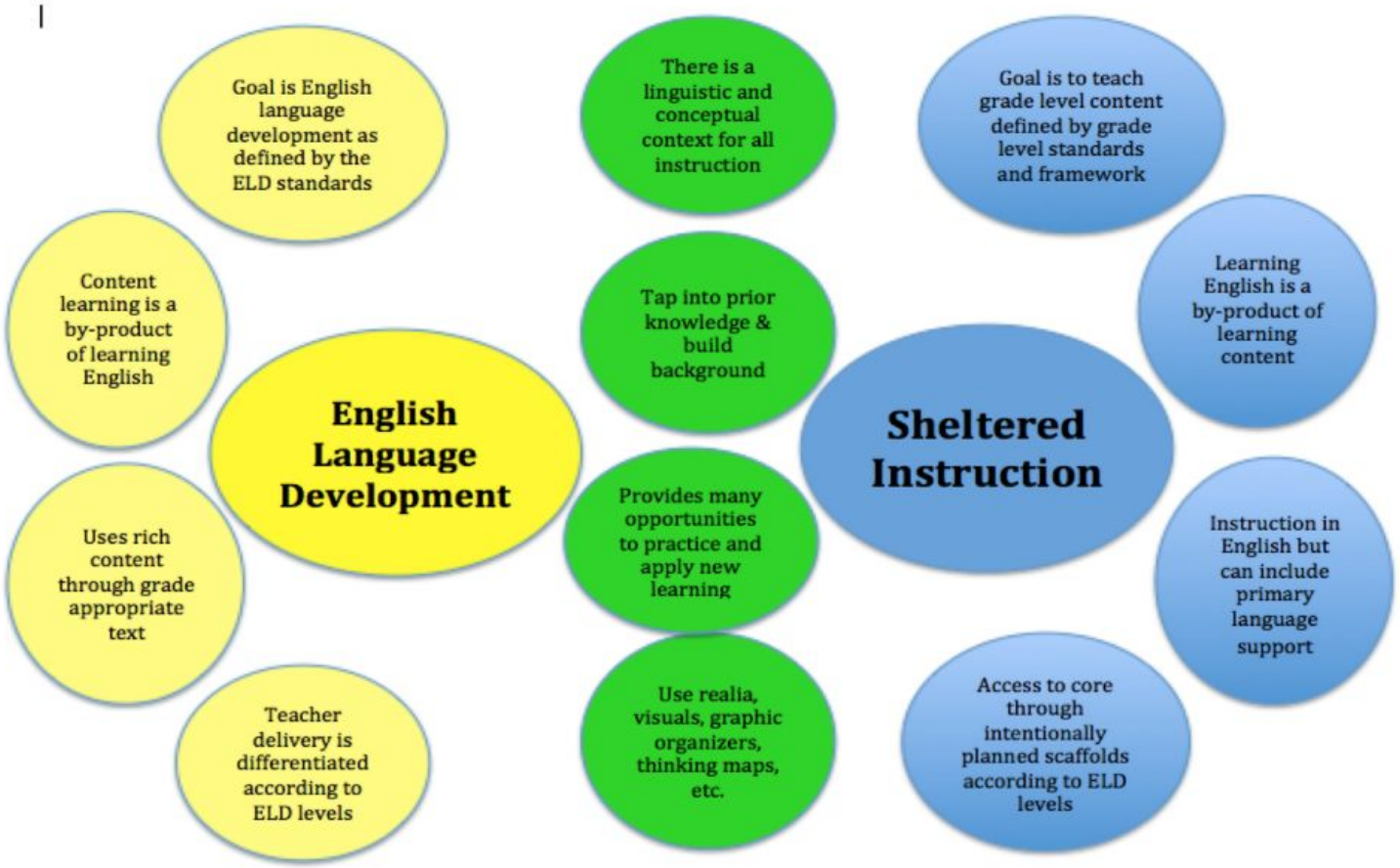
Why think about language?

[Moises' Experience]


Math
SHELTERED INSTRUCTION
Emphasis on content instruction through language
Academic Language
ENGLISH LANGUAGE DEVELOPMENT
Emphasis on language instruction through content
Language

ELD vs Sheltered Instruction

D. Beltram & G. O'Brien



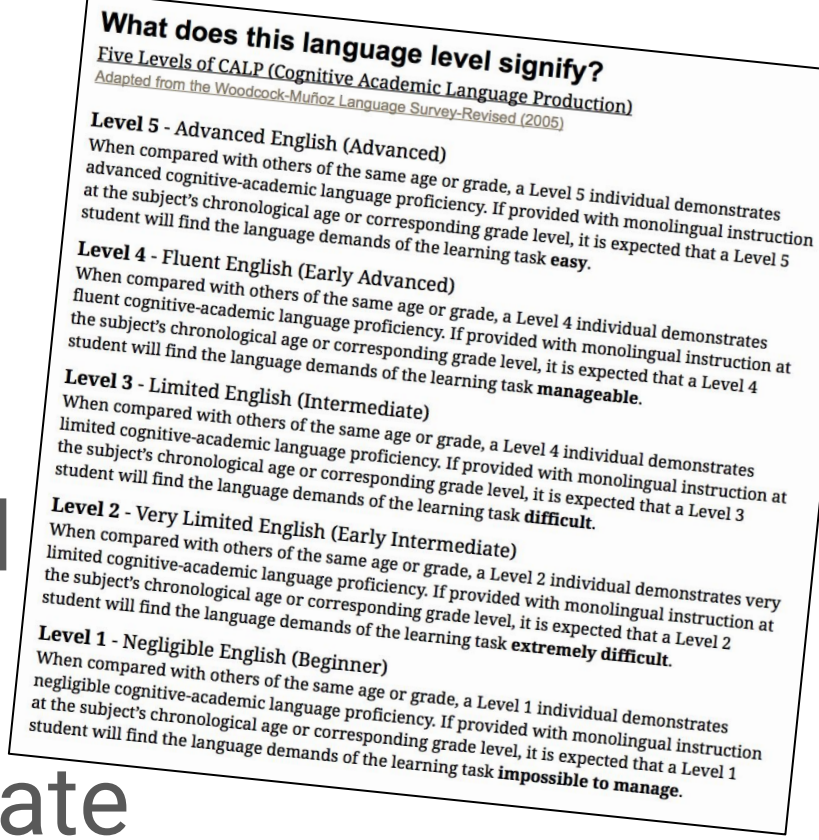
Sheltered Instruction: 8 Main Components

Table 1. SIOP Components (Echevarria et al., 2008)

Lesson Preparation	Examines the lesson planning process, including the language and content objectives, the use of supplementary materials, and the meaningfulness of the activities.
Building Background	Focuses on making connections with students' background experiences and prior learning and developing their academic vocabulary.
Comprehensible Input	Considers adjusting teacher speech, modeling academic tasks, and using multimodal techniques to enhance comprehension.
Strategies	Emphasizes teaching learning strategies to students, scaffolding instruction, and promoting higher-order thinking skills.
Interaction	Reminds teachers to encourage elaborated speech and to group students appropriately for language and content development.
Practice/Application	Provides activities to practice and extend language and content learning.
Lesson Delivery	Ensures that teachers present a lesson that meets the planned objectives, promotes students' engagement and paces the lesson appropriately.
Review and Assessment	Considers whether the teacher reviewed the key language and content concepts, assessed student learning, and provided feedback to students on their output.

Language Levels

- Level 5 Advanced
- Level 4 Early Advanced
- Level 3 Intermediate
- Level 2 Early Intermediate
- Level 1 Beginner



What does this language level signify?

Five Levels of CALP (Cognitive Academic Language Production)

Adapted from the Woodcock-Muñoz Language Survey-Revised (2005)

Level 5 - Advanced English (Advanced)
When compared with others of the same age or grade, a Level 5 individual demonstrates advanced cognitive-academic language proficiency. If provided with monolingual instruction at the subject's chronological age or corresponding grade level, it is expected that a Level 5 student will find the language demands of the learning task **easy**.

Level 4 - Fluent English (Early Advanced)
When compared with others of the same age or grade, a Level 4 individual demonstrates fluent cognitive-academic language proficiency. If provided with monolingual instruction at the subject's chronological age or corresponding grade level, it is expected that a Level 4 student will find the language demands of the learning task **manageable**.

Level 3 - Limited English (Intermediate)
When compared with others of the same age or grade, a Level 4 individual demonstrates limited cognitive-academic language proficiency. If provided with monolingual instruction at the subject's chronological age or corresponding grade level, it is expected that a Level 3 student will find the language demands of the learning task **difficult**.

Level 2 - Very Limited English (Early Intermediate)
When compared with others of the same age or grade, a Level 2 individual demonstrates very limited cognitive-academic language proficiency. If provided with monolingual instruction at the subject's chronological age or corresponding grade level, it is expected that a Level 2 student will find the language demands of the learning task **extremely difficult**.

Level 1 - Negligible English (Beginner)
When compared with others of the same age or grade, a Level 1 individual demonstrates negligible cognitive-academic language proficiency. If provided with monolingual instruction at the subject's chronological age or corresponding grade level, it is expected that a Level 1 student will find the language demands of the learning task **impossible to manage**.

What does this language level signify?

Five Levels of CALP (Cognitive Academic Language Production)

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The GO TO Strategies Matrix: Scaffolding Across Language Proficiency Levels

Listening

Level 1 **Teacher Talk** is accompanied by hand and body gestures. Talk is clearly enunciated, directions are modeled, speech is slower, and idioms are avoided.

Level 2 **Patterned Oral Language** uses a similar sentence structure and vocabulary within the context of a familiar classroom activity to help learners comprehend classroom routines.

Level 3 **Wait Time** of three to eight seconds provides the time needed for ELLs to comprehend the teacher's question.

Level 4 **Paraphrase Passport** encourages learners to listen to their peers' responses.

Level 5 **Video Observ**
students' prior knowledg
after viewing.

Choose a strategy to match the language level and need

Speaking

Level 1 **Choral Readi**

Level 2 **Think-Pair-Share Squared** encourages students to speak with other students.

Level 3 **Collaborative Dialogues** between the teacher and student promote academic language through strategies such as repeat, recast, reformulate, and prompt.

Level 4 Students can begin to give oral reports at this level, if their reports are scaffolded with note cards and opportunities to practice the presentation.

Level 5 Academic debates on various viewpoints can be scaffolded with **Graphic Organizers** or **Outlines.**

ELD and Sheltered Instruction Resources

Language Levels Descriptions

Sheltered Instruction vs. Language

Components of Sheltered Instruction

English Language Proficiency Standards

Go To Strategies Matrix and Descriptions

Go To Strategies (explains strategies)

Lesson Plan Checklist for SIOP

Resource Page

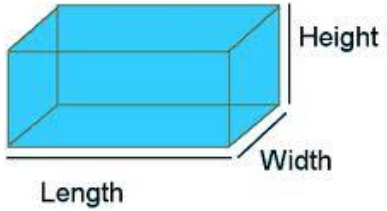
(all in one link)

What does this mean for you?

★ What’s a positive or successful strategy you want to continue?

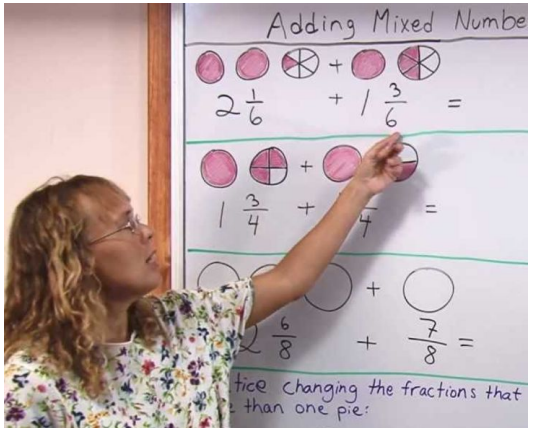
★ What’s one thing you want to implement?

Comprehensible Input



Rectangular prism

- Use pictures and concrete objects to connect to words and concepts
- Visual clues with gestures
- Clear, concise teacher talk
- Modeling tasks or expectations



Strategies for Math Talk

- Sentence Frames
- Precision Partnering
- Elicit Math Talk
- Vocabulary Development
- Multiple Representations
- Number Talks

I noticed _____.

Sentence Frames

I noticed _____

I think _____

Focus the language you want them to use

First I ___. Then I ____.

I agree because _____.

“Language Supports ”

(3:00)

https://www.teachingchannel.org/videos/sentence-frames-ousd

Strategies to Elicit Math Talk

- Precision Partnering

4 Ls of Productive Partnering

1.L = Look at your partner's eyes.

2.L = Lean toward your partner.

3.L = Lower your voice.

4.L = Listen attentively.

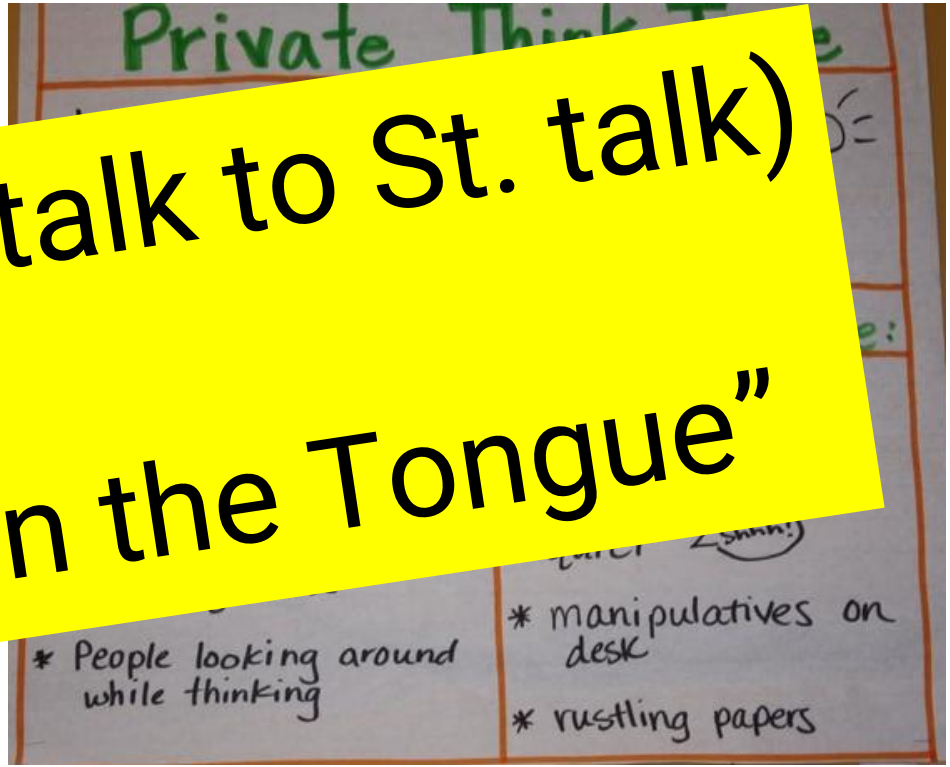
https://www.teachingchannel.org/videos/third-grade-mental-math 1:58-2:50

Strategies to Elicit Math Talk

- Think, pair, share

"10-2" (T. talk to St. talk)

"Miles on the Tongue"



https://goo.gl/mEZuJF

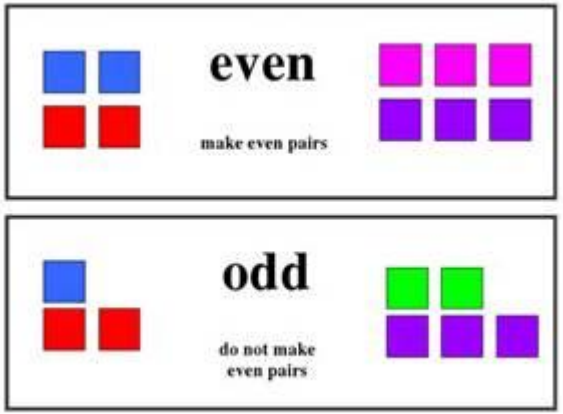
Strategies to Elicit Math Talk

- Explicit Vocabulary development

Building Academic Vocabulary

Steps to Build Initial Understanding

1. Describe – The teacher provides a description, explanation or example of the new term.
2. Restate – Students write and restate in their own words the description, explanation, or example given in class.
3. Draw – Students create a picture, symbol, or graphic representing the term.

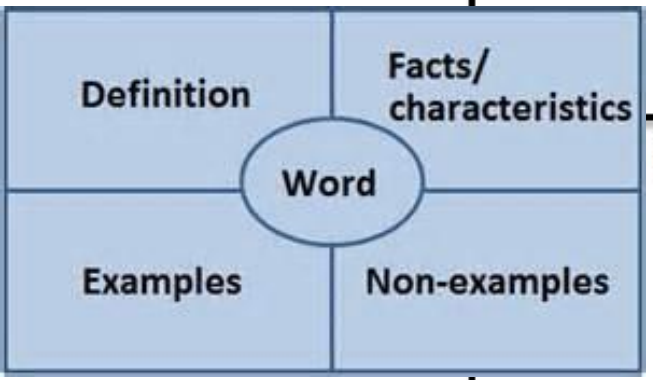


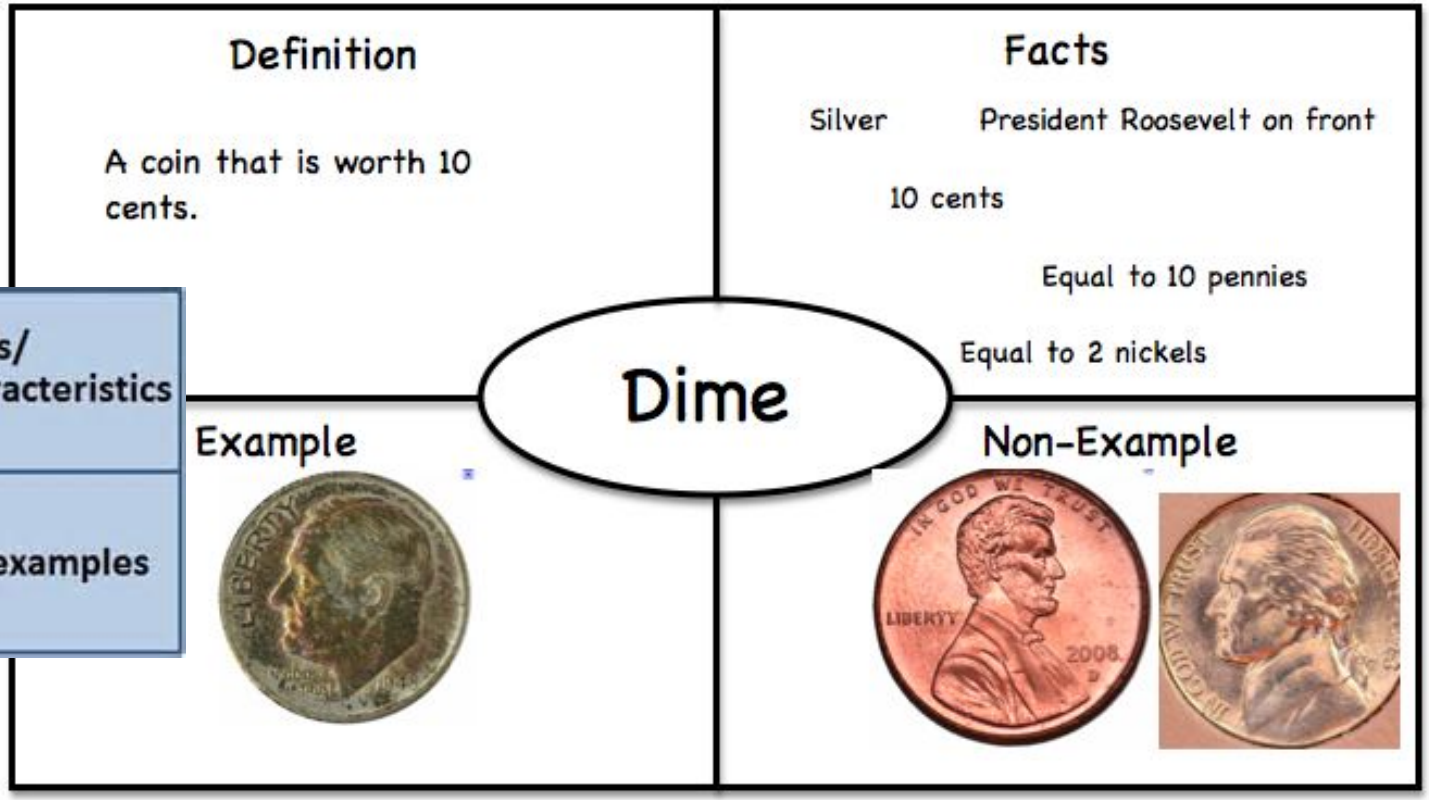
Steps to Create Multiple Exposures

4. Activities - Students work on activities that help them add to their knowledge of the terms.
5. Discuss - Students discuss the terms with one another and share what they are thinking about the term and what it means to them.
6. Games - Students play games that allow them to use the vocabulary terms.

Strategies to Elicit Math Talk

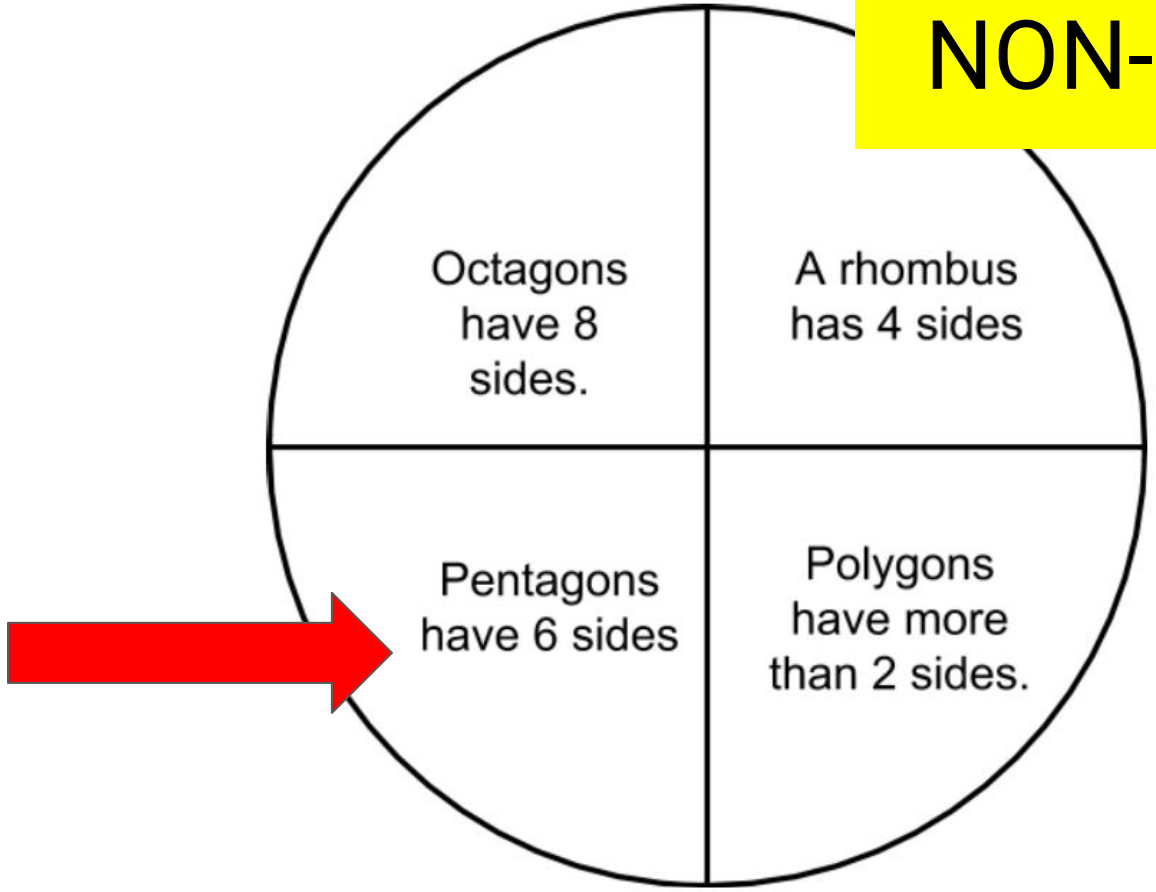
- Explicit Vocabulary development





“Three Facts and a Fib”

Use NON-EXAMPLES



Think, Pair, Share

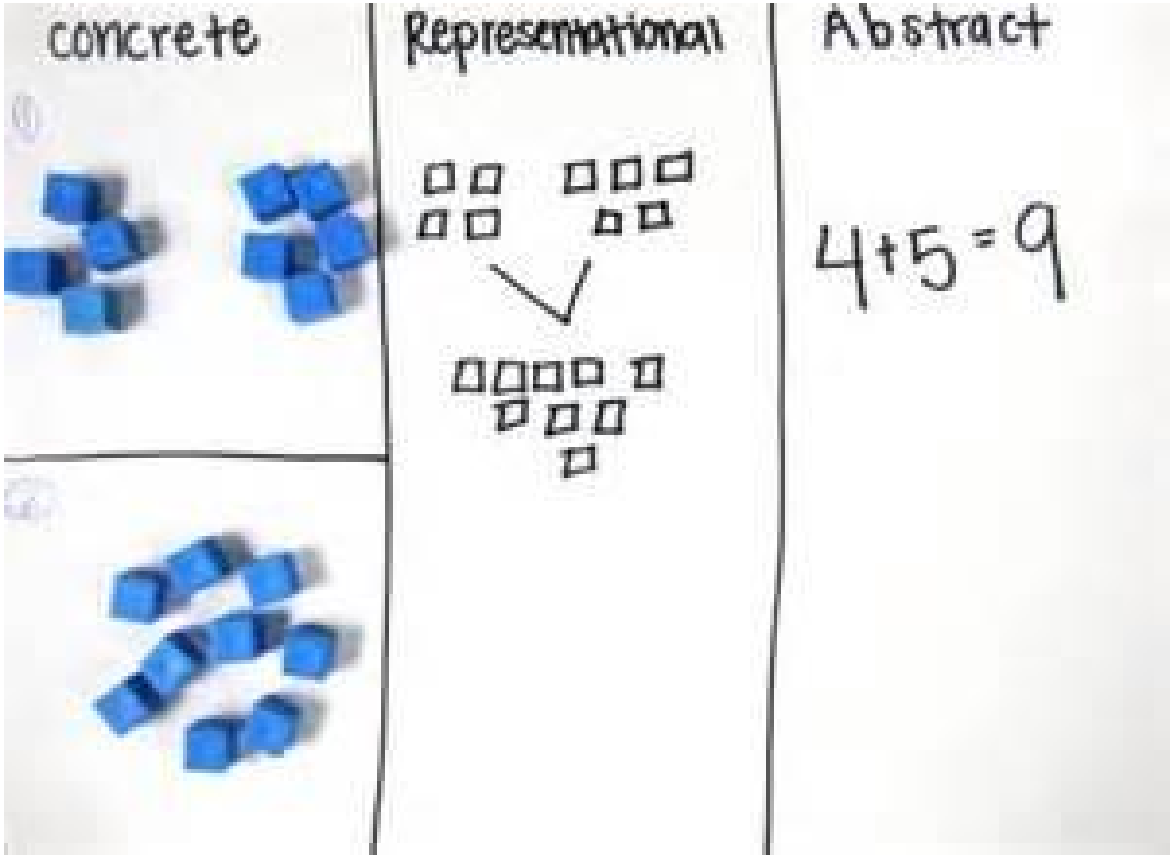
Privately...Think about:

- ❏ One or two things you've learned to elicit math talk
- ❏ A concern, barrier or need you have

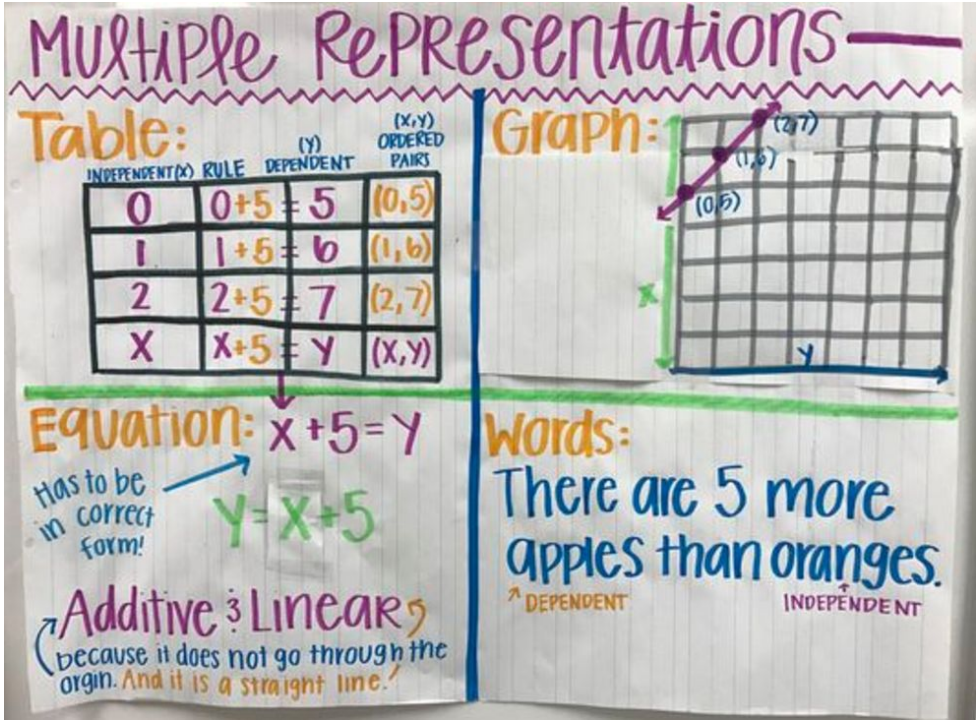
With an elbow partner….share and discuss your concern

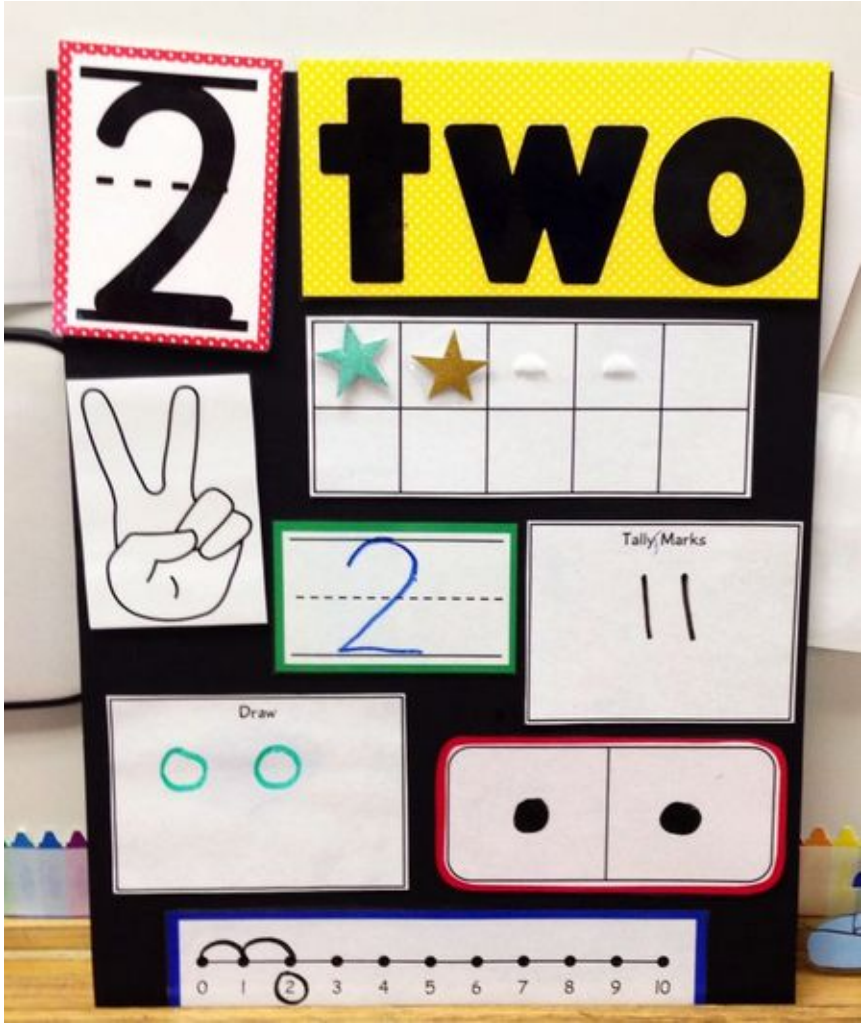
Share out with whole group

Multiple Representations to Build Understanding

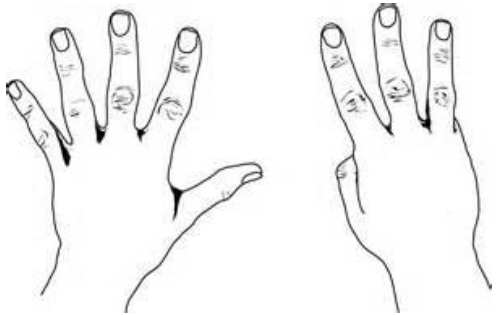


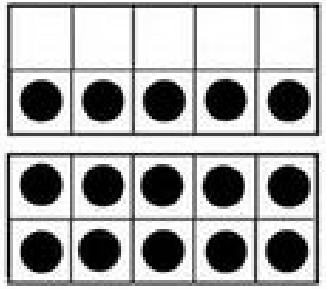
Multiple Representations

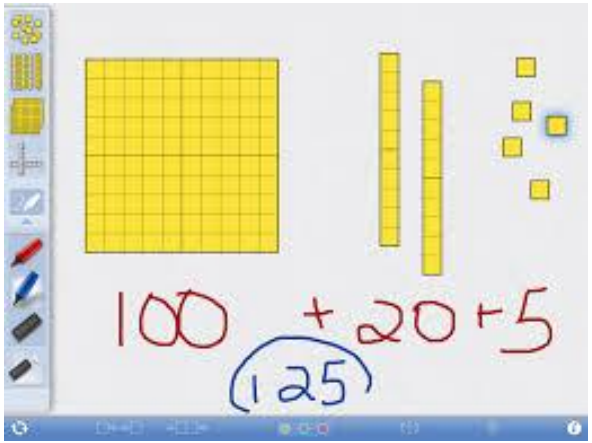


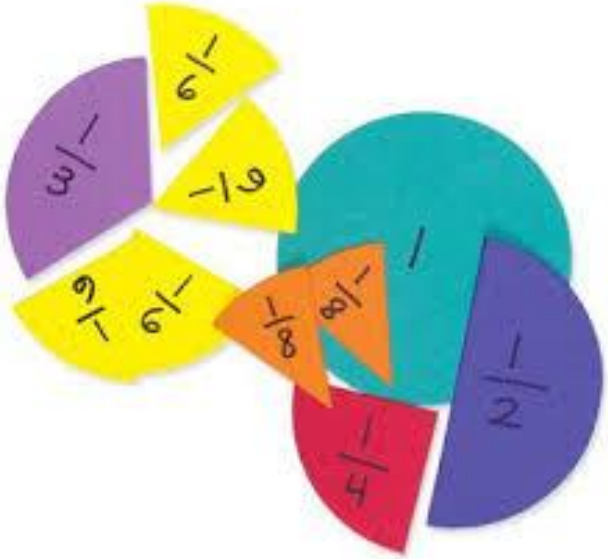


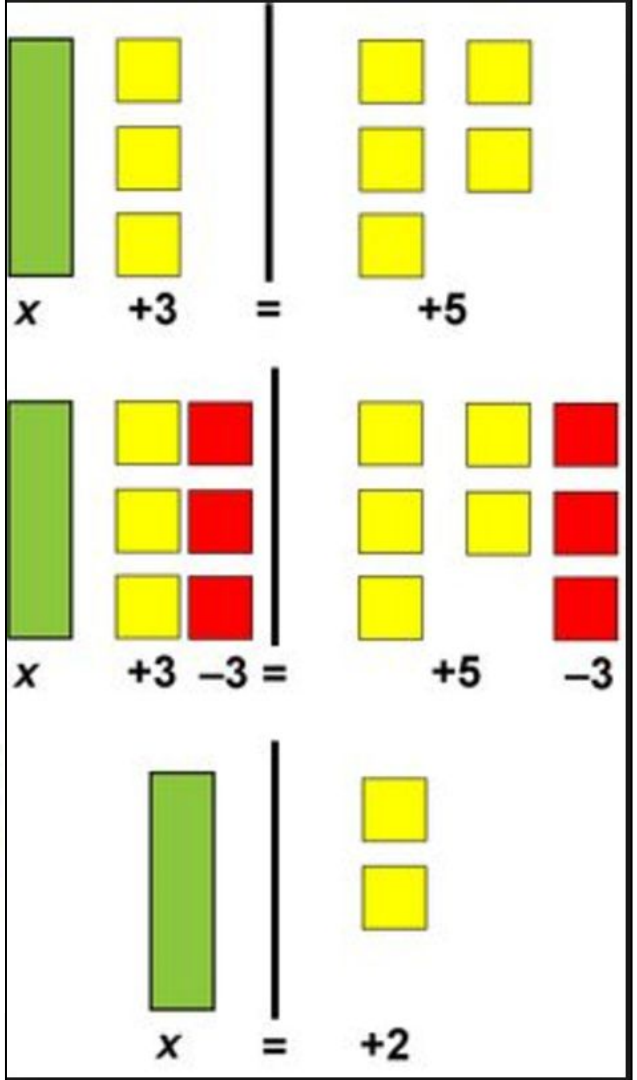
Models





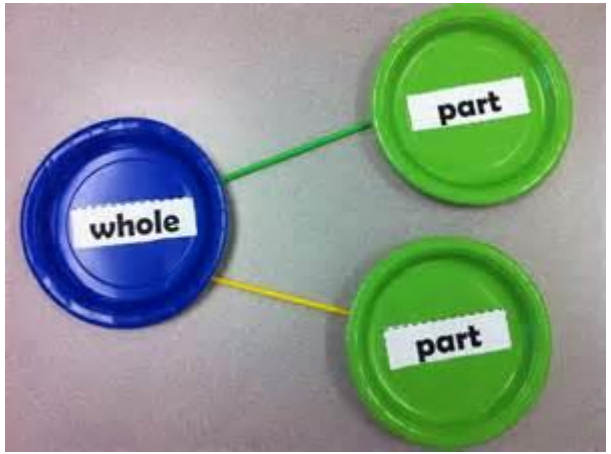


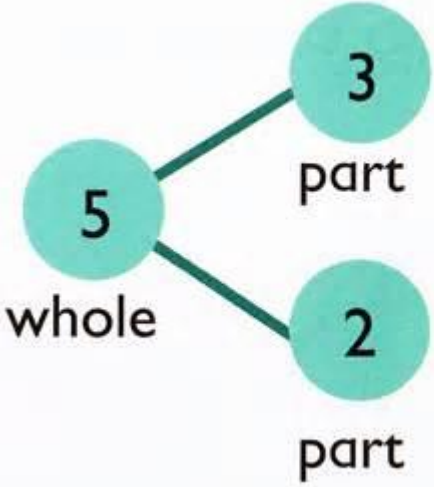


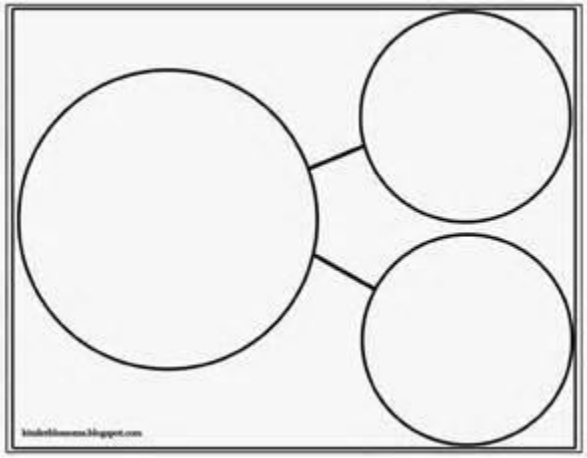


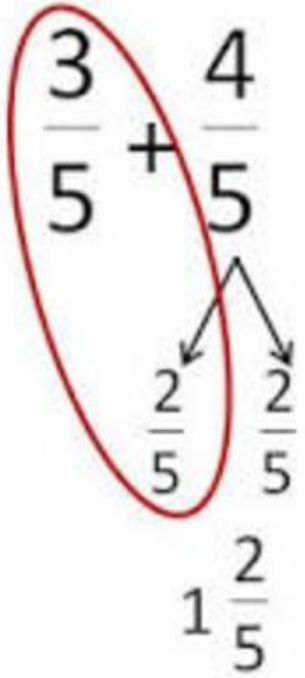
Models

- Number bonds

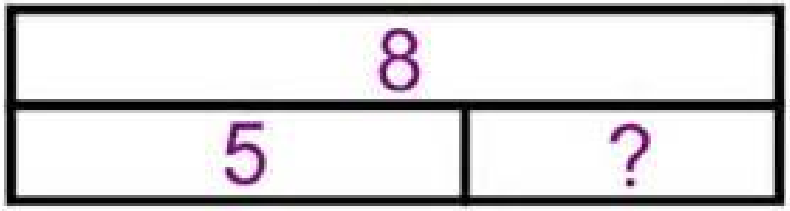


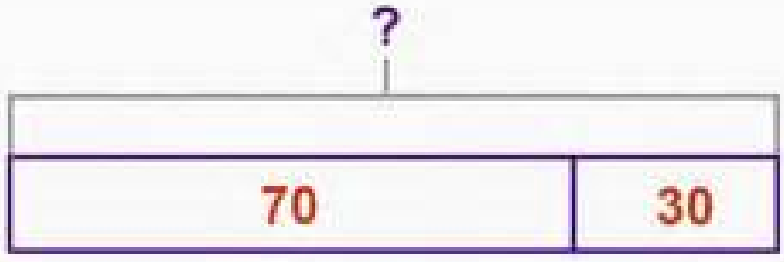


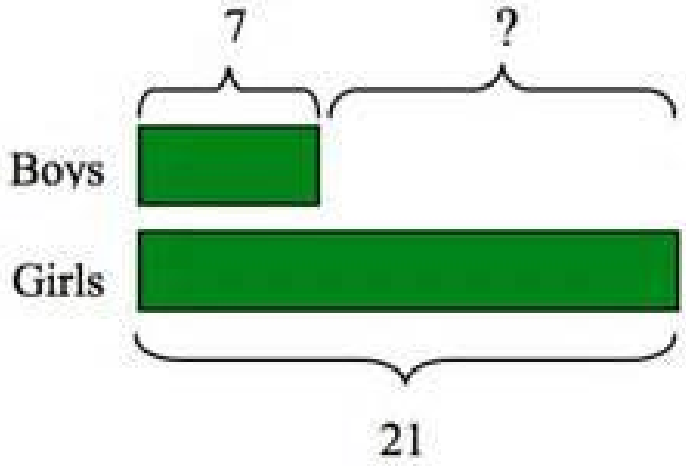


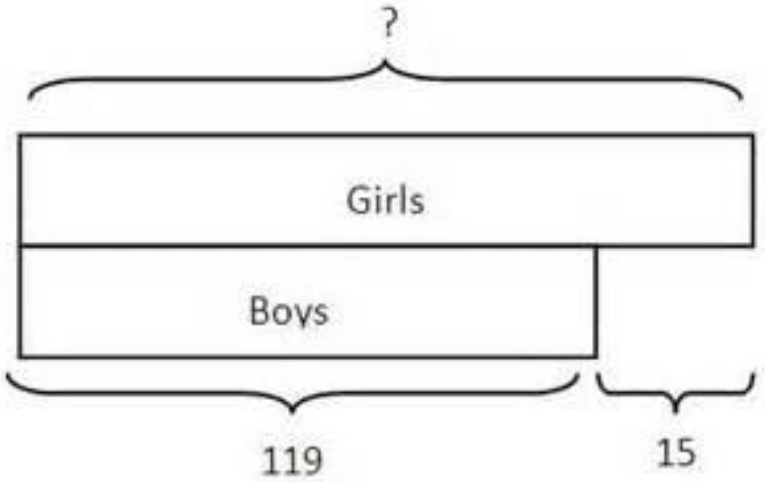


Bar Model or Tape Diagram









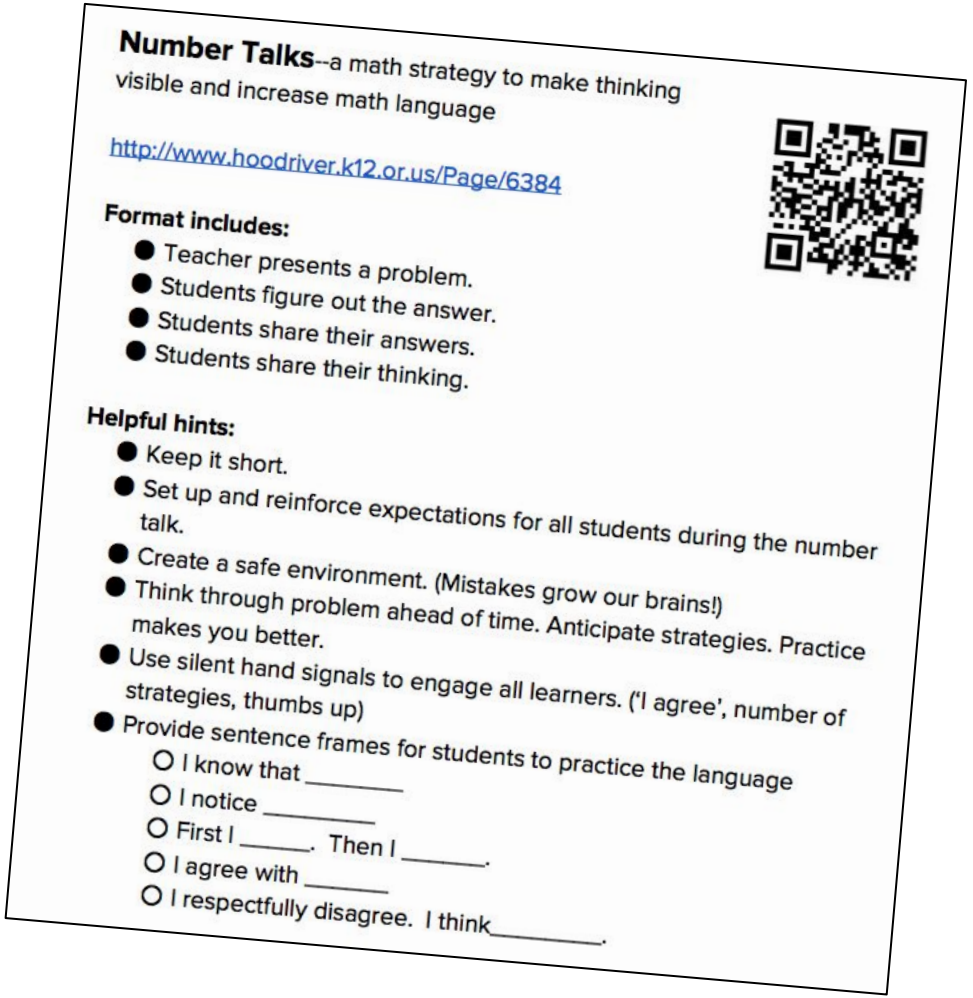
Number Talks

What are they?

- Strategy to make thinking visible
- Strategy to increase math language

[Jo Boaler: What is a Number Talk](www.hoodriver.k12.or.us/Page/6384)

www.hoodriver.k12.or.us/Page/6384



Number Talks--a math strategy to make thinking visible and increase math language

http://www.hoodriver.k12.or.us/Page/6384

Format includes:

- Teacher presents a problem.
- Students figure out the answer.
- Students share their answers.
- Students share their thinking.

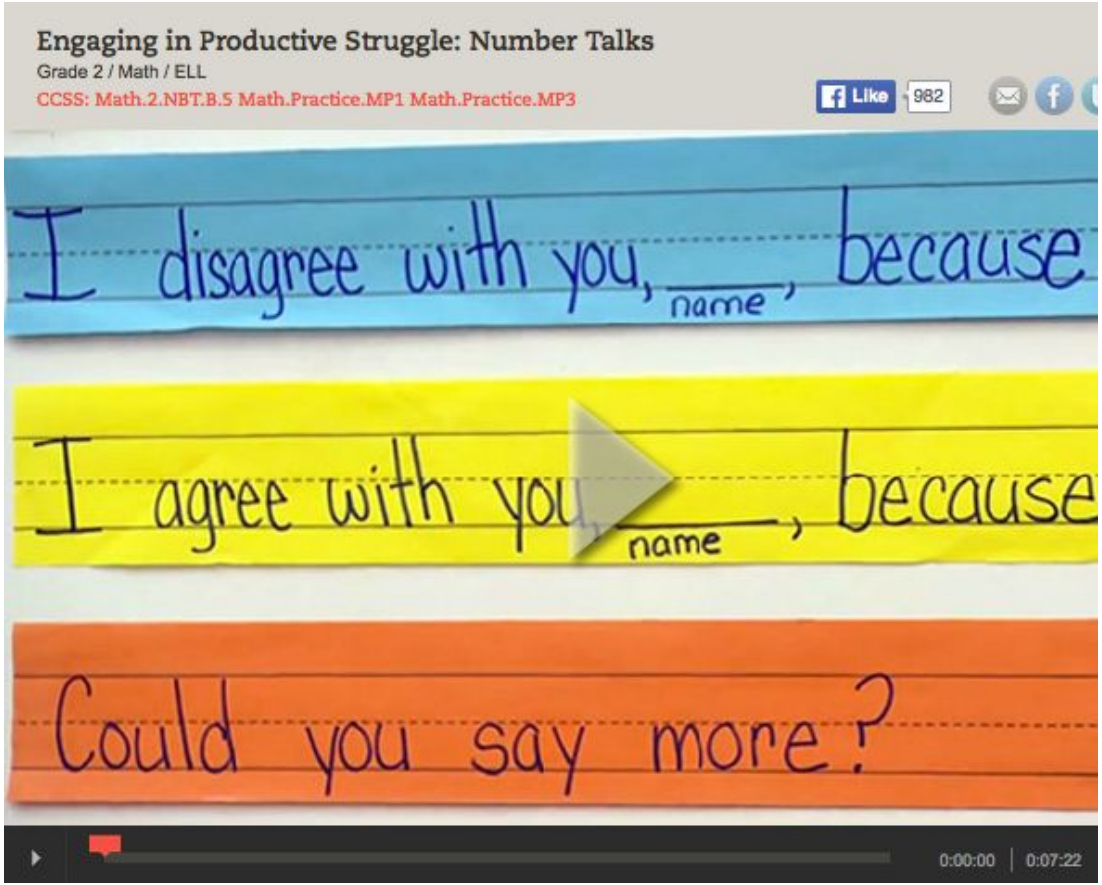
Helpful hints:

- Keep it short.
- Set up and reinforce expectations for all students during the number talk.
- Create a safe environment. (Mistakes grow our brains!)
- Think through problem ahead of time. Anticipate strategies. Practice makes you better.
- Use silent hand signals to engage all learners. ('I agree', number of strategies, thumbs up)
- Provide sentence frames for students to practice the language
  - I know that _____
  - I notice _____
  - First I _____. Then I _____.
  - I agree with _____
  - I respectfully disagree. I think_____.

Number Talks

“Engaging in Productive Struggle”

(Grade 2)
(7:22)



https://www.teachingchannel.org/videos/subtraction-math-lesson-ousd

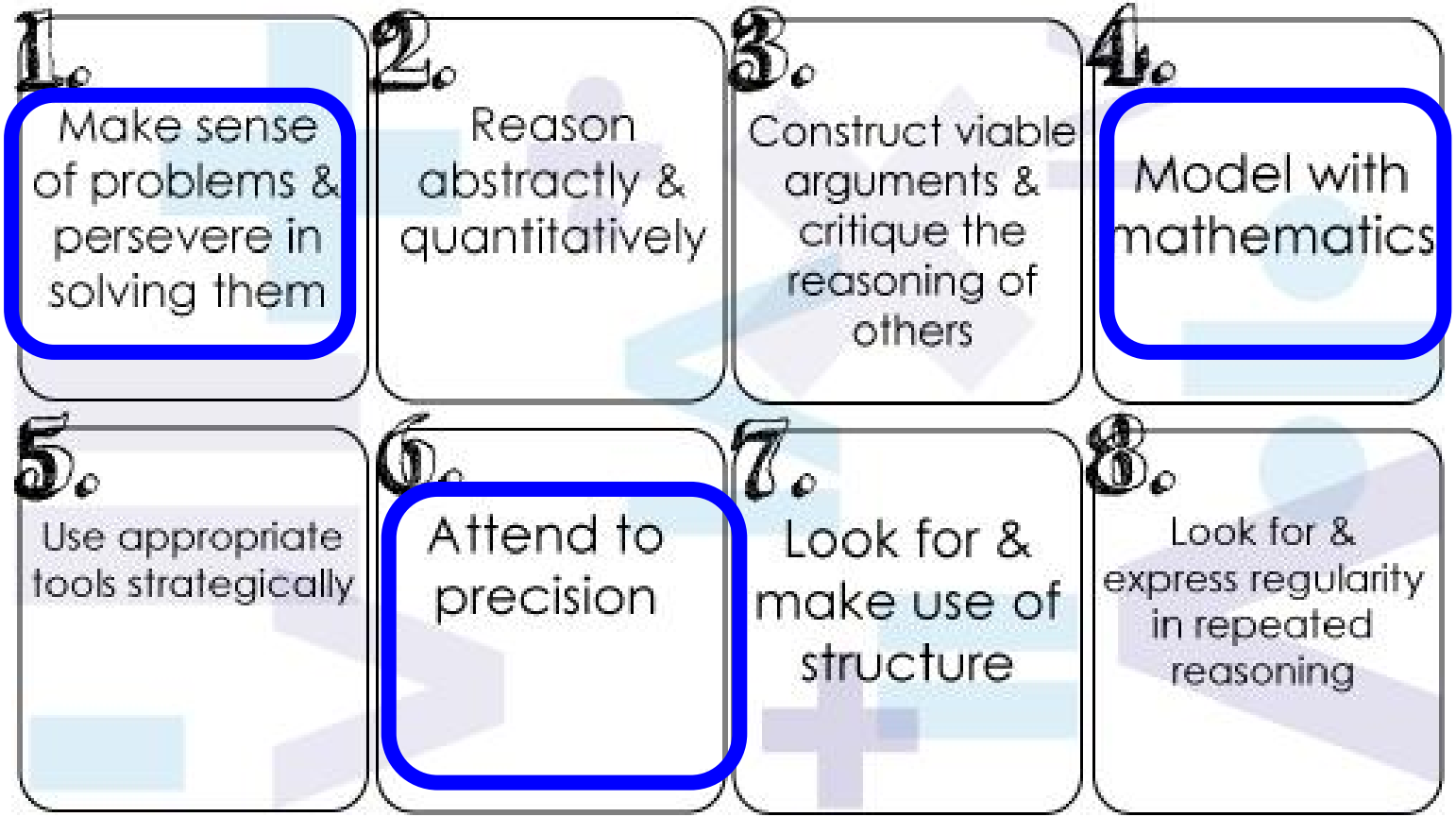
What did you notice?

- ★ What’s the teacher doing?
- ★ What are the students doing?

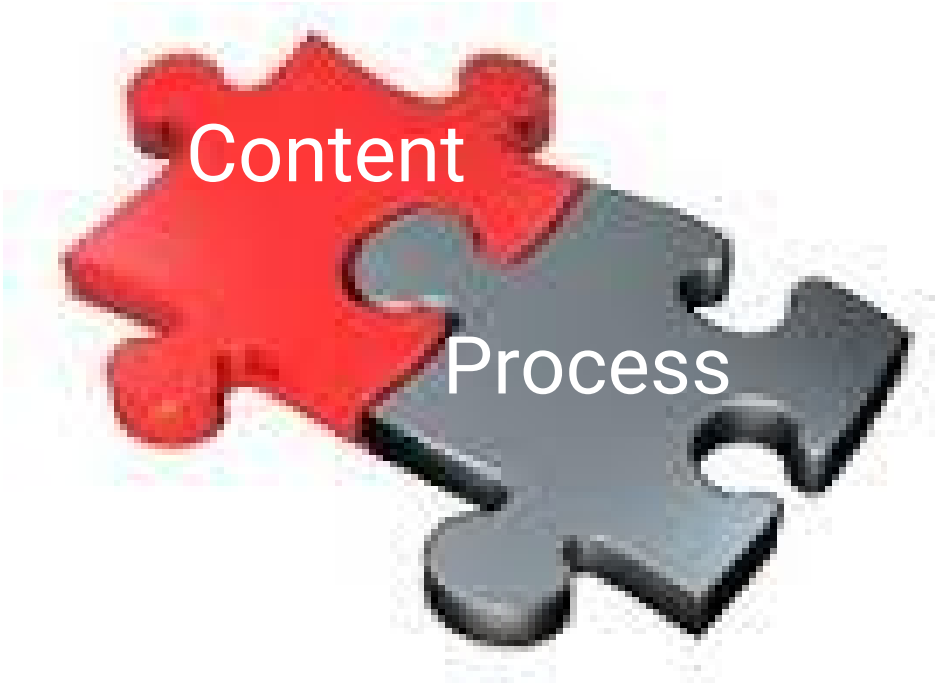
Math Practices

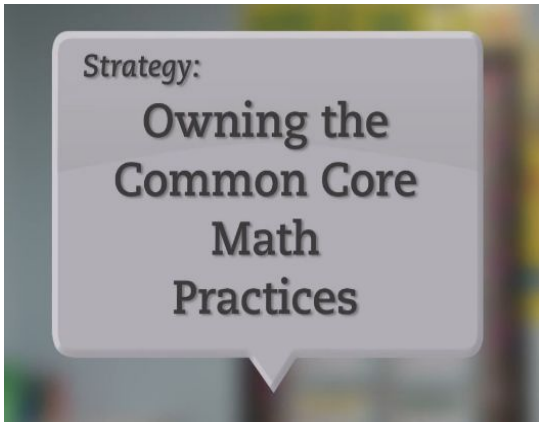
Rate yourself: Fist---1---2---3---4---5

(First time learning about them) (I could teach others)



Math Practices





[“Owning the Math Practices”]

The *what* and the *how*...

Math Practices

http://www.hoodriver.k12.or.us/Page/7459

COMMON CORE STATE STANDARDS OREGON

Standards for Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

1 Make sense of problems and persevere in solving them.

- Mathematically proficient students start by explaining to themselves the meaning of
- looking for entry points to its solution.
- They analyze givens, constraints, relatio
- They make conjectures about the form a
- rather than simply jumping into a solutio
- They consider analogous problems, and t
- in order to gain insight into its solution.

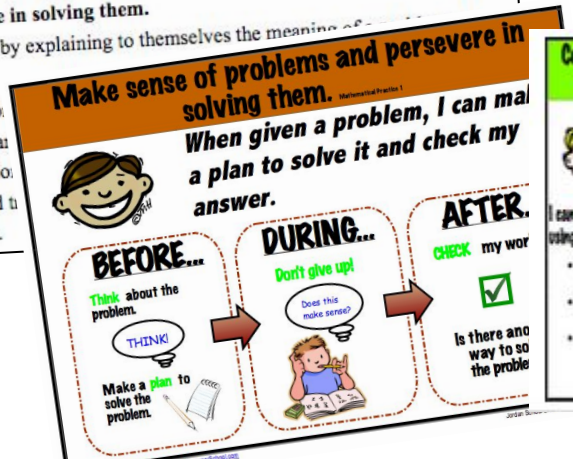
CCSS Standards for Mathematical Practices – "STUDENT Look-fors"

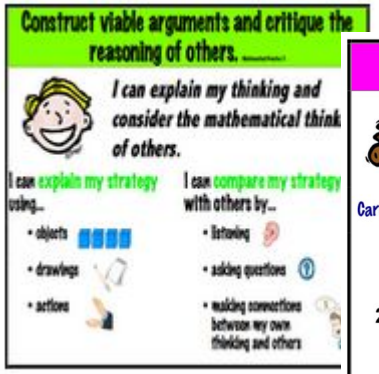
Note: most lessons do not provide opportunities for demonstrating ALL mathematical practices.

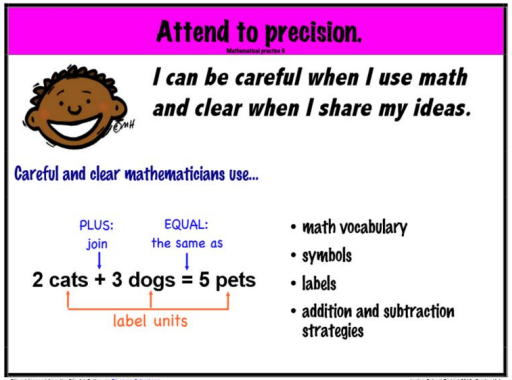
School:	Teacher(s):	Grade:	Start/End Times:	Date:
Mathematical Topic/Learning Target:				

1. Make sense of problems and persevere in solving them	2. Reason abstractly and quantitatively	3. Construct viable arguments and critique the reasoning of others	4. Model with mathematics
☐ Understand meaning of problems ☐ Analyze information (givens, constraints, relationships, goals) ☐ Make conjectures and plan a solution pathway ☐ Monitor and evaluate progress and change course as necessary ☐ Check answers to problems and ask "does this make sense?" Comments:	☐ Make sense of quantities and relationships in problem situations ☐ Represent abstract situations ☐ Understand meaning of quantities ☐ Create a coherent representation (symbolically or visually) of problems ☐ Consider the units involved, when appropriate ☐ Flexibly use properties of operations Comments:	☐ Use definitions and previously established results in constructing arguments ☐ Build a logical progression of statements to explore and support ideas ☐ Communicate and defend mathematical reasoning using objects, drawings, diagrams, actions ☐ Listen to or read the arguments of others ☐ Decide if the arguments of others make sense ☐ Ask probing questions to clarify or improve arguments of others Comments:	☐ Apply prior knowledge to solve real world problems ☐ Identify important quantities and information in a real world context ☐ Make assumptions and approximations to solve a problem ☐ Check to see if an answer makes sense within the context of a situation Comments:

5. Use appropriate tools strategically	6. Attend to precision	7. Look for and make use of structure	8. Look for and express regularity in repeated reasoning
☐ Make sound decisions about the use of tools ☐ Use tools to verify solutions ☐ Identify relevant tools and use them to pose or solve problems ☐ Use technological or concrete tools to explore and deepen understanding of concepts Comments:	☐ Communicate precisely using clear definitions ☐ State the meaning of symbols ☐ Specify units of measure within problems, when appropriate ☐ Provide accurate labels ☐ Calculate accurately and efficiently ☐ Provide carefully formulated explanations Comments:	☐ Look for patterns or structure ☐ Connect concepts and models to patterns or structure ☐ Use patterns or structure to solve related problems ☐ View complicated quantities both as single objects or compositions of several objects ☐ Use operations and properties to make sense of problems Comments:	☐ Notice repeated calculations and look for general methods and shortcuts ☐ Continually evaluate reasonableness of intermediate results while attending to details in multi-step problems ☐ Make generalizations based on repeated reasoning Comments:







Questioning

- Prompts to elicit each Math Practice

Common Core State Standards
Standards for Mathematical Practice
Questions for Teachers to Ask

Make sense of problems and persevere in solving them	Reason abstractly and quantitatively	Construct viable arguments and critique the reasoning of others	Model with mathematics
Teachers ask: • What is this problem asking? • How could you start this problem? • How could you make this problem easier to solve? • How is ___'s way of solving the problem like/different from yours? • Does your plan make sense? Why or why not? • What tools/manipulatives might help you? • What are you having trouble with? • How can you check this?	*Teachers ask:* • What does the number ____ represent in the problem? • How can you represent the problem with symbols and numbers? • Create a representation of the problem.	*Teachers ask:* • How is your answer different than _____'s? • How can you prove that your answer is correct? • What math language will help you prove your answer? • What examples could prove or disprove your argument? • What do you think about _____'s argument • What is wrong with ____'s thinking? • What questions do you have for ____? **it is important that the teacher poses tasks that involve arguments or critiques*	*Teachers ask:* • Write a number sentence to describe this situation • What do you already know about solving this problem? • What connections do you see? • Why do the results make sense? • Is this working or do you need to change your model? **It is important that the teacher poses tasks that involve real world situations*
Use appropriate tools strategically	**Attend to precision**	**Look for and make use of structure**	**Look for and express regularity in repeated reasoning**
Teachers ask: • How could you use manipulatives or a drawing to show your thinking? • Which tool/manipulative would be best for this problem? • What other resources could help you solve this problem?	*Teachers ask:* • What does the word ____ mean? • Explain what you did to solve the problem. • Compare your answer to _____'s answer • What labels could you use? • How do you know your answer is accurate? • Did you use the most efficient way to solve the problem?	*Teachers ask:* • Why does this happen? • How is ____ related to ____? • Why is this important to the problem? • What do you know about ____ that you can apply to this situation? • How can you use what you know to explain why this works? • What patterns do you see? **deductive reasoning (moving from general to specific)*	*Teachers ask:* • What generalizations can you make? • Can you find a shortcut to solve the problem? How would your shortcut make the problem easier? • How could this problem help you solve another problem? **inductive reasoning (moving from specific to general)*

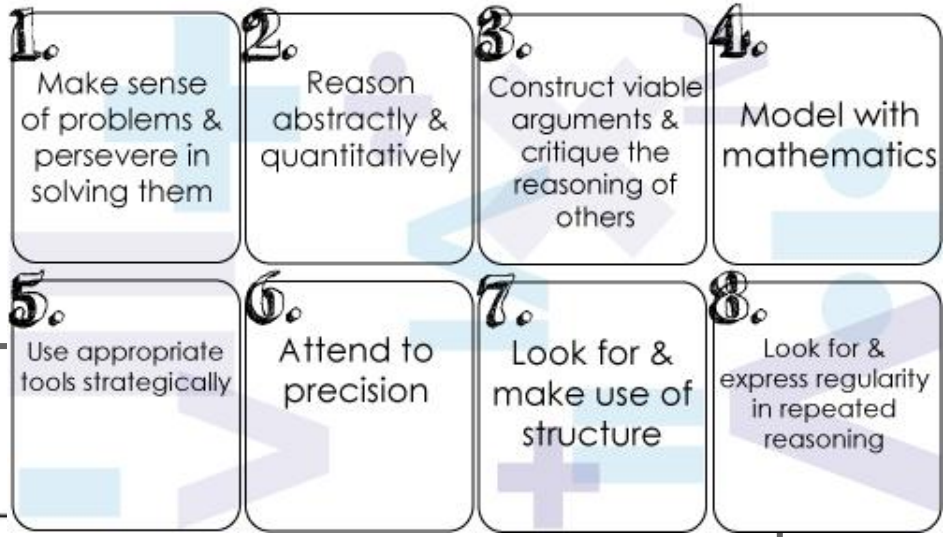
What does this mean for you?

★ What’s a positive or successful strategy you want to continue?

★ What’s one thing you want to implement?

Next Steps….

- **Understand Language Needs**
- **Strategies for Math Talk**
- **Math Practices to "Understand"**



Next Steps...

I want to _____

****

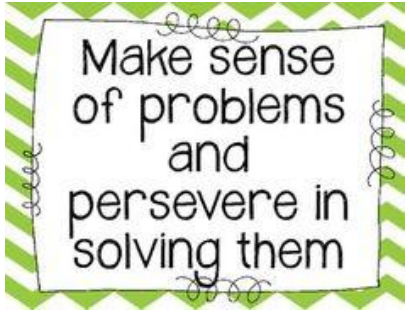
Name _____

I commit to trying / practicing / watching _____

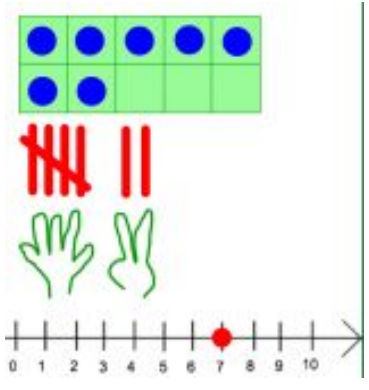
_____

by _____. I would like help with _____.

Today's Agenda...



- Understanding Language Learners' Needs
- Strategies for Math Talk
- Videos and resources



Thank you!

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