Sense Making: Is it a Focus in Your Classrooms and Your Schools?

Annie Fetter, @MFAnnie

NCSM Annual 2019, San Diego, #NCSM19

Links to resources and a PDF of the slides will be available after the talk at
annie.mathematicalthinking.org

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(and Joe Schwartz, @JSchwartz10a, in absentia)

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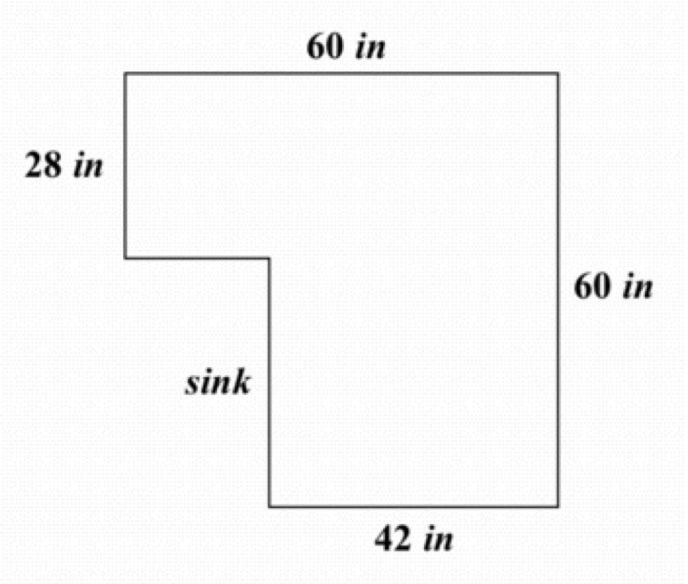
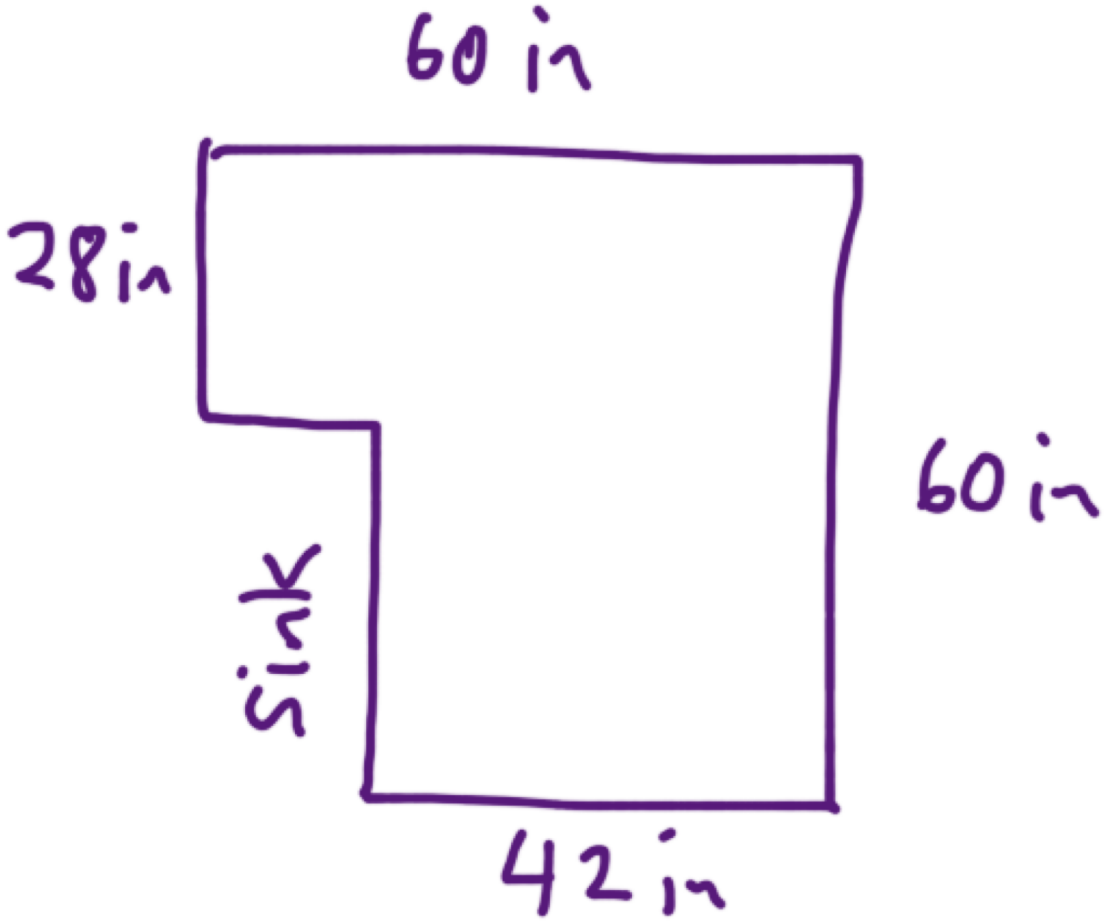
Teresa's Tiles

Teresa is going to put down new ceramic tiles on her bathroom floor. She has selected square tiles that are 4 inches on each side. These are the kind of tiles that can be placed right next to each other without leaving additional space for grout. At The Home Station, she learned how to cut the tiles in case she needs any fractional pieces to cover her floor completely.

This diagram of the bathroom floor shows the dimensions of the floor space she needs to cover. The sink area does not get tiled.

Questions: How many tiles will she need to buy to cover her floor? How many tiles will she have to cut in order to cover the entire space?




60 in
28in
60 in
sink
42 in

Teresa's Tiles

Things that some "low-performing" 8th graders noticed about the picture:

- two sides are equal
- two sides are 60 inches
- one side is 28 inches
- they are longest
- one side is 42 inches
- it used to be a square
- your lines aren't very straight
- the short side of the sink is 18"
- the sink is a rectangle
- the long side of the sink is 32"
- can find the area of the whole thing by making it two pieces

Sample Grade 3 Test Question

The corner deli sells roses in bunches of 6. If Dylan buys 3 bunches of roses, how many roses does he have?

A. 6	18%
B. 9	46%
C. 18	31%
D. 24	4%

Combined scores of the 160 third graders in a group of four “low-performing” schools I used to support.

Sample Test Question Revised

The corner deli sells roses in bunches of 6. Dylan bought 3 bunches.
Draw a picture of the story.

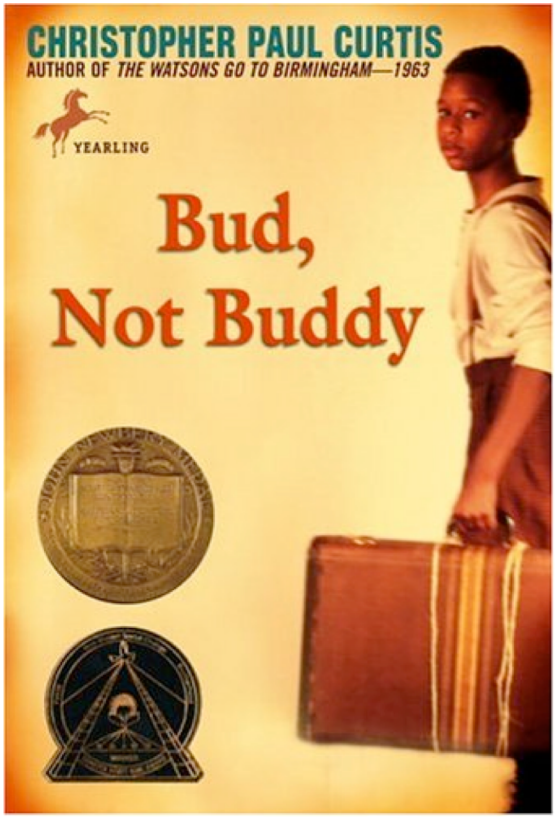
“Doing Math” or Sense Making?

$$12 - p = 5$$

$$12 - ? = 5$$

[Michelle's son] was struggling to “remember” 28/4. When [she] asked him, “How do you think about 28/4?" He replied, “Mom, you aren’t supposed to think about it, you are just supposed to do it!!”

Dr. Jekyll and Mr. Hyde?



Student Perceptions of Math and Sense Making

1. You aren't supposed to sense-make when doing math.
2. You are supposed to use rules and algorithms and accept whatever answer results.
3. You are supposed to do what your teacher said, even when it doesn't seem like a good idea.

CCSS Math Practice 1

Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution.

They analyze givens, constraints, relationships, and goals.

They make conjectures about the form and meaning of the solution and plan a solution pathway **rather than simply jumping into a solution attempt.**

They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution.

They monitor and evaluate their progress and change course if necessary.

The Five Strands of Mathematical Proficiency

National Research Council, 2001, *Adding it up: Helping children learn mathematics*.

1. Conceptual understanding
2. Procedural fluency
3. Strategic competence
4. Adaptive reasoning
5. Productive disposition

"Productive disposition is the inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy."

Your Main Job: Monitoring for Sense-Making

The story of Emily and Margaret

Encouraging Sense Making

Q: What's one way to cultivate a classroom focused on *sense making* rather than *answer-getting*?

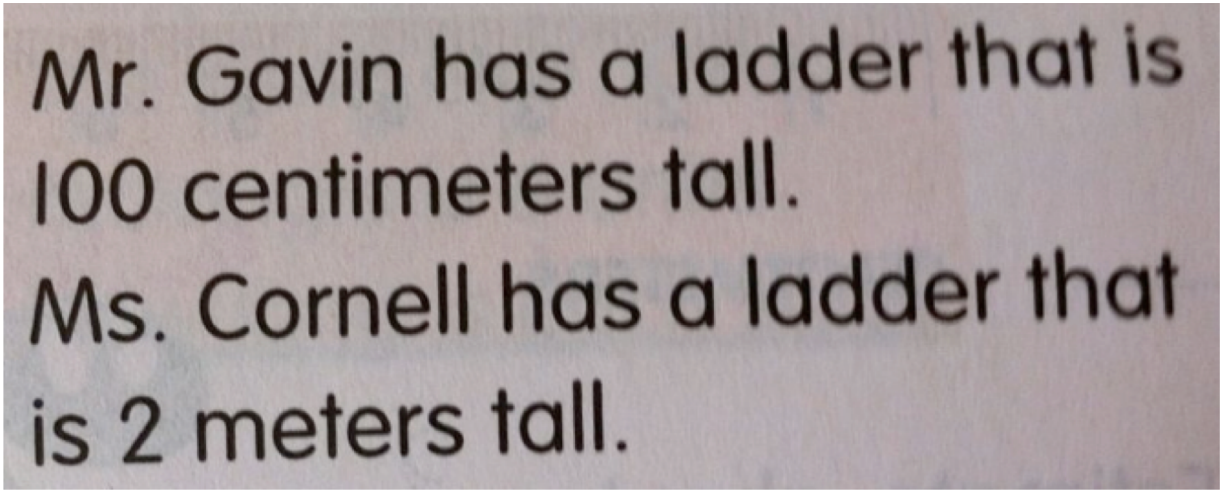
A: Get rid of the question. Literally.

Get Rid of the Question

Apple juice costs 50¢. The juice machine accepts quarters, dimes, and nickels.

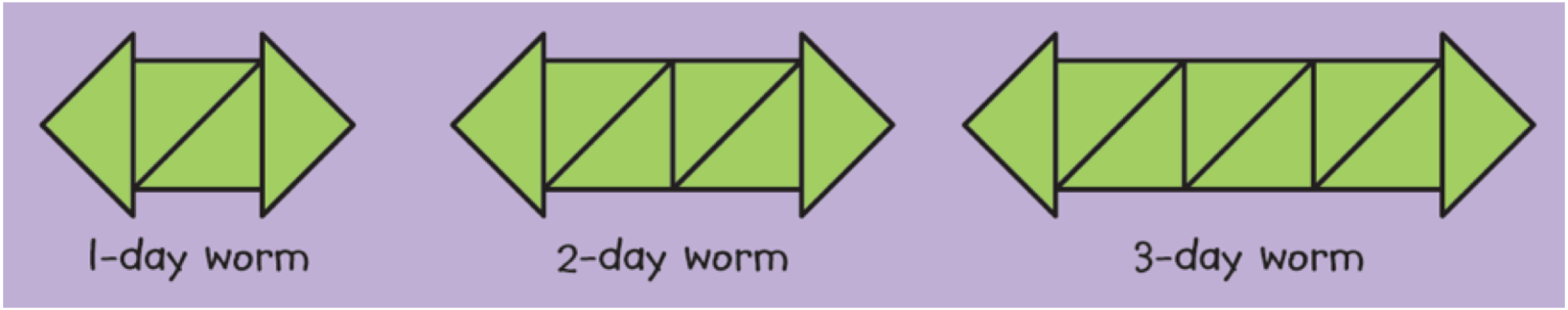
I Notice	I Wonder

Get Rid of the Question

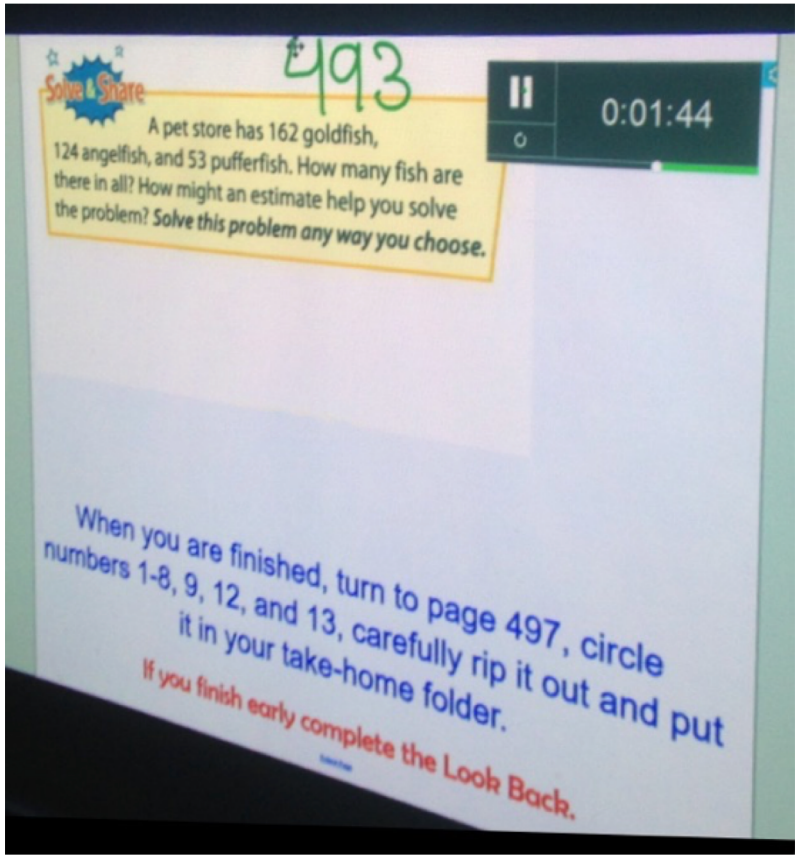


@MFAnnie, #NoticeWonder

Get Rid of the Question



Variation: Ask for Questions



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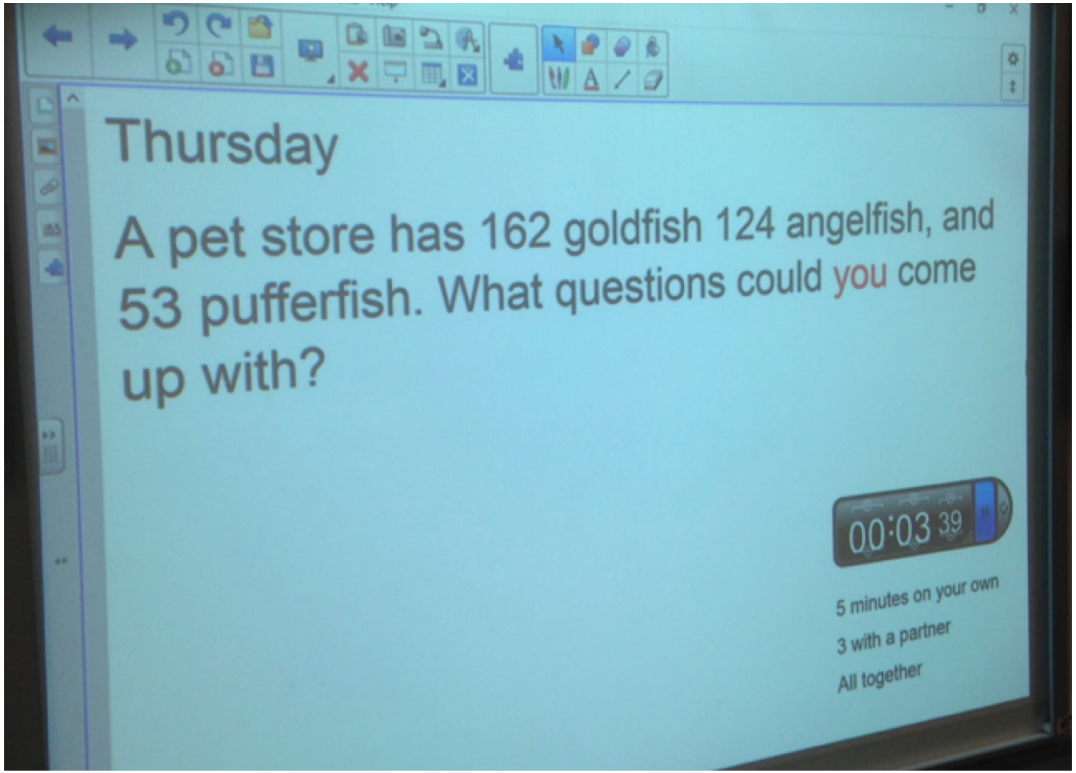
Variation: Ask for Questions



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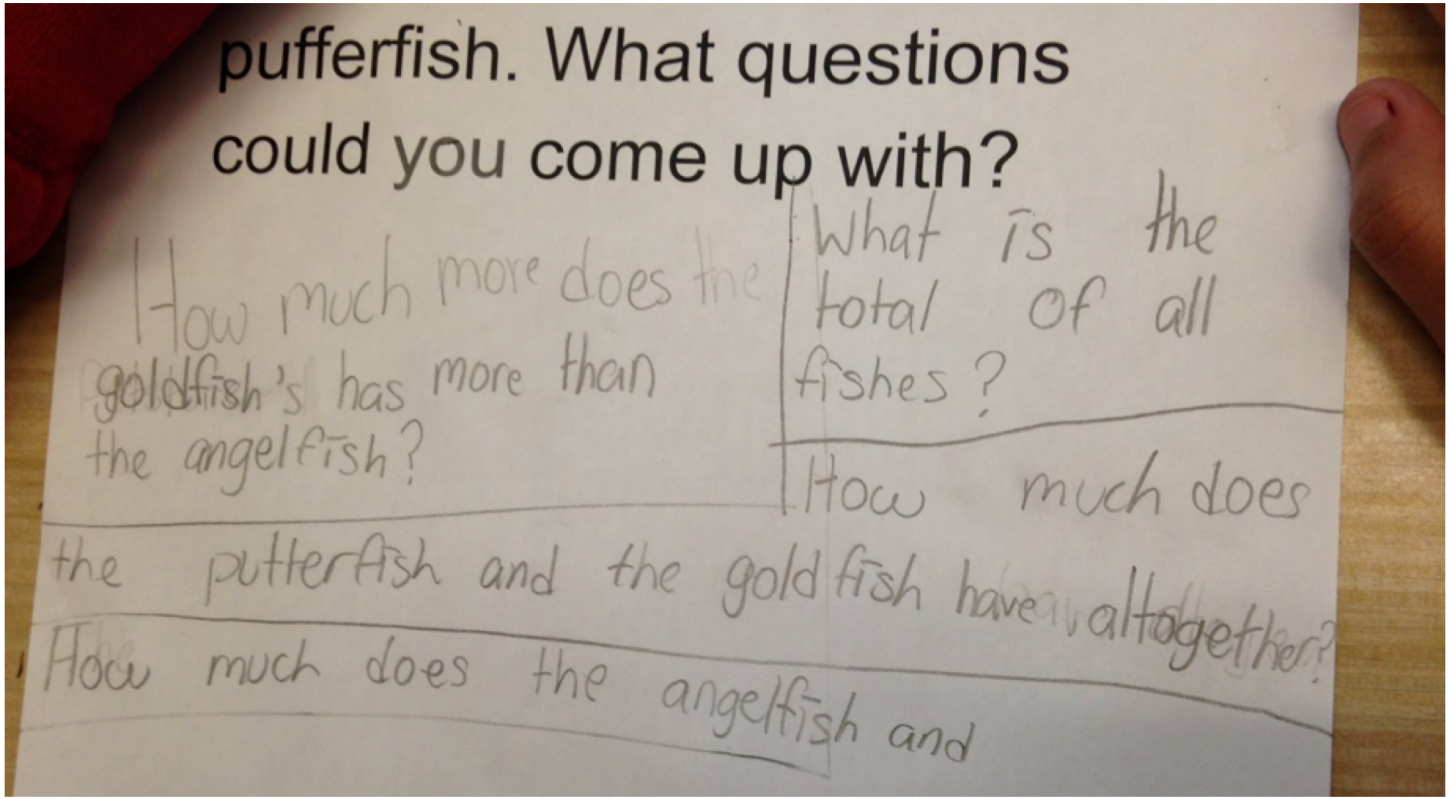
Variation: Ask for Questions



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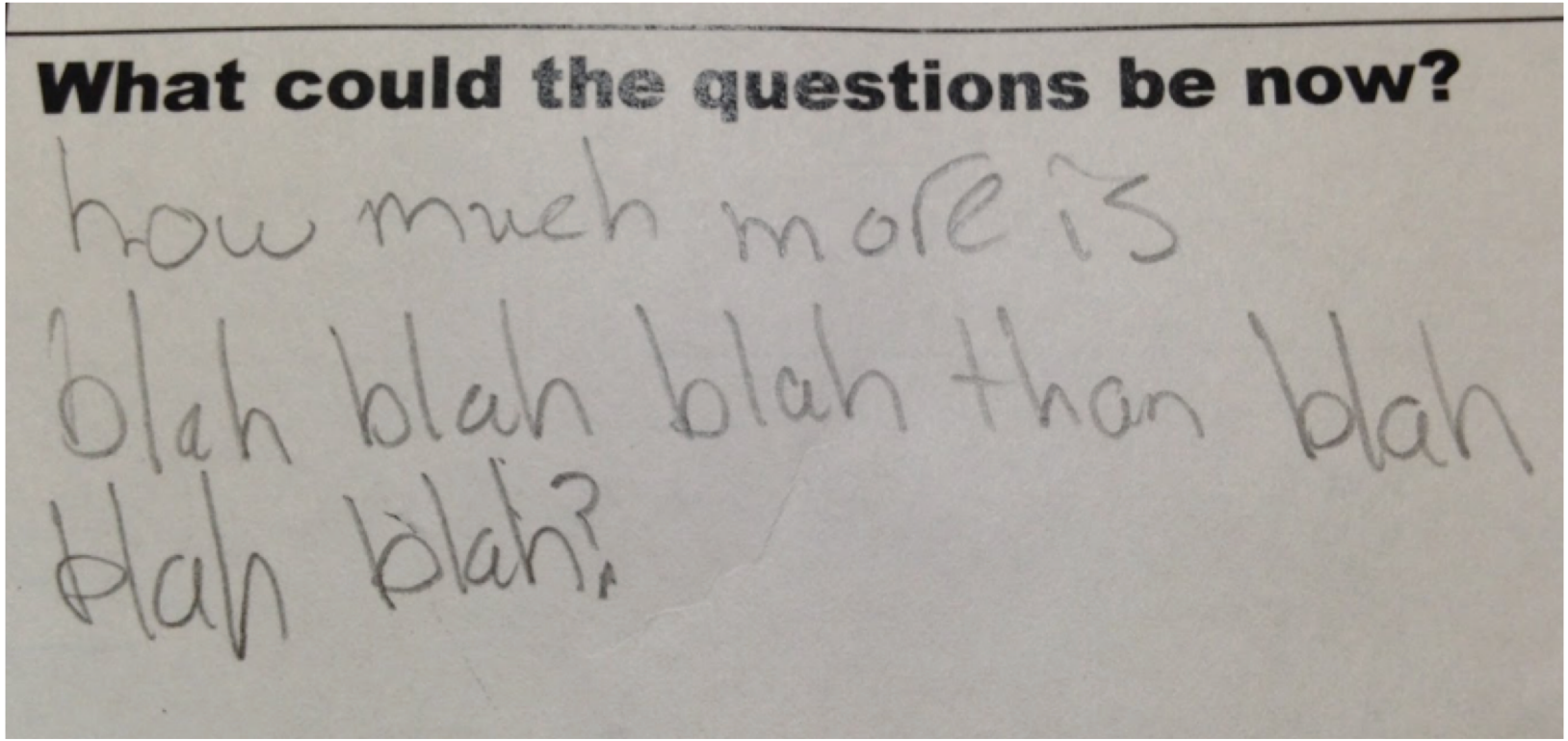
Variation: Ask for Questions



@MFAnnie, #NoticeWonder

Encouraging Sense-Making

Q: What's another way to cultivate a classroom focused on *sense making* rather than *answer-getting*?

A: Get rid of the question *and* the numbers.

Get Rid of the Question and the Numbers

Raul had some pet mice. Xavier gave him some more mice.

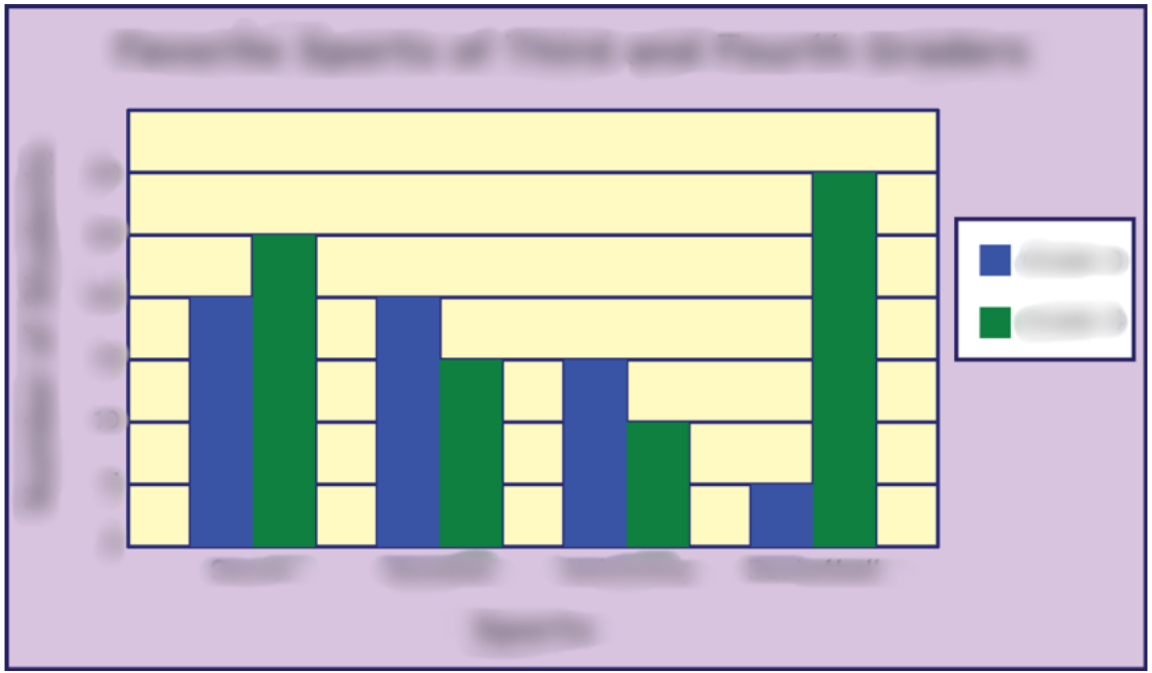
Raul had some pet mice. Xavier gave him 3 more mice.

Raul had some pet mice. Xavier gave him 3 more mice. Now Raul has 8 mice.

Raul had some pet mice. Xavier gave him 3 more mice. Now Raul has 8 mice. How many mice did Raul have to start with?

A Numberless Word Problem from Brian Bushart, bstockus.wordpress.com

Get Rid of the Question and the Numbers



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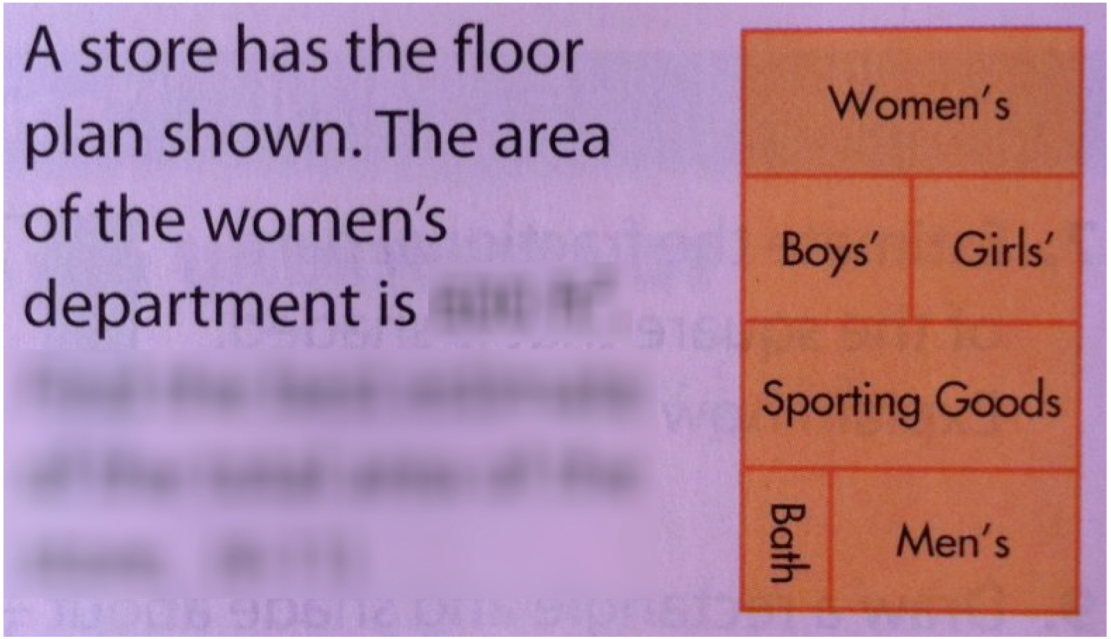

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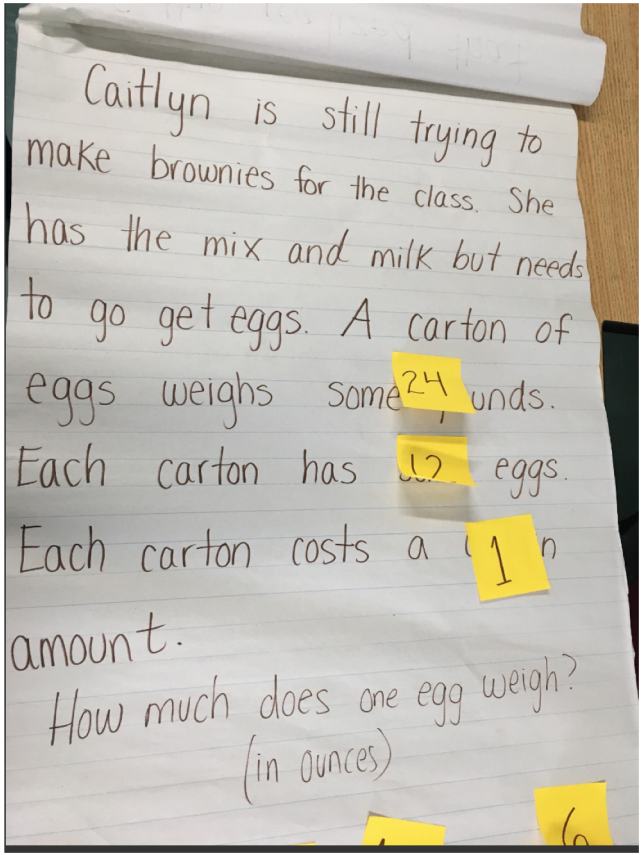
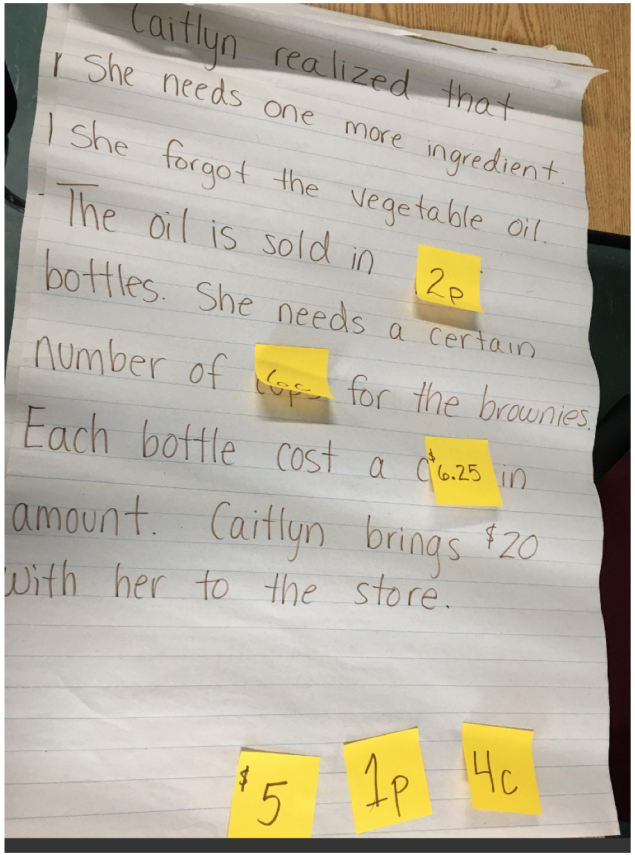




From Kat Kulis, grade 5, Windham Center School, Windham, CT

Encouraging Sense Making

Q: What's another way to cultivate a classroom focused on *sense making* rather than *answer-getting*?

A: Give the answer.

Give the Answer

Math Message Follow-Up

WHOLE-CLASS ACTIVITY

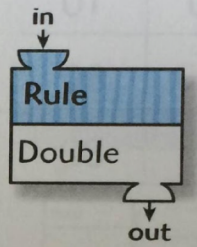
Draw or display a function machine and "What's My Rule?" table. (See Advance Preparation.)

Ask children to imagine that the **function machine** works like this:

- A number (the **input**) is dropped into the machine,
- the machine changes the number according to a rule,
- and a new number (the **output**) comes out the other end.

The **rule** for the Math Message problem is "Double the number." Write the word *Double* in the function machine.

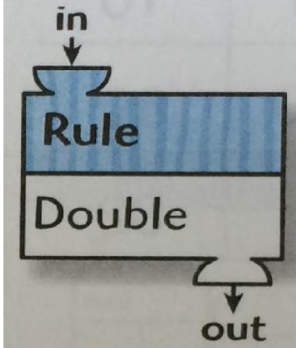
Point out the **"What's My Rule?"** table. Discuss the 8 in the *in* column and the 16 in the *out* column. Explain to children that numbers in the *in* column represent the numbers of bacteria now. Corresponding numbers in the *out* column represent the numbers of bacteria 20 minutes from now.



in	out
8	16
50	100
200	400
75	150
150	300

@MFAnnie, #NoticeWonder

Give the Answer



in	out
8	16
50	100
200	400
75	150
150	300

@MFAnnie, #NoticeWonder

Give *an* Answer (or Several!)

Rachel bakes cookies and delivers them to her friends.

- It takes 8 minutes to mix the batter.
- The cookies bake for 9 minutes.
- For 6 minutes they cool.

If the answer is 23 minutes, what is the question?

If the answer is 3 minutes, what is the question?

If the answer is bake, what is the question?

Encouraging Sense Making

Q: What's another way to cultivate a classroom focused on *sense making* rather than *answer-getting*?

A: Ask about ideas, not answers.

This can be really simple:

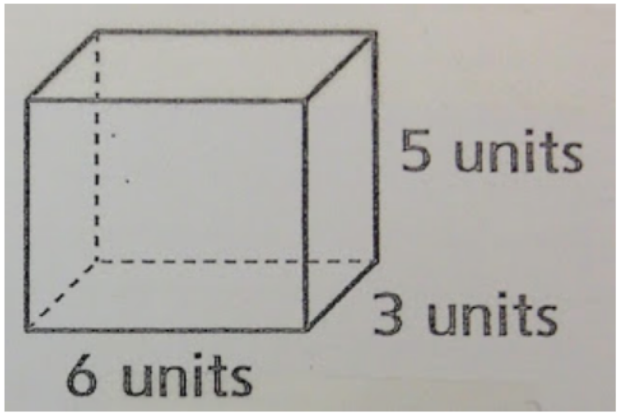
"Tell me something about number 7."

instead of

"What's the answer to number 7?"

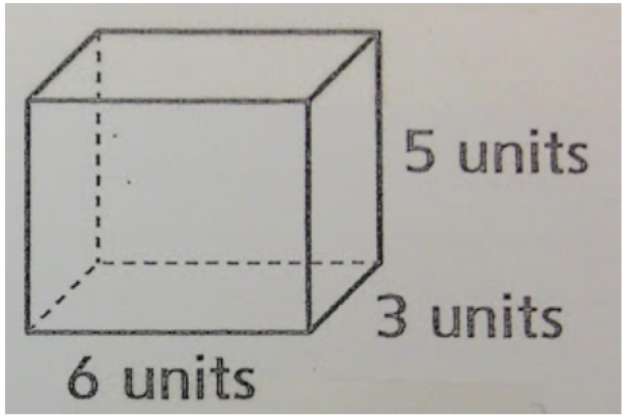
Ask About Ideas, Not Answers

It can be a little more complex:



Tell me everything you can about this figure.

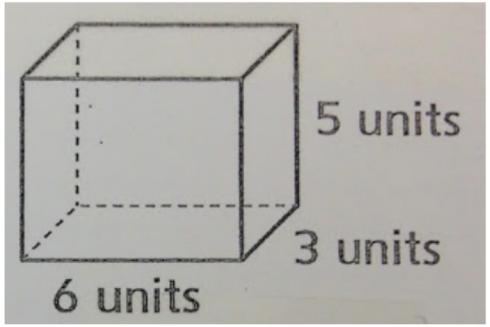
instead of



Find the volume of the rectangular prism.

(from exit10a.blogspot.com, October 10, 2016)

There's nothing inside.



Tell me everything you can about this figure.

It's a full cube with a top and everything else.

So if you times what's on the bottom (6 x 3) then you times the height you'll get the answer.

It has 4 sides.

The shape has 12 right (90 deg) angles.

The perimeter is 14 units.

I know this shape is made up of squares.

Teacher Questions

“Why?”

“How do you know?”

“How did you decide?”

“Tell me more about that.”

“Phone in Pocket”

Are you asking ***idea-focused*** questions or ***answer-focused*** questions? Record yourself and find out!

#ToVForRatio

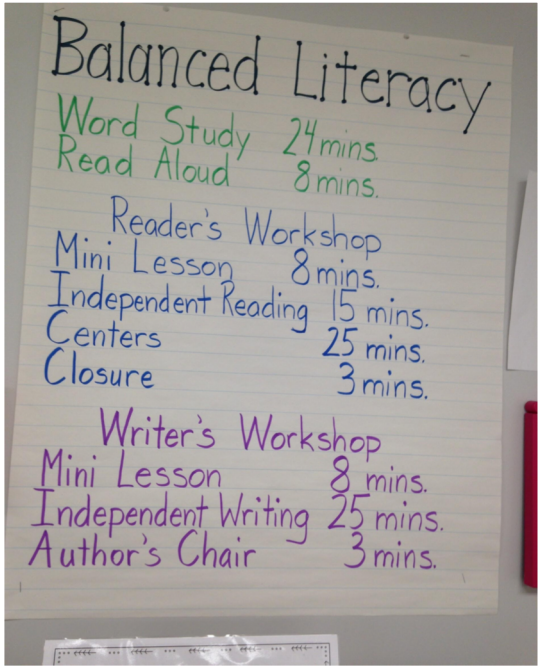
Ways to Encourage Sense Making Rather Than Answer Getting

- Get rid of the question.
- Get rid of the question *and* the numbers.
- Give the answer.
- Ask about ideas, not answers.

How to Encourage the Spread of Sense-Making Strategies?

@MFAnnie, #NoticeWonder

Connect Sense-Making Strategies Used in Other Subject Areas to Math



Marilyn Burns
@mburnsmath

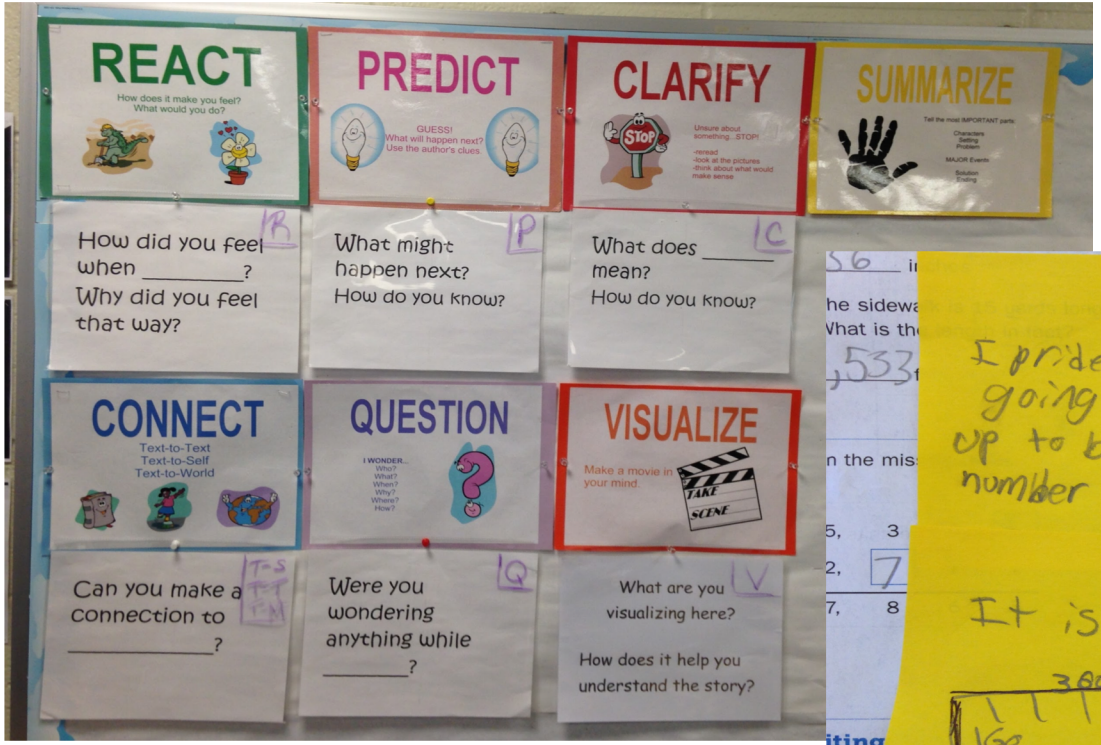
Replying to @MarkChubb3 and @LanaSteiner4

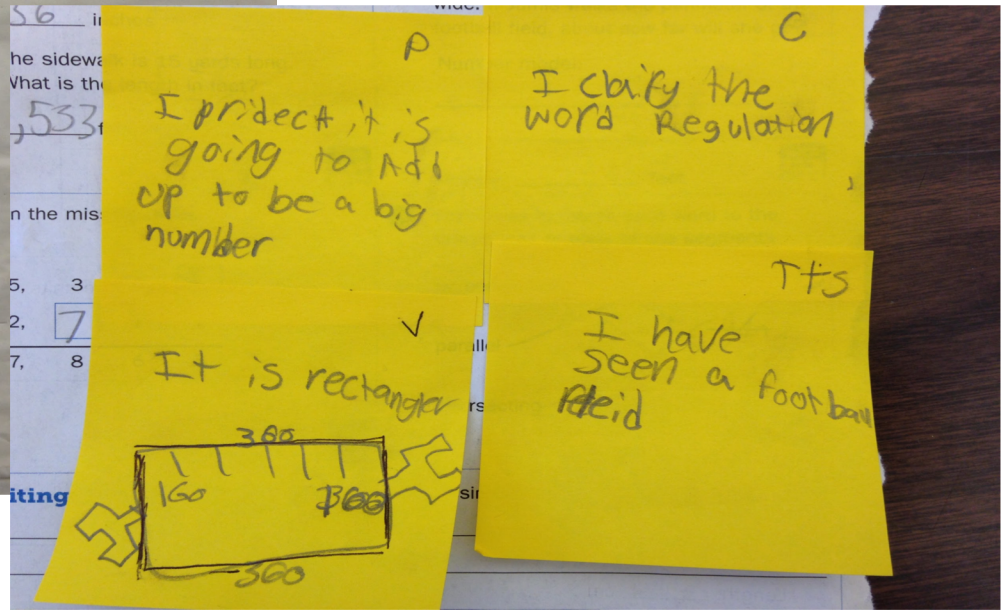
I'm on the search for overlaps so we can help teachers use their skills in one area to inform their teaching in the other.

3/30/18, 12:02 PM

@MFAnnie, #NoticeWonder

Using Active Reading Strategies





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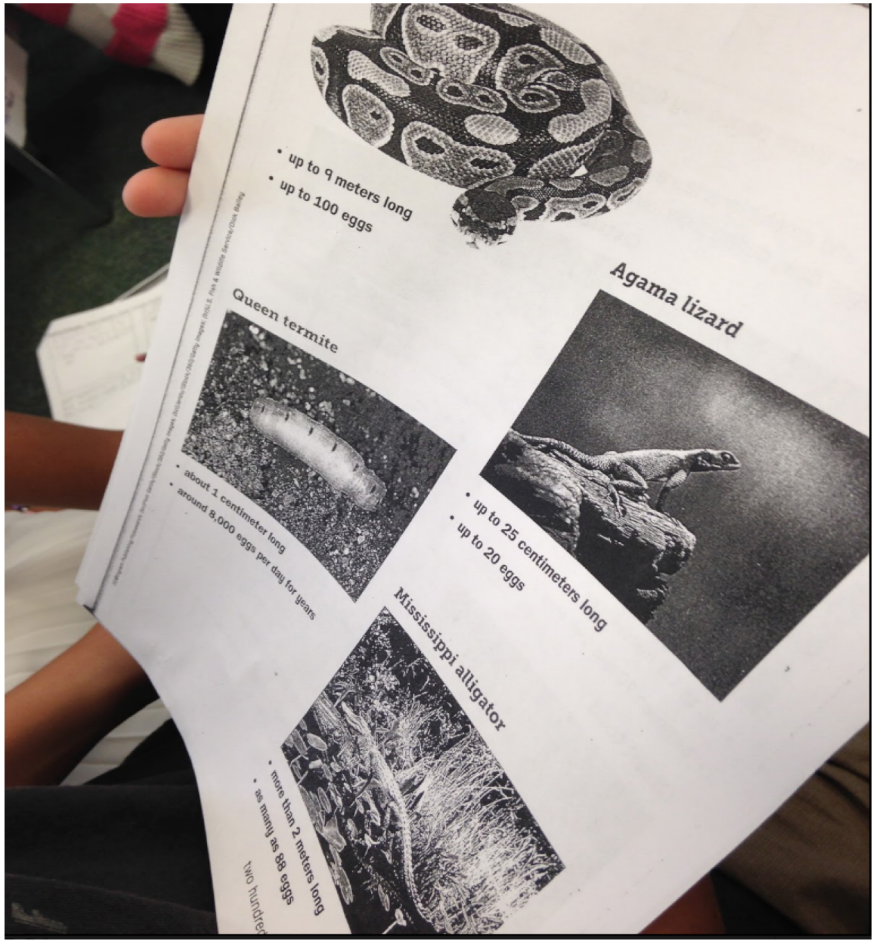
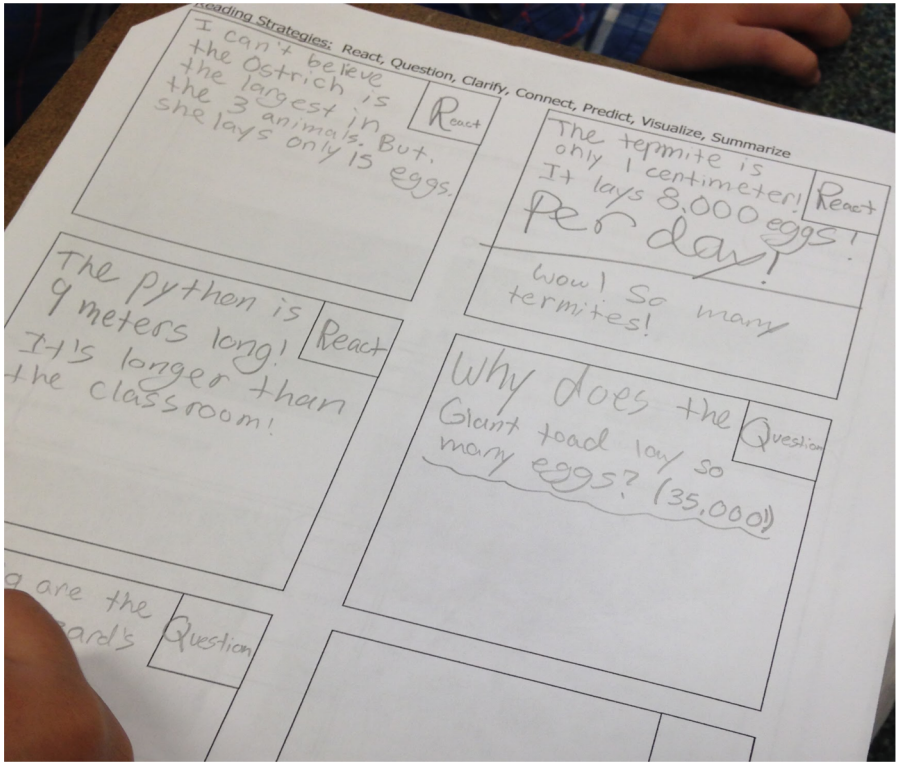
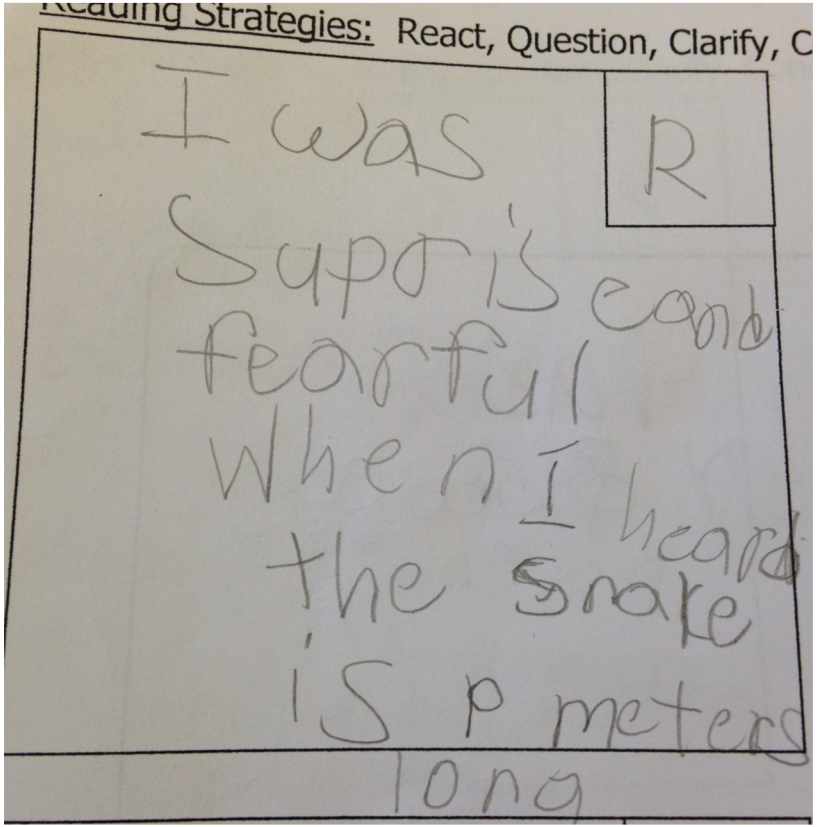
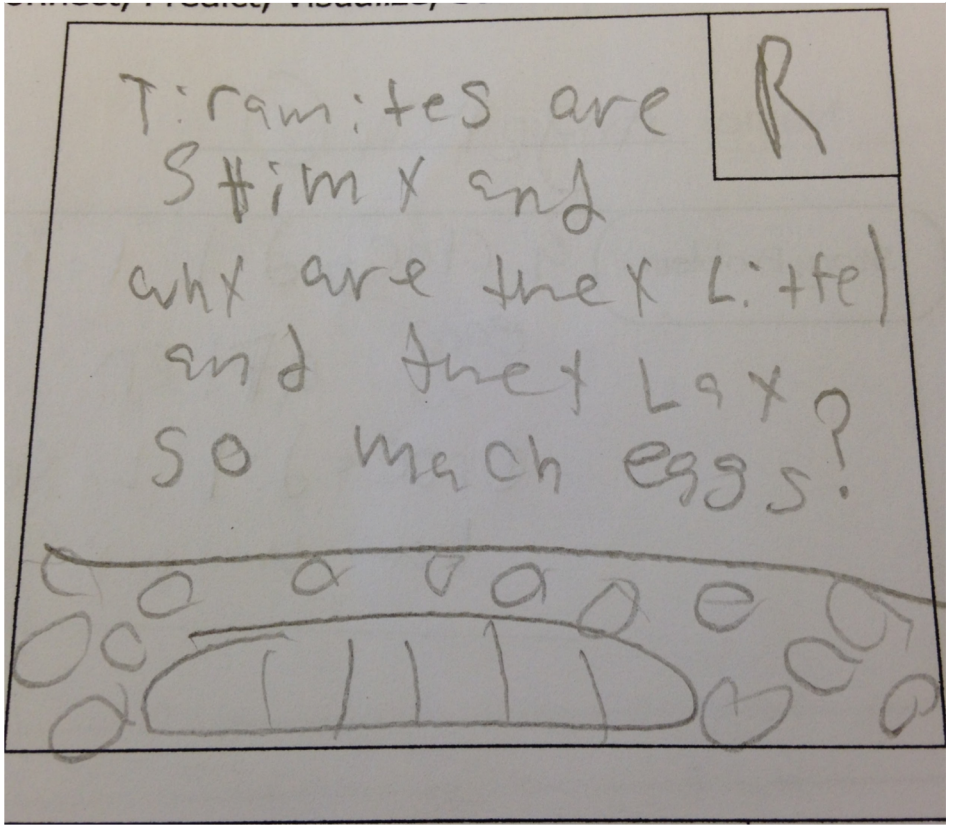




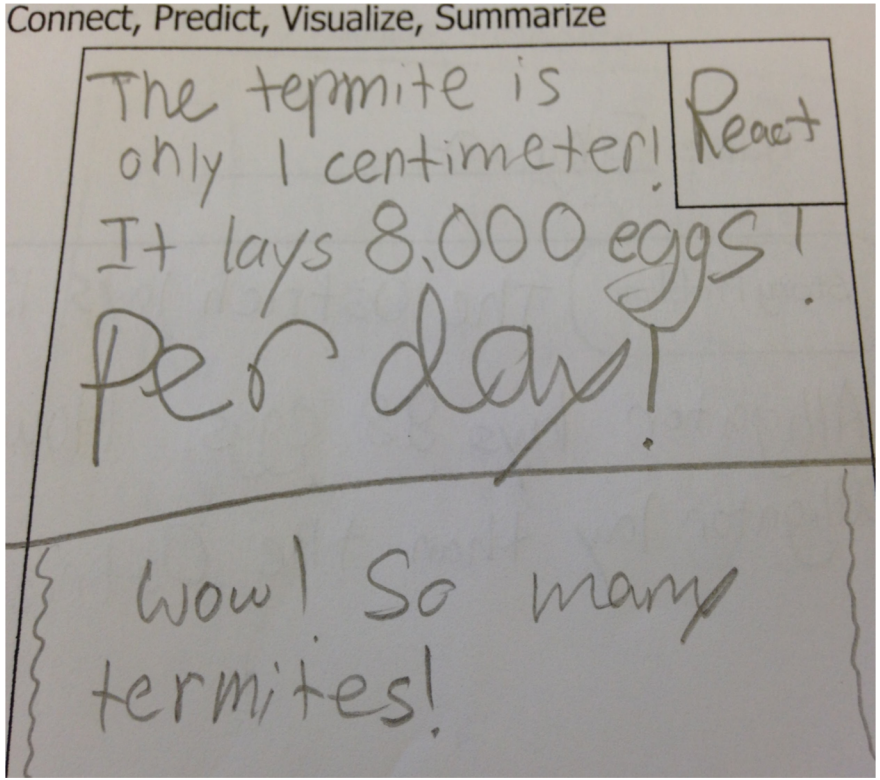
From Shannon Poquette's grade 3 class, Chittick School, East Brunswick, NJ

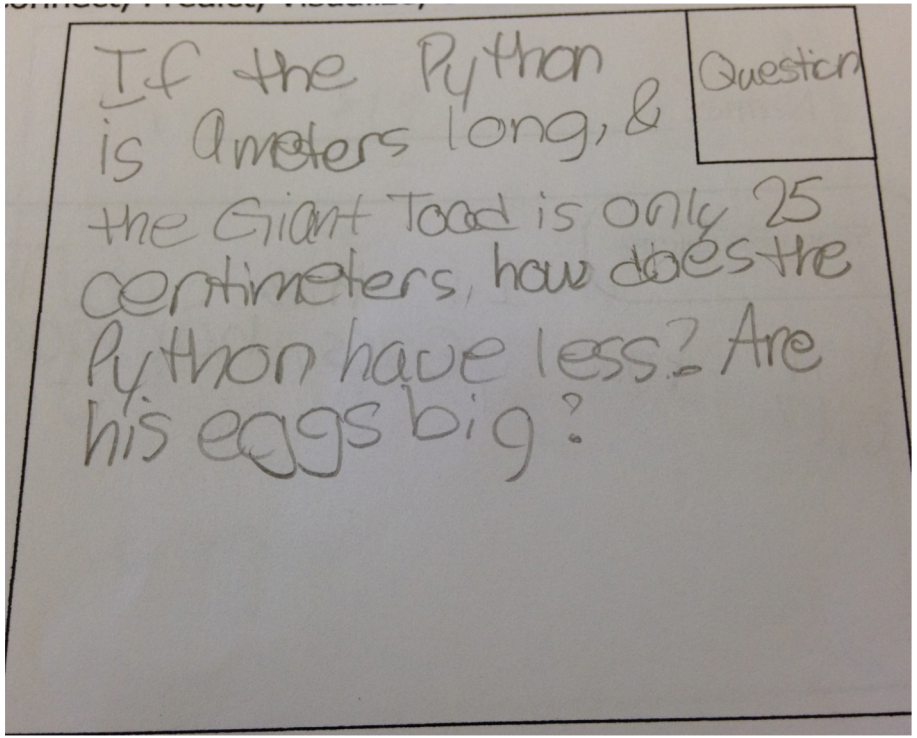
@MFAnnie, #NoticeWonder





From Shannon Poquette's grade 3 class, Chittick School, East Brunswick, NJ



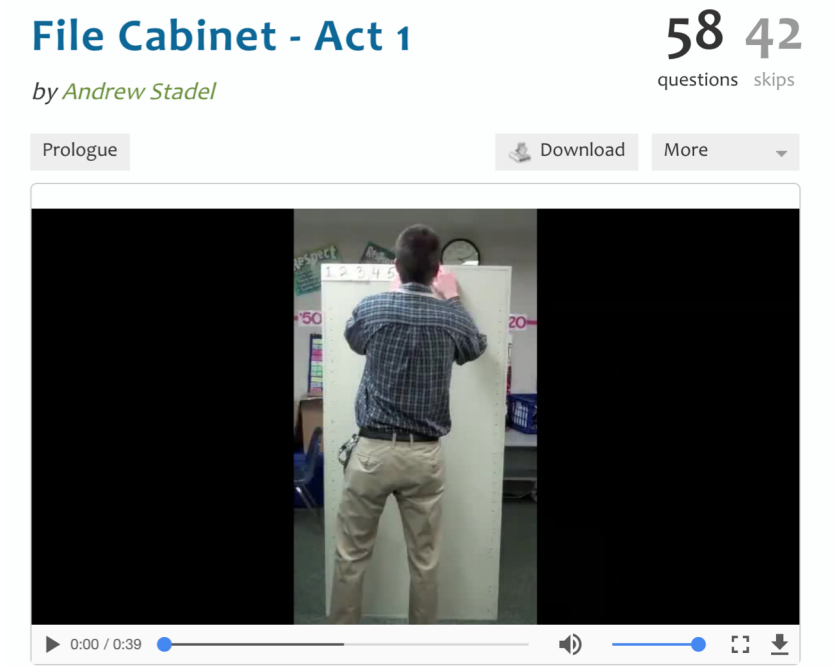


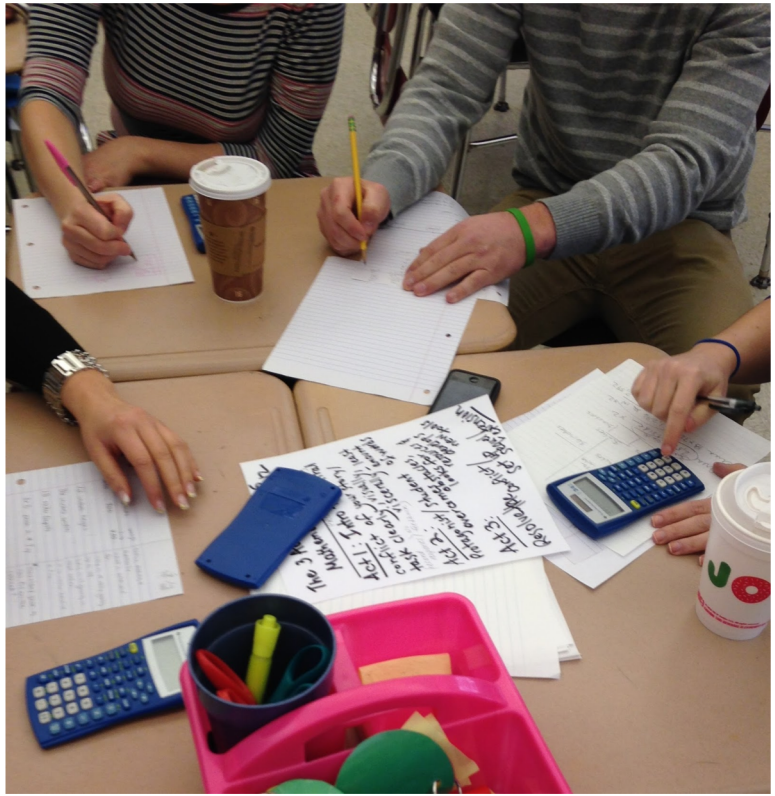
From Shannon Poquette's grade 3 class, Chittick School, East Brunswick, NJ

Sample Test Question Revised

The corner deli sells roses in bunches of 6. Dylan bought 3 bunches.
Draw a picture of the story.

Model Sense-Making in Our PD





@MFAnnie, #NoticeWonder

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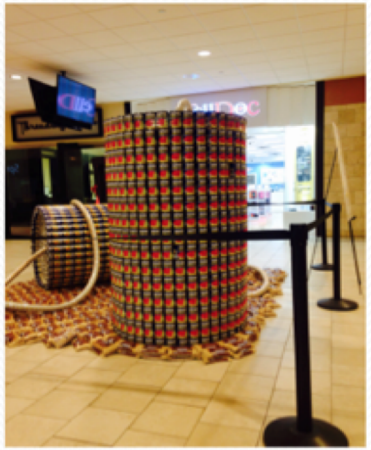
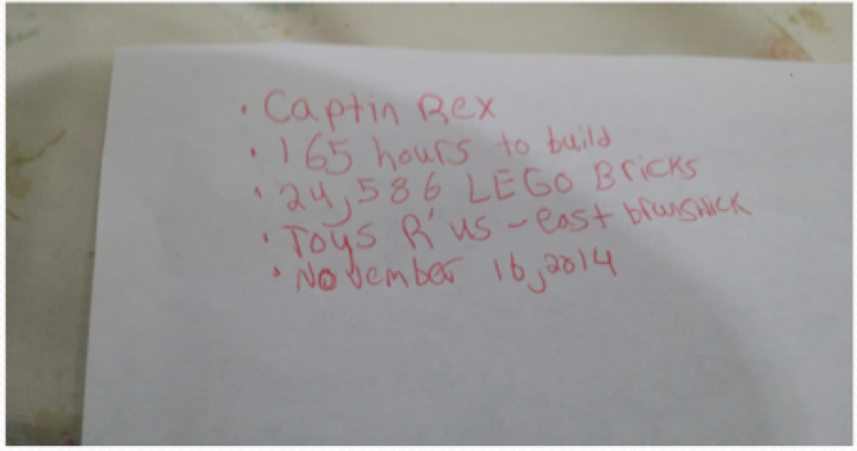


From Rich Whalen's grade 5 class, Chittick School, East Brunswick, NJ



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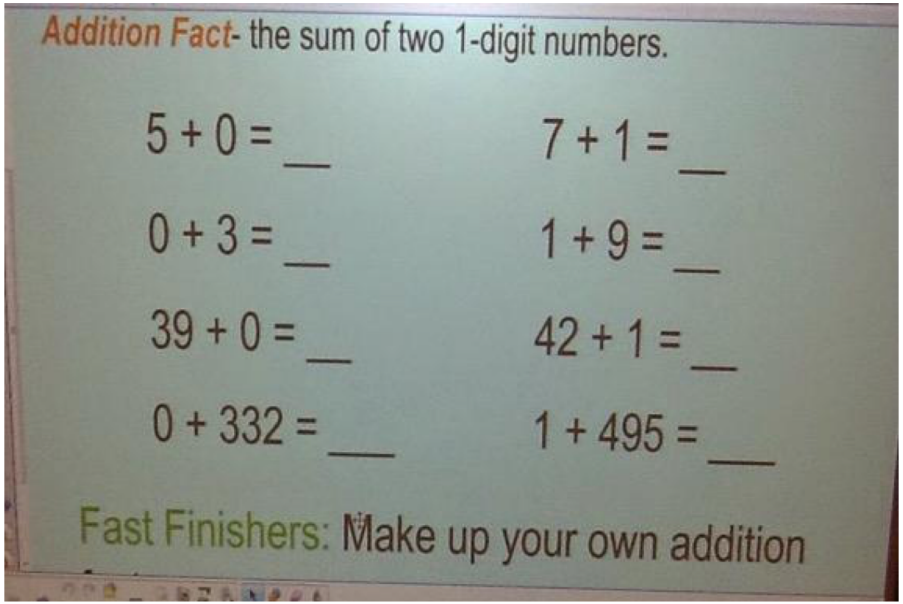
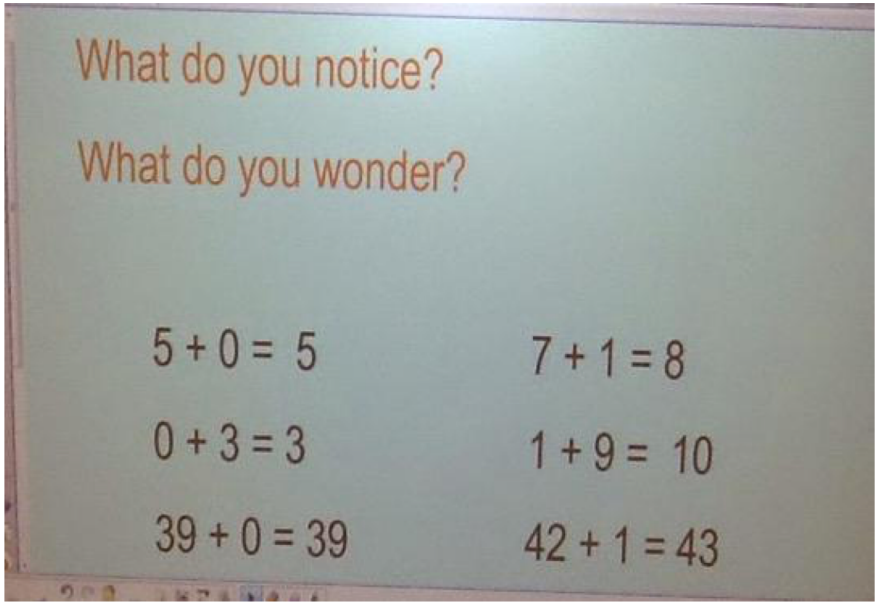
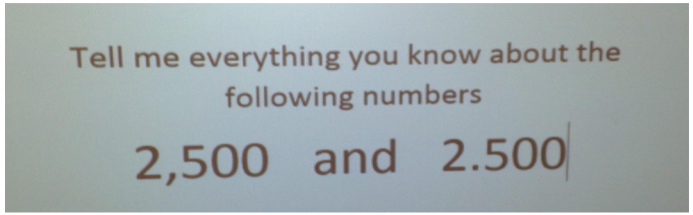
Find the “Nucleus”



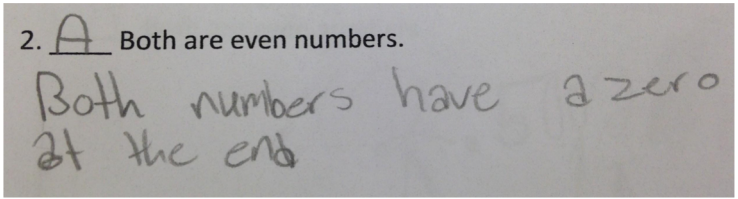


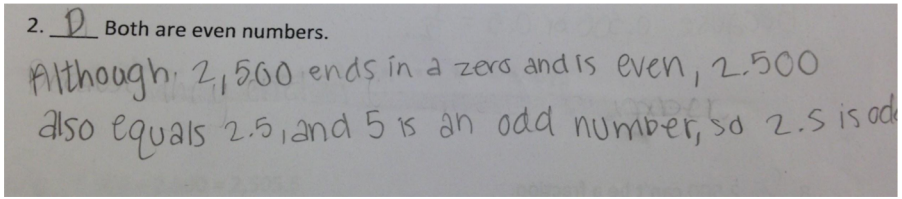
@MFAnnie, #NoticeWonder

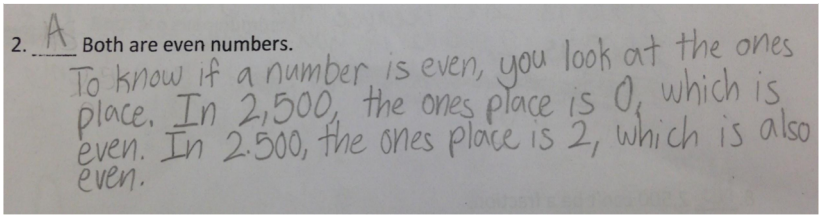
Model Vulnerability

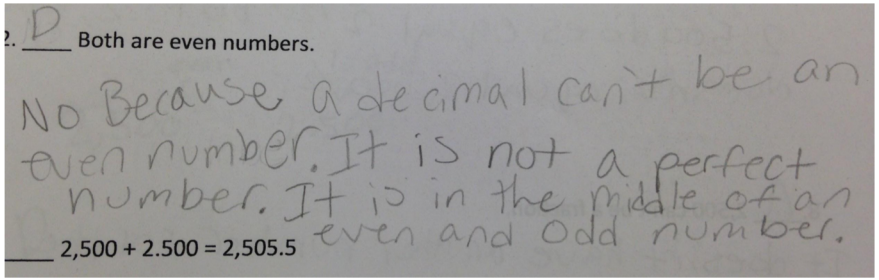


Both are even numbers.









@MFAnnie, #NoticeWonder

Model Vulnerability

> Label: Three Year Permanent Delete (3 years) Expires: 4/6/2020 9:20 AM

Thanks for your help yesterday. Another question: So only whole numbers can be even or odd, not fractions. But any whole number can be expressed as a fraction, i.e. 2,500 = 2,500/1. So every whole number is also a fraction, but not all fractions are whole numbers?

Joe Schwartz
Math Specialist
Murray A. Chittick Elementary School
5 Flagler St.
East Brunswick, NJ 08816
732-613-6830

Ways to Encourage The Spread of Sense Making

- Connect sense-making strategies from other subject areas.
- Model sense-making in PD.
- Find the nucleus.
- Model vulnerability.

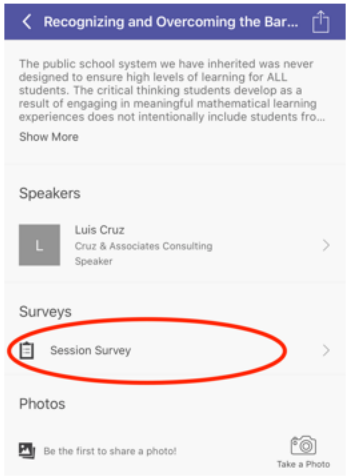
Moment for Reflection and Personal (Possibly Public) Commitments

Share Your Feedback

We strive to continually improve our educational programming. Please take a moment to evaluate this session by following the instructions below:

In the NCSM Conference App, click the "Schedule" icon and select this session (search function is available)

On the session page, scroll down to the "Surveys" section and click on "Session Survey" to begin



Thank you for sharing your feedback with us!

Thanks!

@MFAnnie, anniefetter@gmail.com, @MFAnnie

(Don’t forget to fill out the survey in the app.)

Links and Slides

annie.mathematicalthinking.org