

Sense Making: Aren't We Already Doing That in Literacy?



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Northwest Math Conf, #NWMC2019

Slides and links to related resources will be available on my blog after the talk:

annie.mathematicalthinking.org

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.



Sample Grade 3 Test Question

Hot dog buns come in packages of 8. Michael buys 6 packages of hot dog buns. How many hot dog buns does Michael have in all?

- A. 14 43%
- B. 36 8%
- C. 48 40%
- D. 56 5%

“Cracking the Math Code”

ADDITION

Add
Altogether
And
Both
How many
How much
In all
Increased by
Plus
Sum
Together
Total

SUBTRACTION

are not
change
decreased by
difference
fewer
have left
how many did not
have
how many more
less than
remain
subtract
take away
Taller/shorter

MULTIPLICATION

By (dimension)
Double
Each group
Multiplied by
Of
Product of
Times
Triple

DIVISION

as much
cut up
divided by
each group has
half (or other
fractions)
how many in each
parts
quotient of
Separated
Share something
equally
split

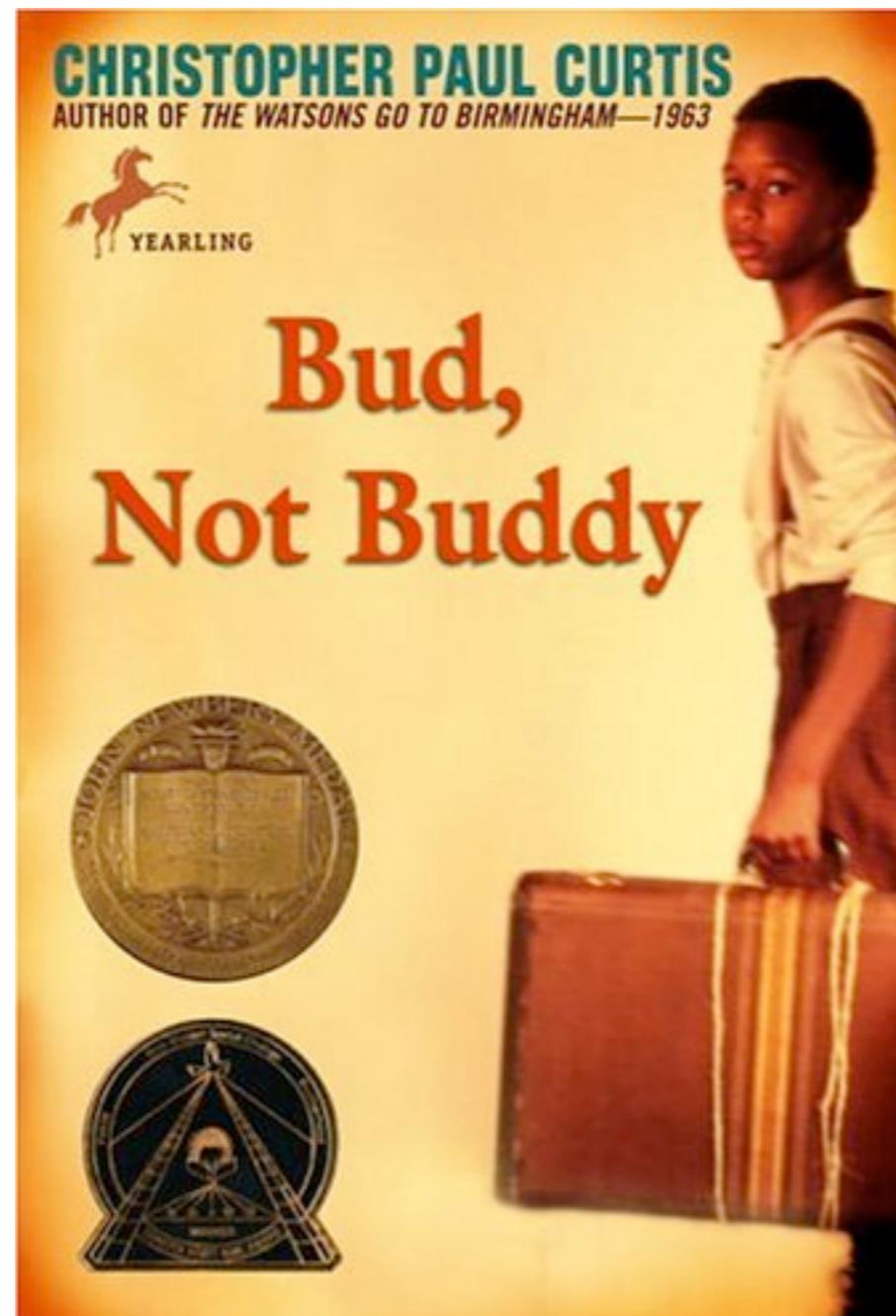
(document from the web site of a large Eastern US metropolitan school district)

Sample Grade 3 Test Question

Hot dog buns come in packages of 8. Michael buys 6 packages of hot dog buns. How many hot dog buns does Michael have **in all**?

- A. 14 43%
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Dr. Jekyll and Mr. Hyde



Reading Strategies

What are some reading strategies that you've taught or seen taught so far this year?

Strategies - Unfamiliar Words

- Sound it out
- Context clues
- Apply known patterns to a new situations

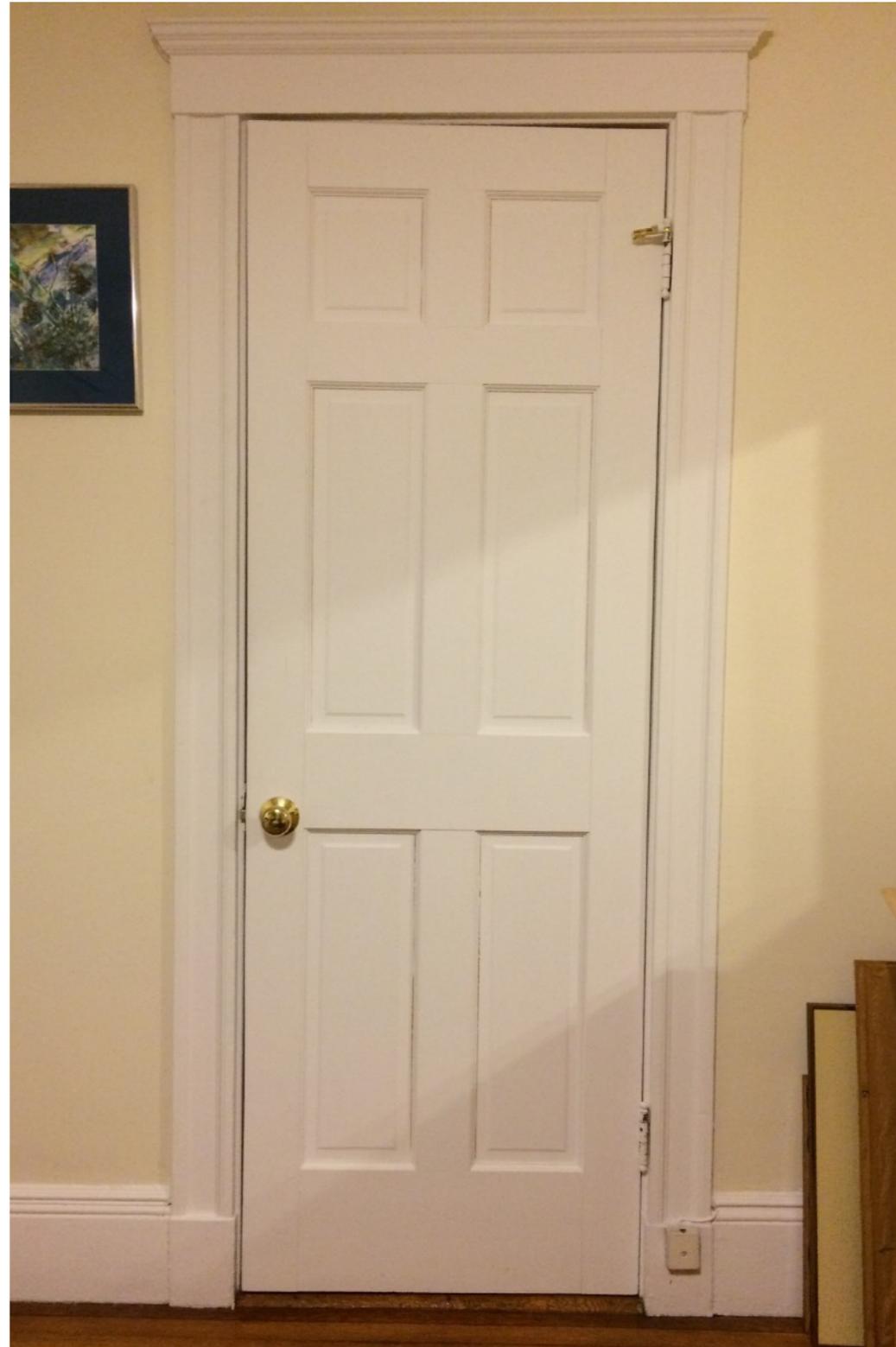
Strategies - Comprehension

- Predicting
- Estimating
- Hypothesizing
- Make a movie in your mind
- Storyboarding (beginning, middle, end)
- Story elements (character, setting, problem, solution)

What Are We Really Teaching?

Most *reading* skills and strategies are really *thinking* skills and strategies.

Making a Movie in Your Mind



Does the Room Look Different?

“Oh, I can’t use small group work during math.”

Defining Our Role(s)

What is your/the teacher's role during the literacy block?

What is your/the teacher's role during the math block?

Characteristics of Strong ~~Readers~~ Mathematicians

- They are motivated to ~~read.~~ tackle problems
- They are able to ~~read words~~ accurately and automatically. recite facts
- They comprehend what they read.
- They are able to read with expression.
- They use a variety of strategies to tackle ~~words~~ they don't recognize. problems
- They use active problem solving strategies to search for information, to determine meaning, to make sense of words, to make connections.

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: Do Your Students Think Math Makes Sense?

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

Mr. Gavin has a ladder that is 100 centimeters tall.

Ms. Cornell has a ladder that is 2 meters tall.

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?

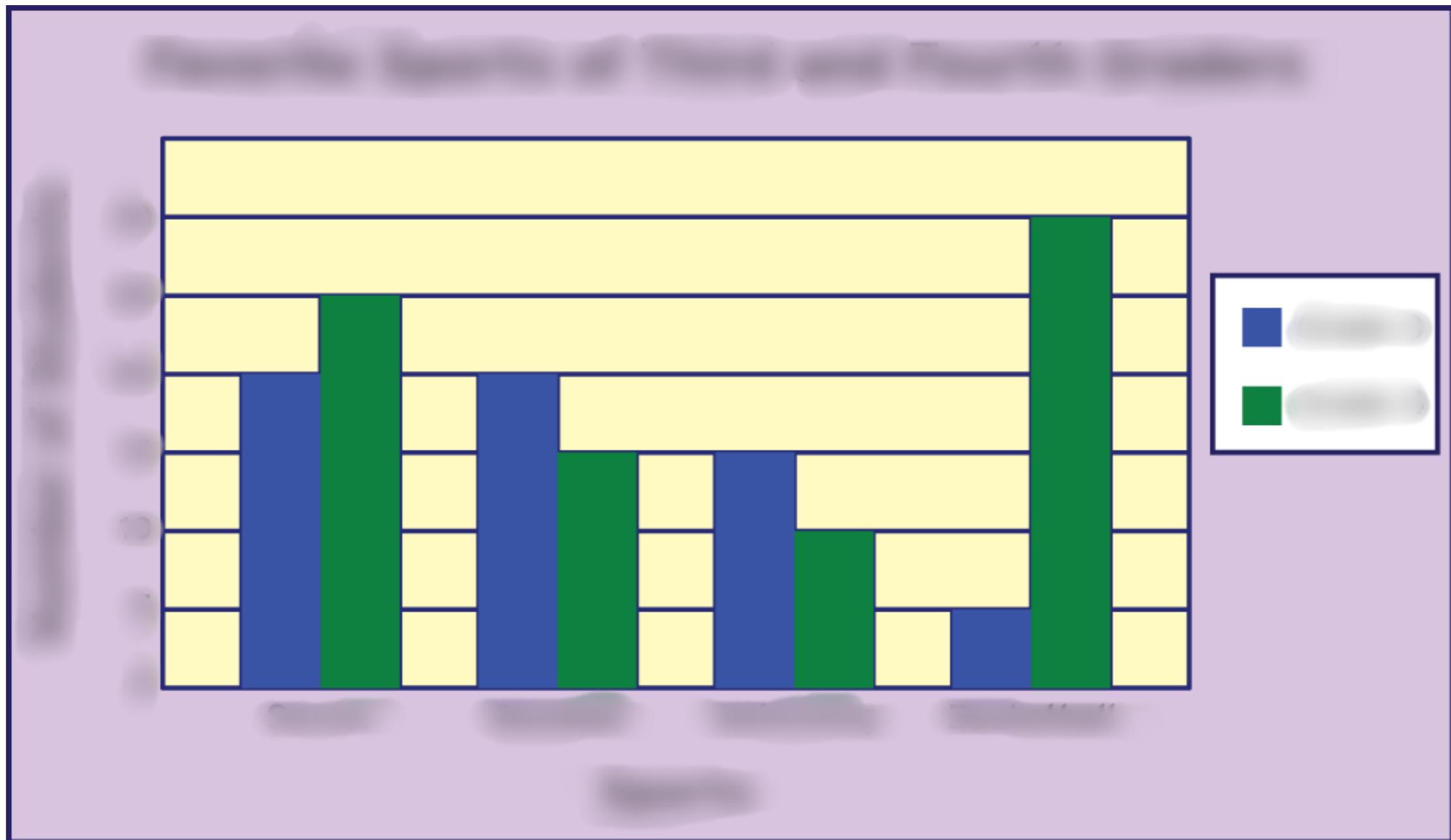
A Numberless Word Problem from Brian Bushart, bstockus.wordpress.com

Get Rid of the Question and the Numbers

A store has the floor plan shown. The area of the women's department is



Get Rid of the Question and the Numbers



Get Rid of the Numbers

Caitlyn is still trying to make brownies for the class. She has the mix and milk but needs to go get eggs. A carton of eggs weighs some **24** pounds. Each carton has **12** eggs. Each carton costs a **1** dollar amount.

How much does one egg weigh?
(in ounces)

6

Caitlyn realized that she needs one more ingredient. She forgot the vegetable oil. The oil is sold in **2** liter bottles. She needs a certain number of **6** cups for the brownies. Each bottle cost a **6.25** dollar amount. Caitlyn brings \$20 with her to the store.

\$5 **1p** **4c**

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

Numbers vs. Relationships

$$A = L \times W$$

$$A = \pi r^2$$

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

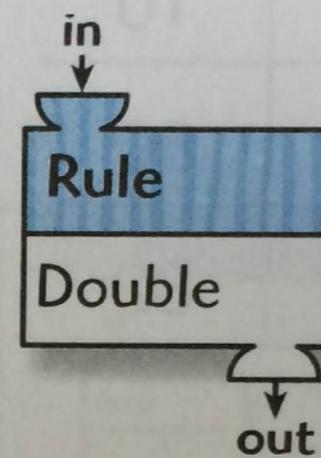
Draw or display a function machine and “What’s My Rule?” table. (See Advance Preparation.)

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.

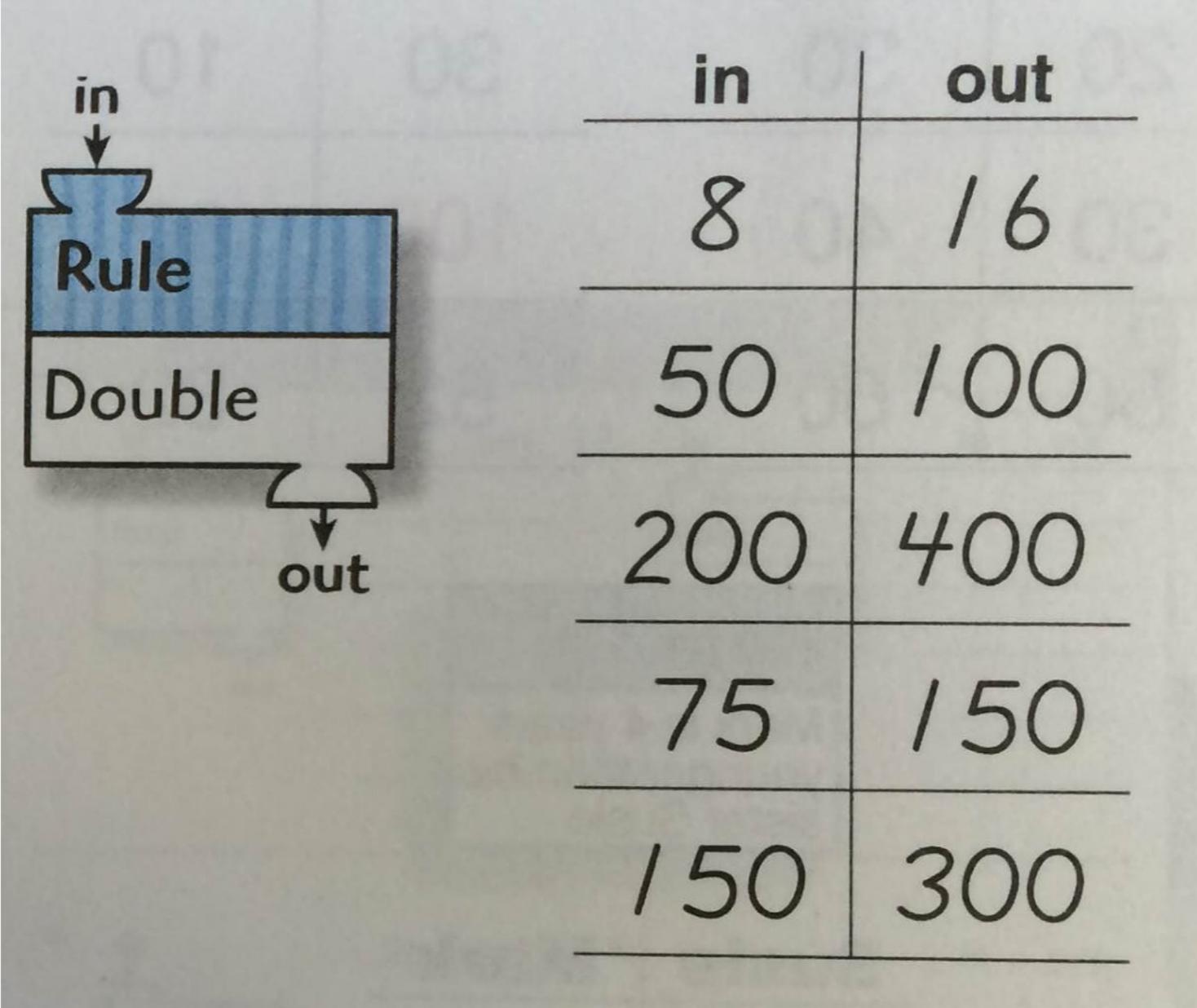
The **rule** for the Math Message problem is “Double the number.” Write the word *Double* in the function machine.

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 |

Give the Answer



The diagram shows a black box with two sections: a blue hatched top section labeled "Rule" and a white bottom section labeled "Double". An arrow labeled "in" points into the top of the box, and an arrow labeled "out" points out from the bottom. To the right of the box is a table with two columns: "in" and "out".

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

You know $2.4 * 1 = 2.4$. Will $2.4 * 1.8$ be greater than or less than 2.4? How do you know?

Math Message 6.8

"Notice and Wonder" - "I notice...."

$2.4 * 1 = 2.4$
 $2.4 * 1.8 = 4.32$

What do you notice?

- When you multiply by 1, you get same answer as what you multiplied by.
- They multiplied $8 * 4 = 32$ → and they multiplied $4 * 4$.
- $2.4 < 4.32$
- Second problem is wrong. → It's not multiplying, it's adding.
- Both problems have 2.4
- ~~Take out~~ the 3 for swapping 2 and 4 and get same answer as problem 1.
- 4.32 is nearly 2 times as much 2.4
- Can't multiply $2 * 1 = 4$.

Math Message 6.8

"Notice and Wonder" - "I notice...."

$2.4\frac{1}{3} * 1 = 2.4\frac{1}{3}$
 $2.4 * 1.8 = 4.32$

What do you notice?

- It's the same decimals. → 2.4 is the same as answer.
- When multiplying, the product is less.
- The first problem equals the same number.
- By adding $\frac{8}{10}$ to 1, the answer was changed to 4.32.
- Almost all the same numbers except $\frac{8}{10}$.
- The decimals in the ones place is adding up to 2.
- In the second problem it looks like the answer is incorrect because the whole #'s and decimals multiplied would give 2 instead of 4.
- Both problems contain (2) two's and (2) 4's.

Sally Nordyke, Grade 5, Daniel F. Ryan School 19, Passaic, NJ

Give the 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?

from Joe Schwartz, @JSchwartz10a

Ask for Questions

Solve & Share

493

A pet store has 162 goldfish, 124 angelfish, and 53 pufferfish. How many fish are there in all? How might an estimate help you solve the problem? *Solve this problem any way you choose.*

0:01:44

When you are finished, turn to page 497, circle numbers 1-8, 9, 12, and 13, carefully rip it out and put it in your take-home folder.

If you finish early complete the Look Back.

Ask for Questions

The image shows a SMART Notebook interface on a classroom board. The software title is "SMART Notebook" and the menu bar includes "File", "Edit", "View", "Insert", "Format", "Tools", "Add-ons", and "Help". The main workspace contains the following text:

Thursday

A pet store has 162 goldfish 124 angelfish, and 53 pufferfish. What questions could you come up with?

In the bottom right corner, there is a digital timer showing "00:03 39" and a list of options:

- 5 minutes on your own
- 3 with a partner
- All together

On the left side of the board, there is a sign with the following text:

Outside Voice
Entire Class Can Hear You
Only People Near You Can Hear
Whisper
No Talking No Sound

On the right side, there are various classroom decorations, including a sign that says "Explore Learn DISCOVER" and a small poster with a picture of a boat.

Ask for Questions

pufferfish. What questions could you come up with?

How much more does the goldfish's has more than the angelfish?

What is the total of all fishes?

How much does the pufferfish and the goldfish have altogether?

How much does the angelfish and

Ask for Questions

What could the questions be now?

how much more is

blah blah blah than blah

blah blah?

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:

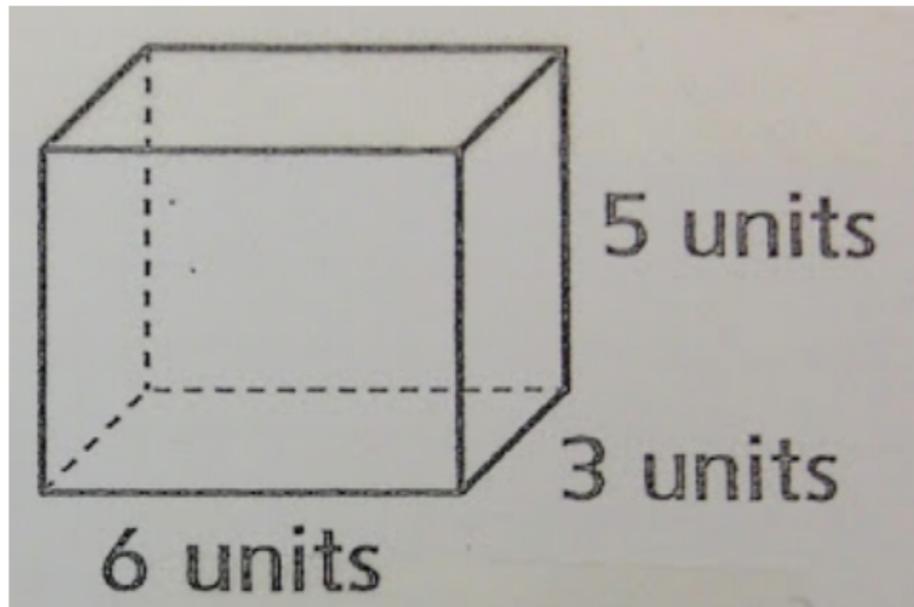
“Tell me something about number 7.”

instead of

“What's the answer to number 7?”

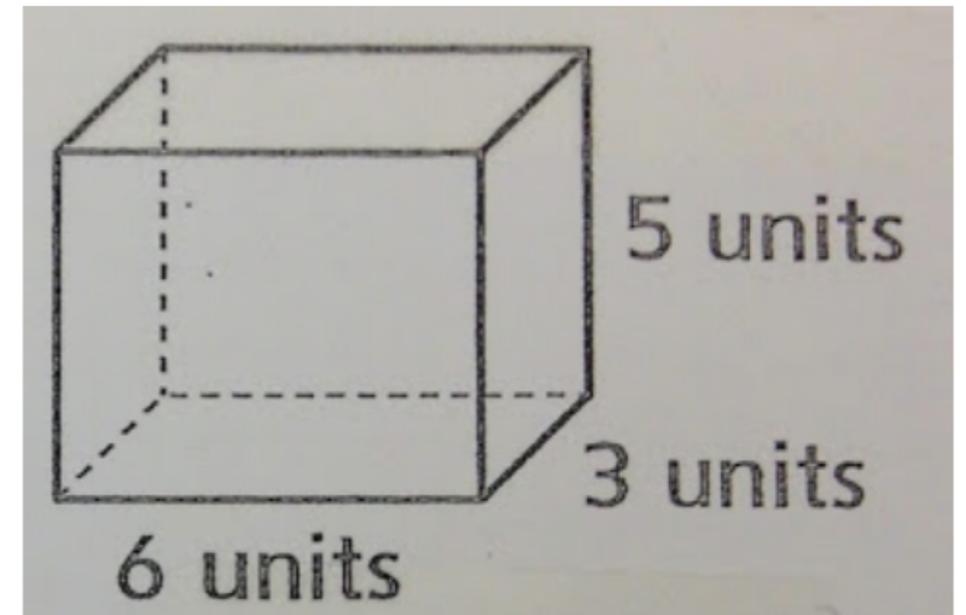
Ask About Ideas, Not Answers

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 Joe Schwartz's blog, exit10a.blogspot.com, October 10, 2016)

Ask About Ideas, Not Answers

1. Suppose 5 U.S. dollars (5 USD) can be exchanged for 64 Mexican pesos. What operation would be used to find the value of 1 USD in pesos?

division

Find the value of 1 USD in pesos. 1 USD = 12.8 pesos

Tell everything you can about this statement: 5 U.S. dollars (5 USD) can be exchanged for 64 Mexican pesos.

Teacher Questions

“Why?”

“How do you know?”

“How did you decide?”

“Tell me more about that.”

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.

Reflection Questions

Write down and/or tell your neighbor

- two sense-making strategies you're going to try in your class, or shifts you want to make in your role during math block
- two things you're wondering

Thank you!

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