# Sense Making: Is It at the **Core of Your Classroom?**

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it mear someone else an elbow partmer va CMC North Conference 2023 Pathways to Mathematical Power Asilomar (I hope you went to the beach)

A PDF of the slides will be on my blog after the session: annie.mathematicalthinking.org



### 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?



### Teresa's Tiles "Scenario"

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
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.

## Integrated Math 2 (Grade 10)

	Boy	Girl	Total
Wear Sunscreen	84	133	217
Do Not Wear Sunscreen	170	118	288
Total	254	251	505

P(wears sunscreen) P(is a boy)

P(wears sunscreen | is a boy)

P(wears sunscreen *and* is a boy) P(wears sunscreen *or* is a boy) P(is a boy | wears sunscreen)

#### P(is a boy or a girl)

# "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!!"

#### Teacher Knows Best

# $\frac{3}{4} + \frac{5}{8} = \frac{8}{12}$

## Jekyll and 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.
- 4. Right answers NOW are what matters.

# Sample Test Question Revised

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



### **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."

### We teach humans.

### "Draw a picture of the story," and what else?

# 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.

<b>I</b> Notice	l Wonder	

### Get Rid of the Question



### Get Rid of the Question

#### Male and Female Medical Doctors





Highlight, when fellow teacher sends this text: "Look what I tried today! Not bragging-just excited to share. It wasn't as scary or crazy as I thought it would go. The Notice and Wonder was very effective for what I was teaching on today." @MFAnnie @ElementarySalem @HobaughTeach2



9:22 PM - Mar 21, 2022 - Twitter for iPhone

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#### Replying to @MFAnnie

#### @MFAnnie when I gave the graph and did notice/wonder first I didn't have to answer nearly so many questions when they did the handout

5:36 PM · Nov 24, 2014 · Tweetbot for iOS

Replying to @MFAnnie

@MFAnnie worth the few minutes it took and meant we skipped wrap up discussion (they already had it) drawingonmath.blogspot.com/2014/11/distan...

5:37 PM · Nov 24, 2014 · Tweetbot for iOS

http://drawingonmath.blogspot.com/2014/11/distance-graph.html

Annie Fetter • @MFAnnie • #NoticeWonder

...

"I was so happy that they managed to figure out the story with little prompting and answer several of the questions on the handout before they even got the handout with the story and questions! They were eager to get to work on the handout when they did get it because they already understood the context. It was awesome."

—Tina

#### What's Going On in This Graph? | Dec. 6, 2023

#### How Often Teens Say They Use Each Platform



Note: Among teens ages 18 to 17. Those who did not give an answer are not shown. Figures are rounded. 
Source: Pew Research Center survey conducted April 14-May 4, 2022. 
The New York Times

#### from the NYTimes Learning Network

#### What's Going On in This Graph? | Dec. 6, 2023

 After looking closely at the graph above (or at this full-size image), answer these four questions:

- What do you notice?
- What do you wonder?
- How does this relate to you and your community?
- Create a catchy headline that captures the graph's main idea.

The questions are intended to build on one another, so try to answer them in order.



# 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, <u>bstockus.wordpress.com</u>

#### Get Rid of the Question <u>OR</u> 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 unds. Each carton has 12 eggs Each carton costs a () amount. How much does one egg weigh? (in ounces)

cattlyn realized I She needs one more ingredient I she forgot the vegetable oil The oil is sold in 2p bottles. She needs a certain Number of for the brownes. Each bottle cost a chas in amount. Caitlyn brings \$20 with her to the store. 1p 5

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

### Get Rid of the Question and the Numbers

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









#### You Need To Start a Conversation



# 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 (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

# 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 question 7." *instead of* "What's the answer to question 7?"

### Ask About Ideas, Not Answers

#### It can be a little more complex:



Tell me everything you can about this figure.

Find the volume of the rectangular prism.

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

### Ask About Ideas, Not Answers

#### It can be a little more complex:



# Ask About Ideas, Not Answers Explain everything you can about the derivative of this function.

#### 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.

### But Wait! There's More!

## Honoring Students' Ideas

#### Q: Another?

A: Launch by asking for their ideas instead of telling them things. (Just hush up for a bit!)

## Gathering Ideas as a Launch

#### Relate Pictures to Tens and Ones (1997)

MP.1 Make Sense of Problems Analyze the

Problem Discuss the pictures in Exercises 1 and 2. Count the number of cars in the first row. 10 cars Explain that drivers may be directed to fill a row before parking in the next row of a parking lot. In the same way, people may be asked to fill a row of seats before sitting in the next row at a theater.

- How can a filled row help you count the number of cars or the number of people? Possible response: A filled row shows ten, so I can use the picture to count tens and extras.
- How do the cars in Exercise 1 show tens and ones?
   2 filled rows show tens and 3 extra cars show ones.
- How do the people in Exercise 2 show tens and ones? There are 4 rows of ten with 6 extra ones. This time the ones are at the top and the tens are shown below.

Math and the Community Theater

Linda and her family go to a show.



10 cars can park in each row.



How many cors are there?

tens ones - cars

I 0 people can sit in each row.



How many people are there?

\_\_\_\_ tens \_\_\_\_ people

UNIT N 2000N H

Second in Mathematical Produces, 127

## What Do They Notice? Wonder?



### Stop Talking So Much!

#### Equality on the Number Line

To illustrate the equation 3t + 12 = 5t + 6, you can draw *t* as an unknown length. Whatever length you choose for *t*, you cannot compare it to the length of 6 or 12, because you do not yet know the value of *t*. You do know that every *t* has the same length.



The symbols above the number line show 3t + 12. The symbols below the number line show 5t + 6. The equation 3t + 12 - 5t + 6 tells you that the two expressions are equal. So, when you draw the two expressions, they can start and end at the same point on the number line.

Look at the 3t's on the left above and below the line.

3t is in each expression.



Suppose you ignore the 3t's on both the top and bottom. The 12 above the line and the 2t + 6 below the line start and end at the same point on the number line. So they must be equal.

Ignoring the 3t's above and below the line is the same as subtracting 3t from both sides of the equation. Above the line, 12 units are left over, and below the line 2t + 6 units are left over. Now you have an equation, 12 = 2t + 6, that you can solve using bactracking.

### Let Them Make Sense of Things



## Let Them Make Sense of Things



Jessica Strom @strom\_win

"We" dont give students enough credit! I had my Ss graph points for sinx & cosx, then #noticewonder about their graphs. They noticed EVERYTHING I wanted to teach them and the discussion was amazing! Thanks @saravdwerf & @MFAnnie for inspiring me! #MTBoS #iteachmath #NWMNmath

8:13 PM · Feb 15, 2019 · Twitter for Android



*Reveal Math*, Grade 4, from McGraw Hill



# Ways to Honor Students' Ideas

- Get rid of the question.
- Get rid of the question *and/or* the numbers.
- Ask for questions.
- Ask about ideas, not answers.
- Gather their ideas as a launch instead of talking at them.

#### Your students all have valid mathematical ideas about pretty much every problem or story.

Your job is to help them believe that.

#### In addition to eliciting and honoring students' ideas, your job is to monitor for sense making All. The. Time.

# Are We All Doing This?

Susie Hakånsson: *Increase Underserved Students' Mathematical Agency by Using Equity Commentators in Lesson Study* (at the Indianapolis Regional NCTM in 2022)

> "Teachers are designing lessons for students to show their brilliance."

### Learn More, Start Conversations

- <u>Sense-Making: Aren't We Already Doing That in Literacy?</u> (5 minute Ignite video)
- <u>The Hurrier I Go, the Behinder I Get</u> (5 minute Ignite video)
- Emily and the Kindergartners (blog post)
- <u>#NoticeWonder Love</u> (blog post)
- Noticing and Wondering in Elementary School (blog post)
- Noticing and Wondering in High School (blog post)
- <u>Can Novices Do #NoticeWonder?</u> (blog post by me and a student teacher)
- Search Twitter for #NoticeWonder
- Search the web for Notice and Wonder
- NCTM Members can check out my June 2021 webinar, "<u>It All</u> <u>Starts with Noticing and Wondering</u>"

#### Take a Moment to Reflect

#### Write down:

# What's one thing you *noticed* in these ideas?

What's one thing you're wondering?

(Remember to send me some - email or Twitter)

## Wonderings?

#### Thank you! Don't forget to leave feedback: (this is session 500)



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Reminder that a PDF of the slides will be on my blog shortly: <u>annie.mathematicalthinking.org</u>