The Power of Students' Ideas in the Math Classroom

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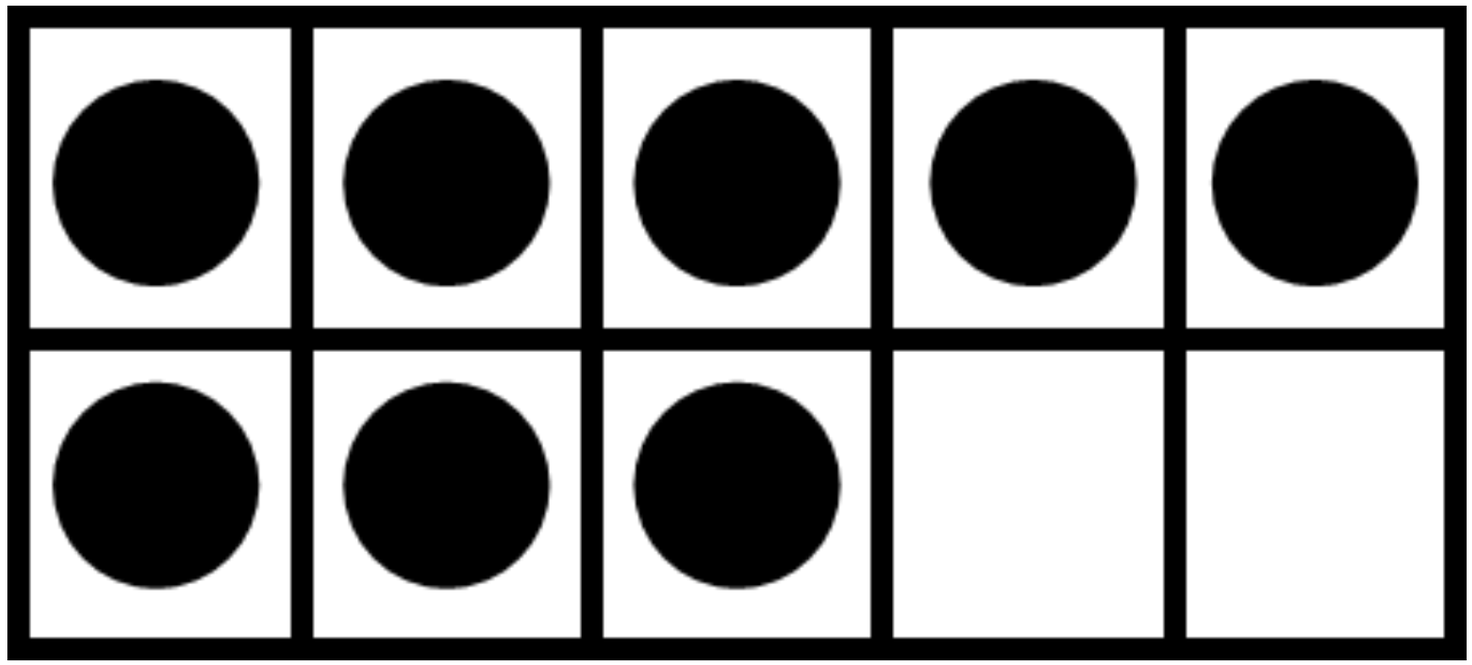
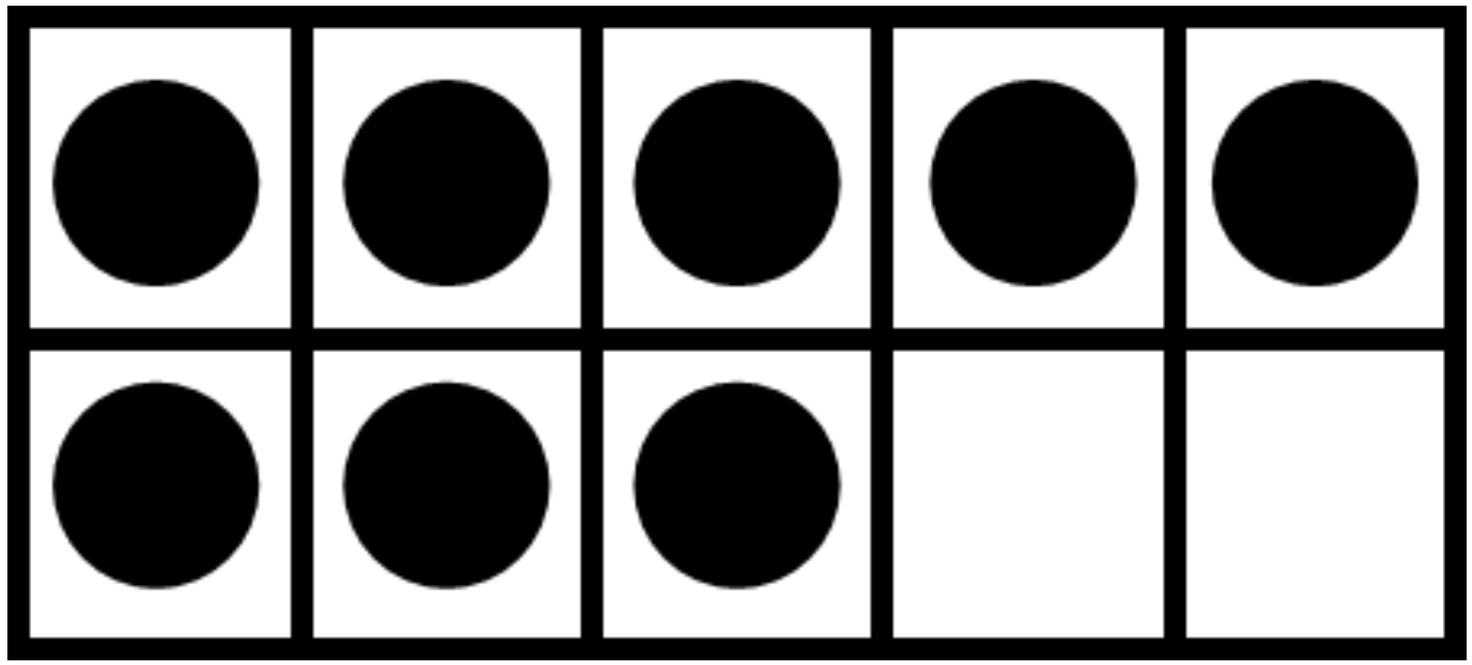
Slides and links to related resources will be available on my blog after the talk:

annie.mathematicalthinking.org

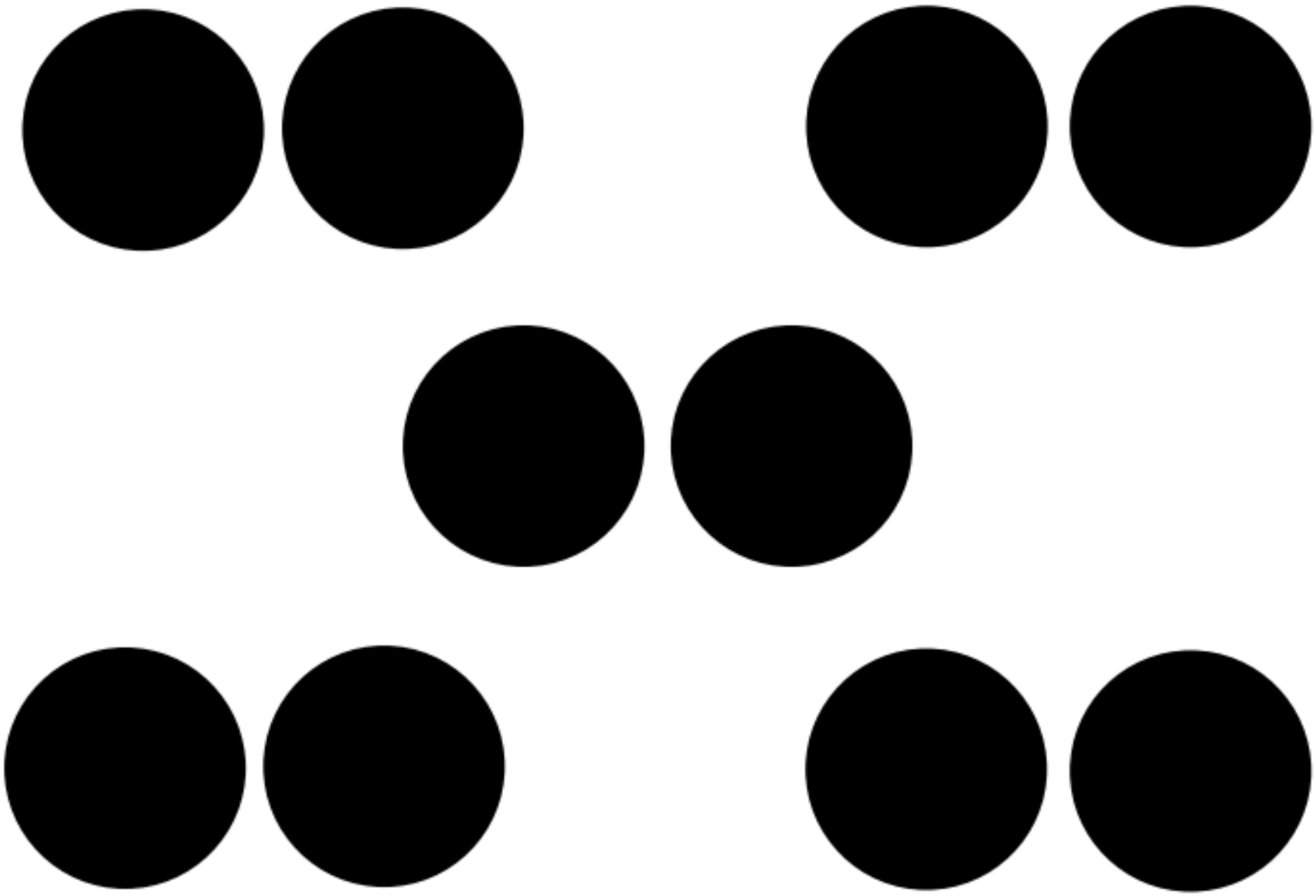
Let's Count!

Put your thumb up when you have an answer and are ready to describe how you figured it out.





- Put your thumb up when you have an answer and are ready to describe how you figured it out.
- Add another finger for every other way you see that it could be figured out.



How Many?

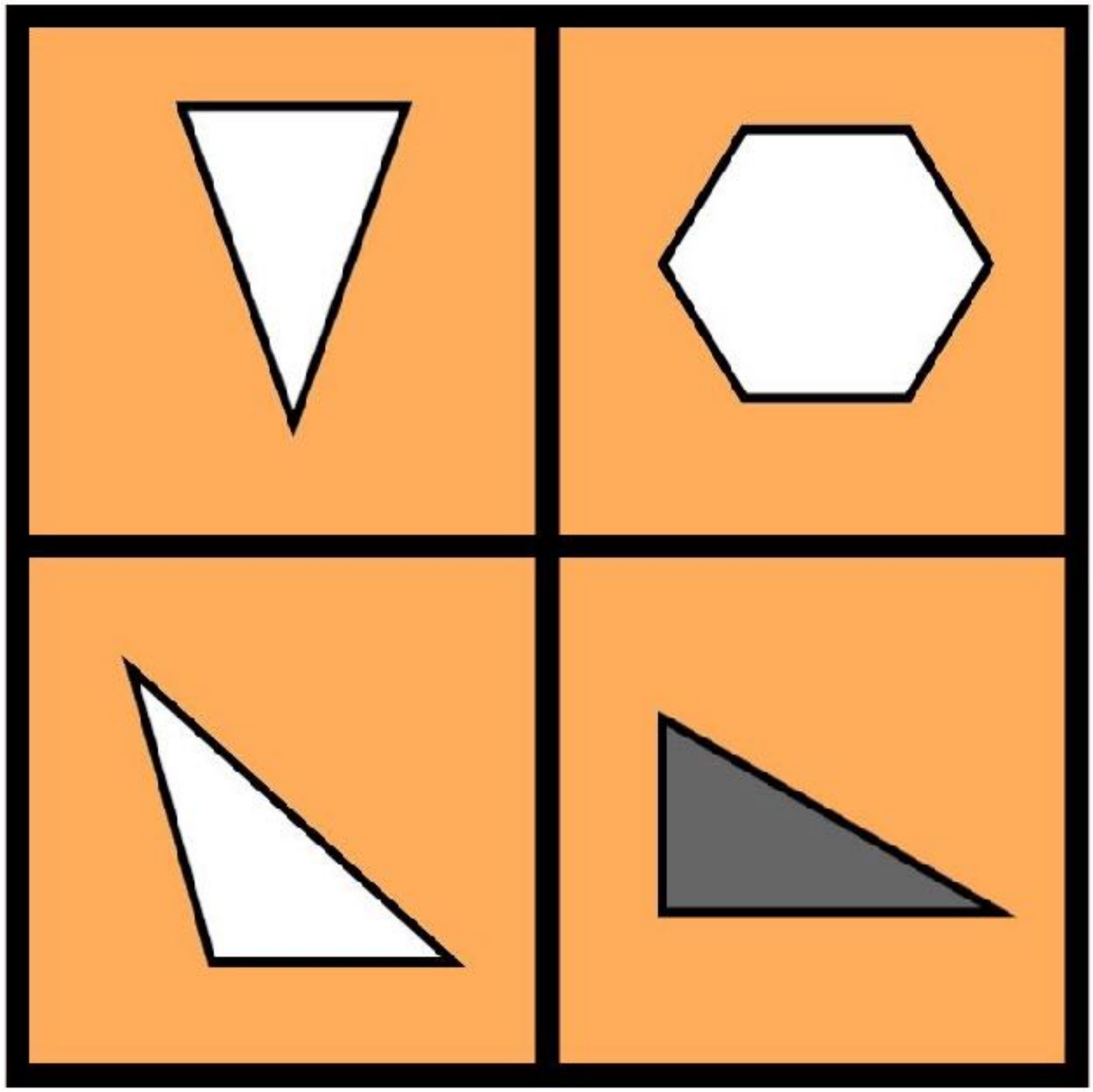
How Did You Count?

15 + 16

26 + 49

Number Talks

9	16
25	43



Which One Doesn't Belong?

Check out http://wodb.ca

Routines That Focus on Ideas

- How Many? How Did You Count?
- Number Talks
- Which One Doesn't Belong?

I used to think my job was to teach students to see what I see. I no longer believe this. My job is to teach students to see; and to recognize that no matter what the problem is, we don't all see things the same way. But when we examine our different ways of seeing, and look for the relationships involved, everyone sees more clearly; everyone understands more deeply.

—Ruth Parker

Grade 3 State Test Problem

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.

CCSS Mathematical 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.

As young teachers, we believed our job was to carefully explain what we knew about mathematics to our students. We asked questions and listened to our students' answers but our listening was aimed at assessing whether our students got what we had explained rather than uncovering their understanding of the content.

We now see that we missed valuable opportunities to develop students' understanding because we did not elicit their ideas or relate their ideas to the content we were teaching.

—Susan B. Empson and Linda Levi
Extending Children's Mathematics: Fractions and Decimals

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

You have 7 cups of dog food. You use two-thirds of a cup of food at each meal.

Get Rid of the Question

Relate Pictures to Tens and Ones

MATH TALK

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.

1. 10 cars can park in each row.

How many cars are there?

_____ tens _____ ones = _____ cars

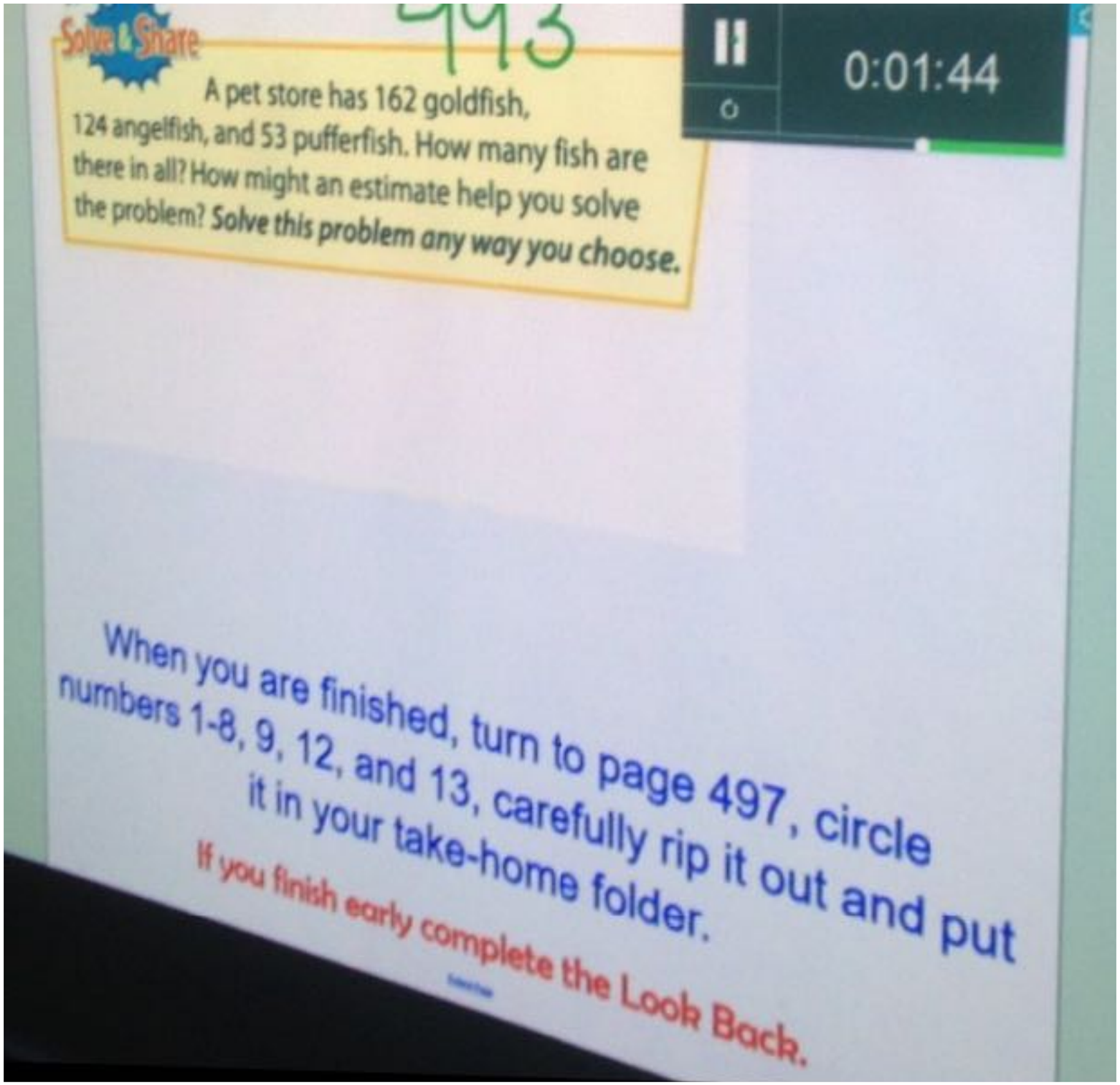
2. 10 people can sit in each row.

How many people are there?

_____ tens _____ ones = _____ people

Get Rid of the Question

Ask for Questions, Not Answers



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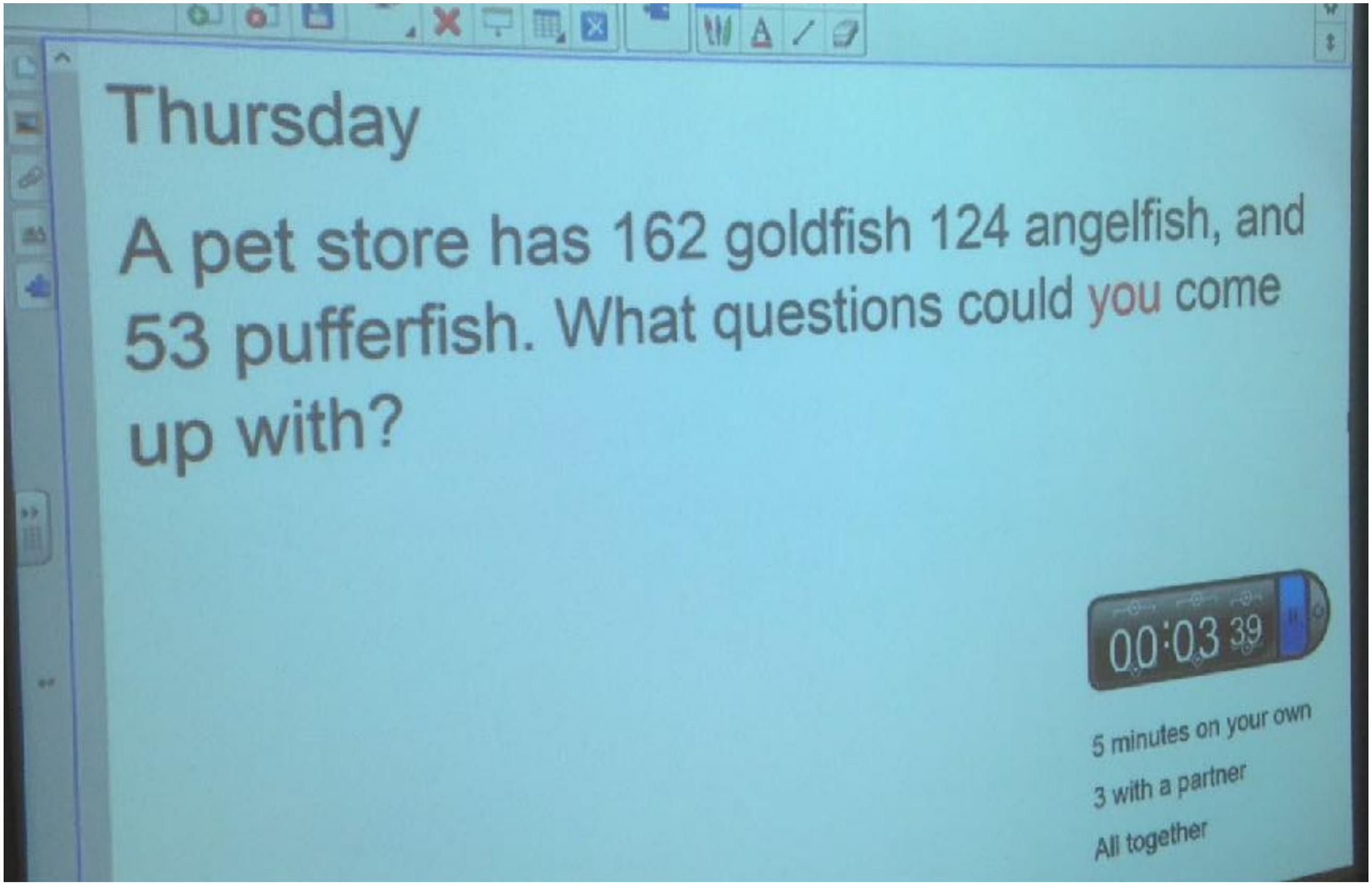

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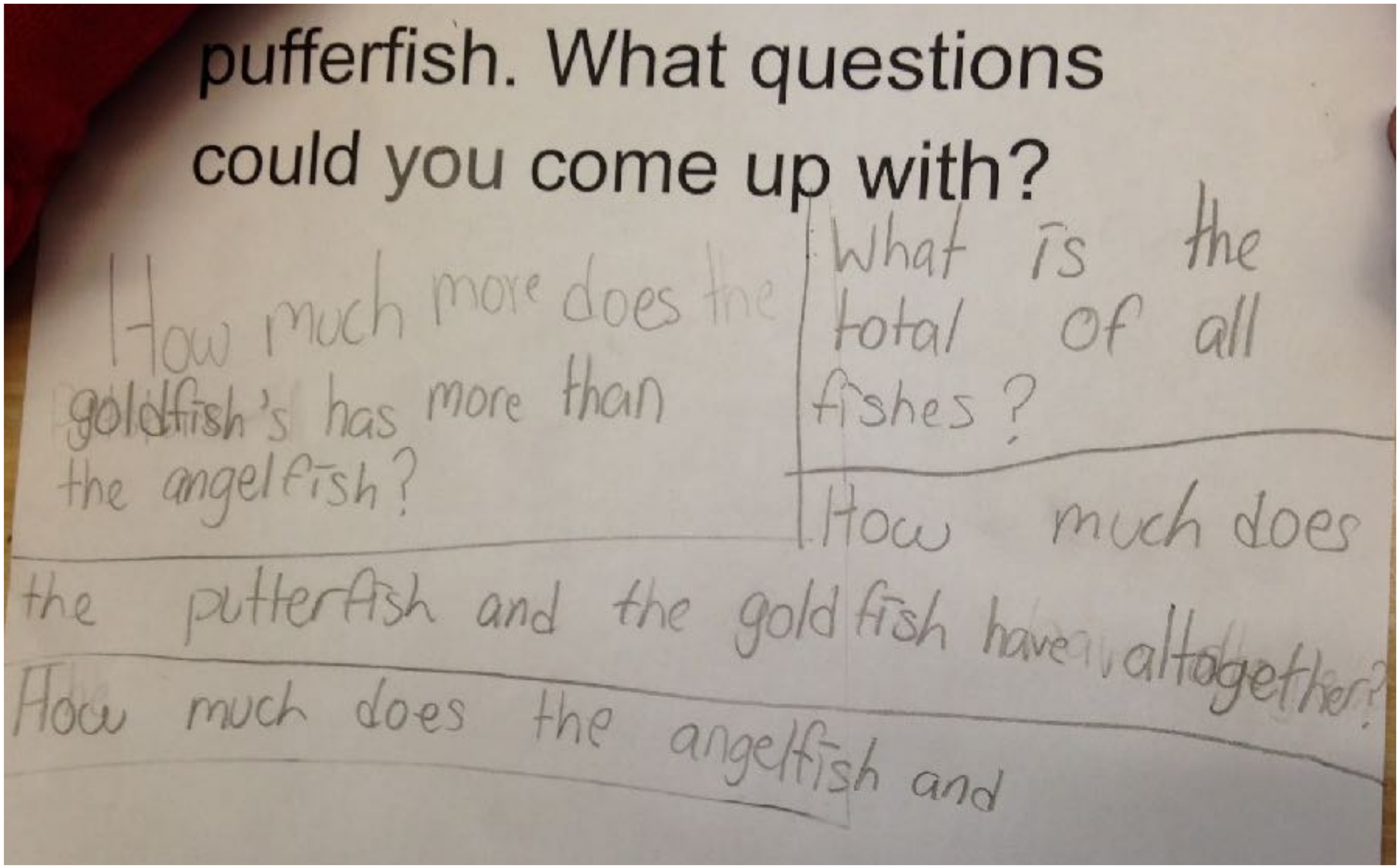

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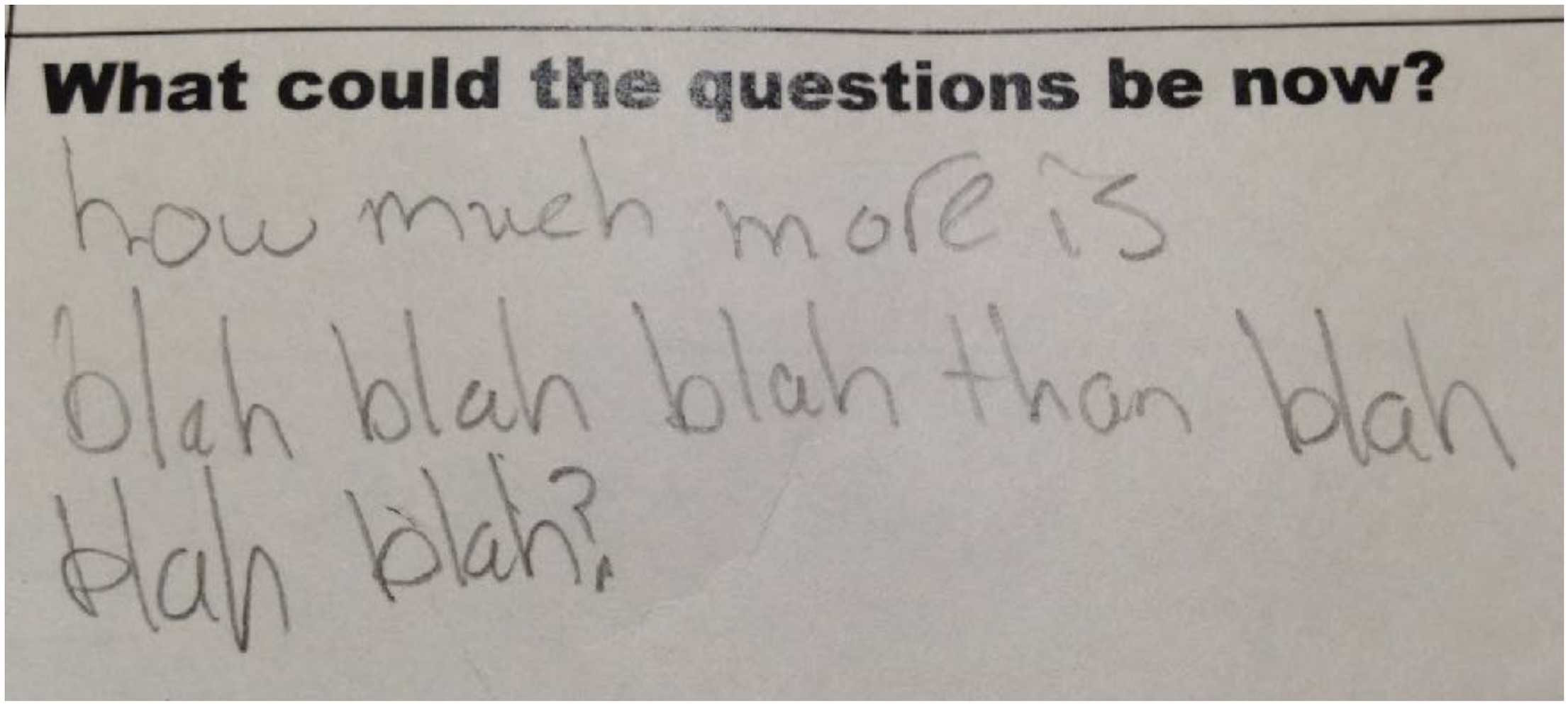


Encouraging Sense-Making

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

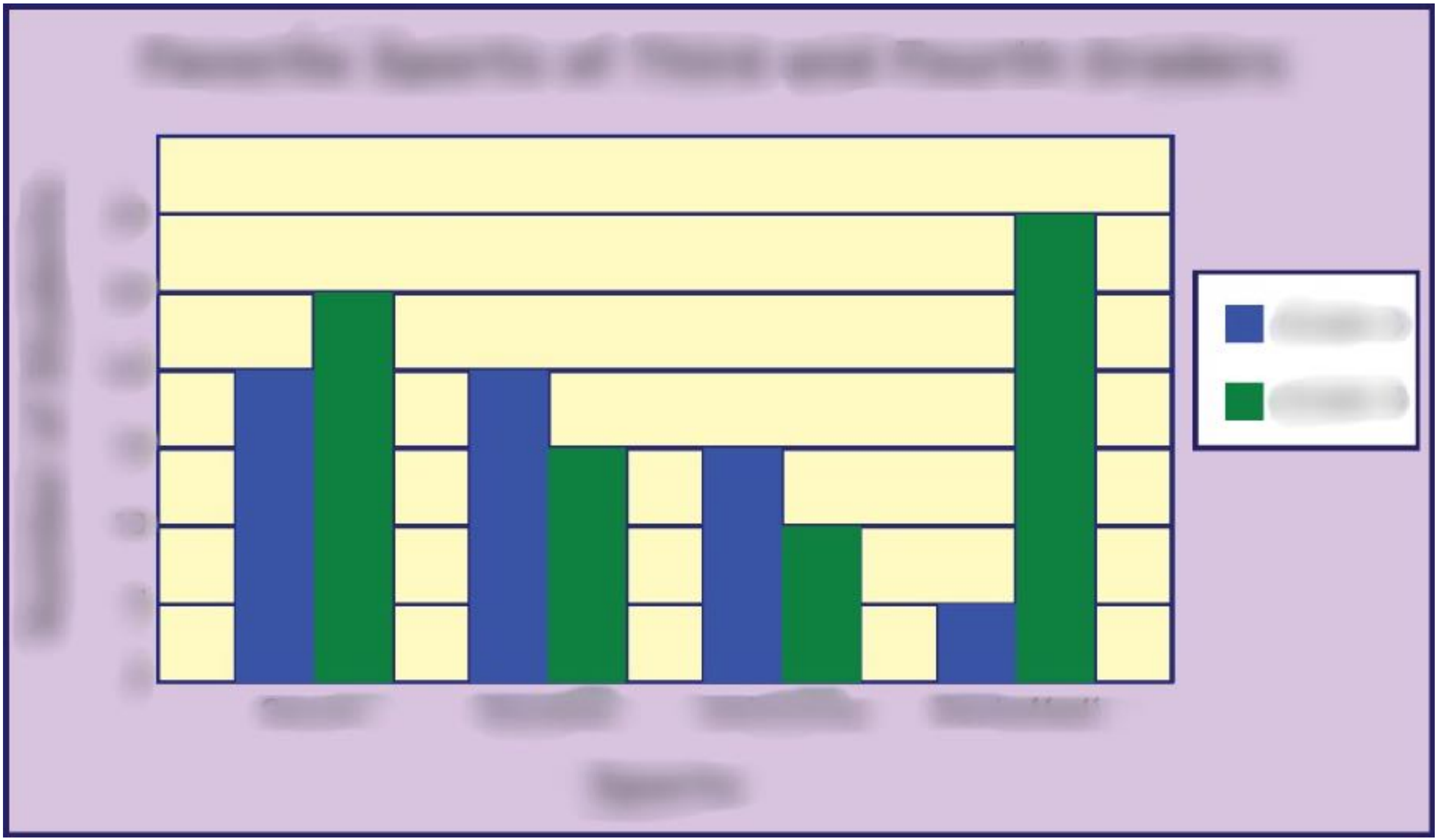
A: Get rid of the question *and/or* the numbers.

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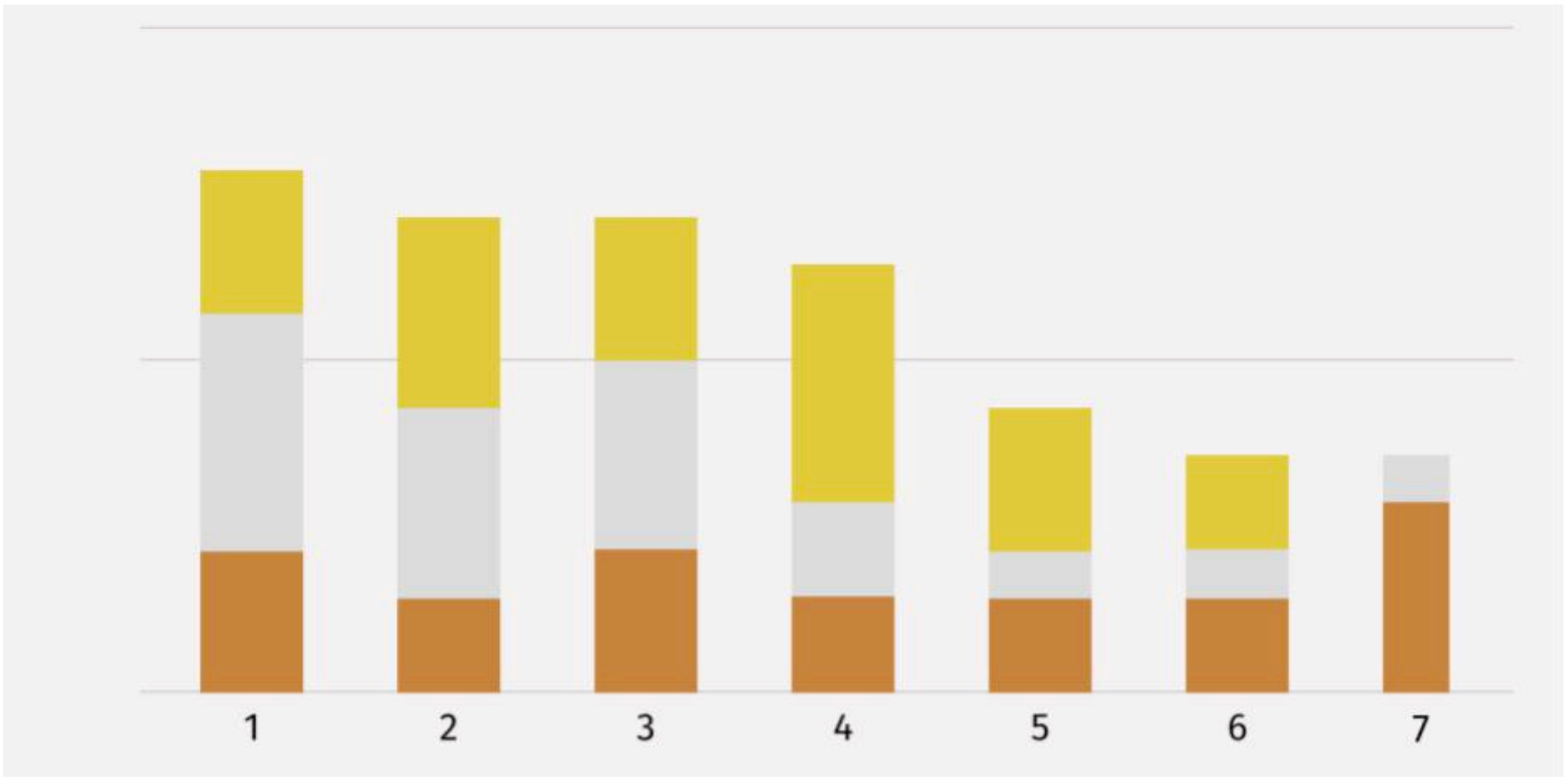

from John Stevens @Jstevens009

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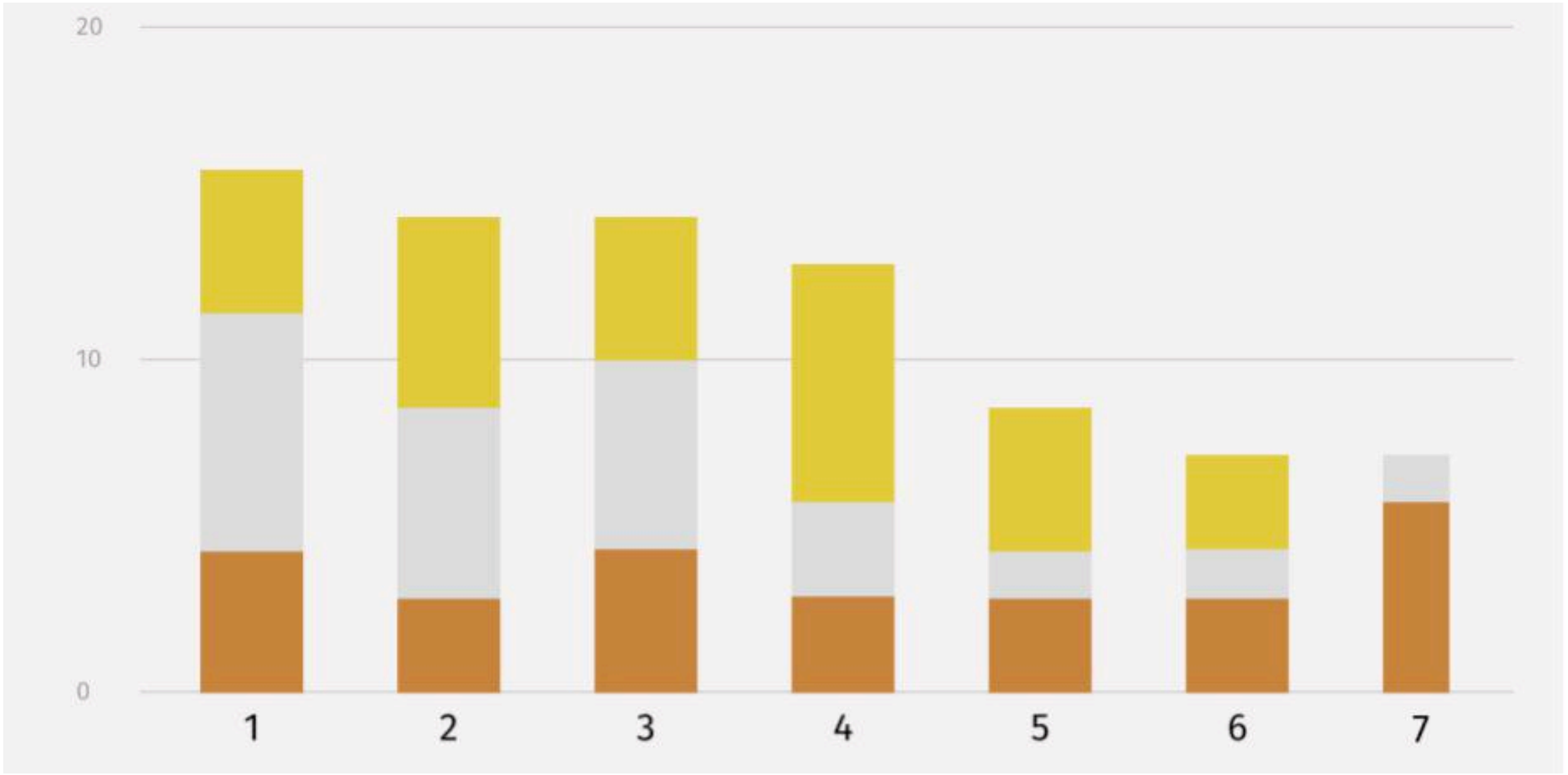

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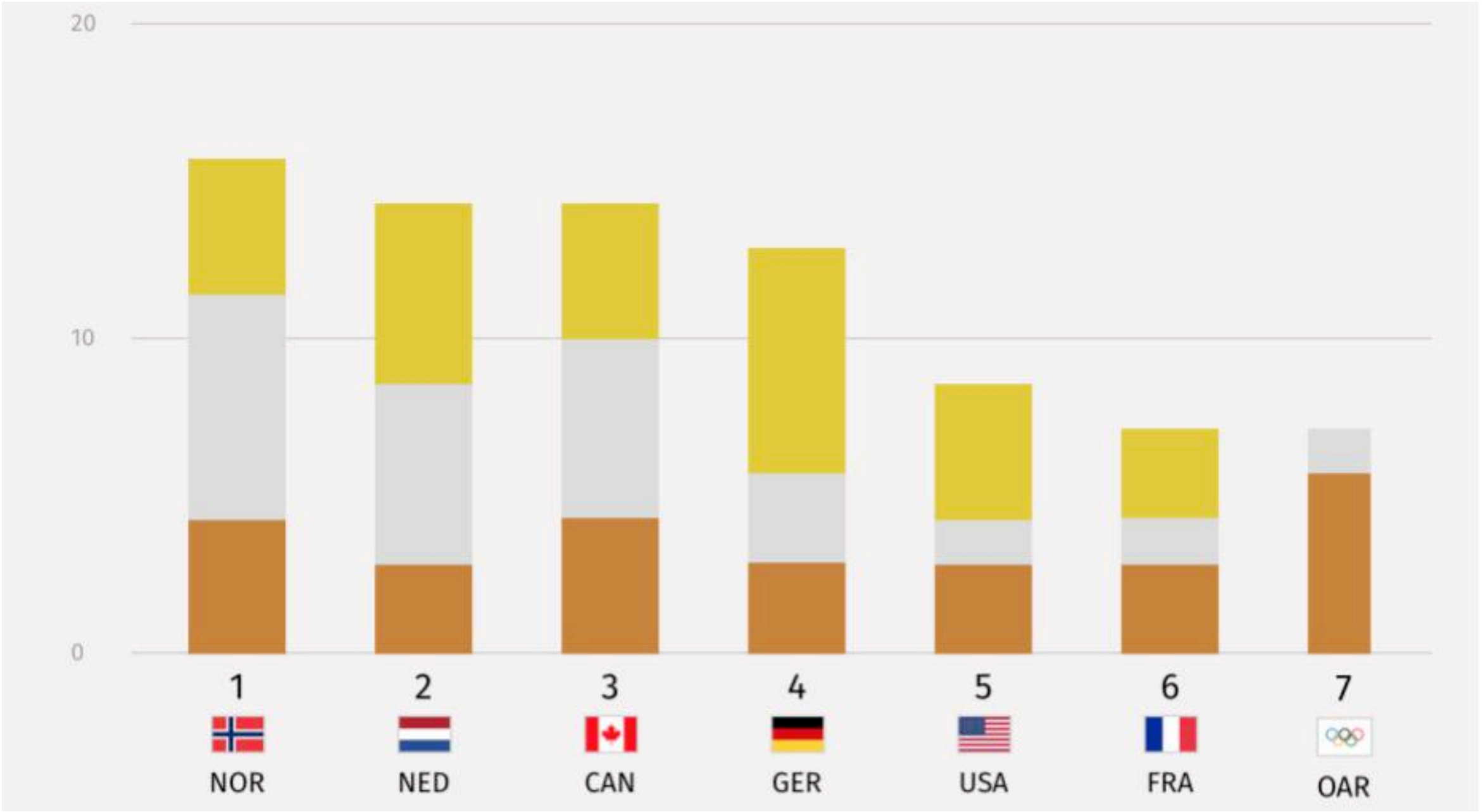
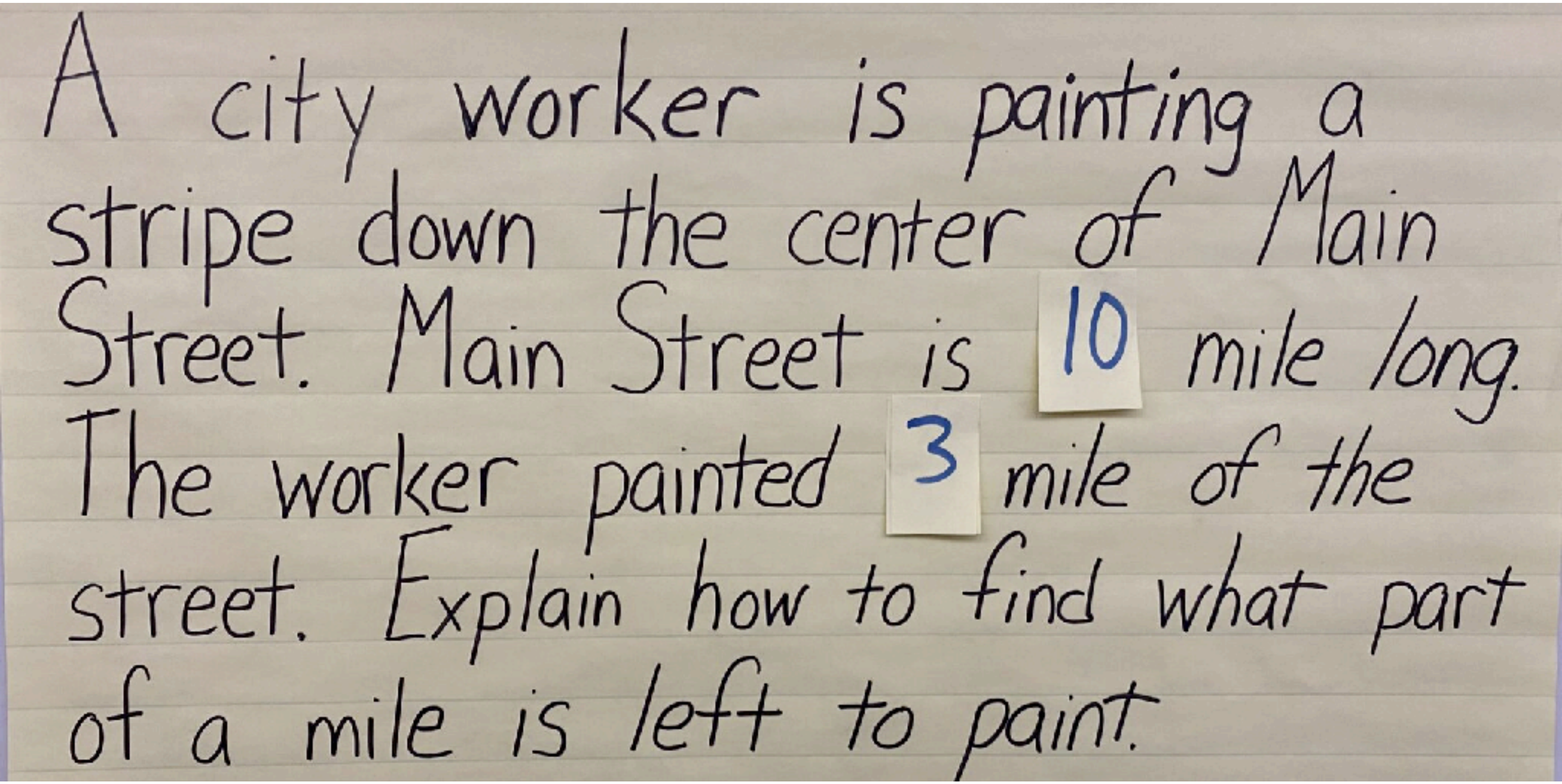


Get Rid of the Numbers...

A city worker is painting a stripe down the center of Main Street. Main Street is ____ mile long. The worker painted ____ mile of the street. Explain how to find what part of a mile is left to paint.

...or Use Nicer Ones



Get Rid of the Numbers, or Use Nicer Ones

A city worker is painting a stripe down the center of Main Street. Main Street is $\frac{8}{10}$ mile long. The worker painted $\frac{4}{10}$ mile of the street. Explain how to find what part of a mile is left to paint.

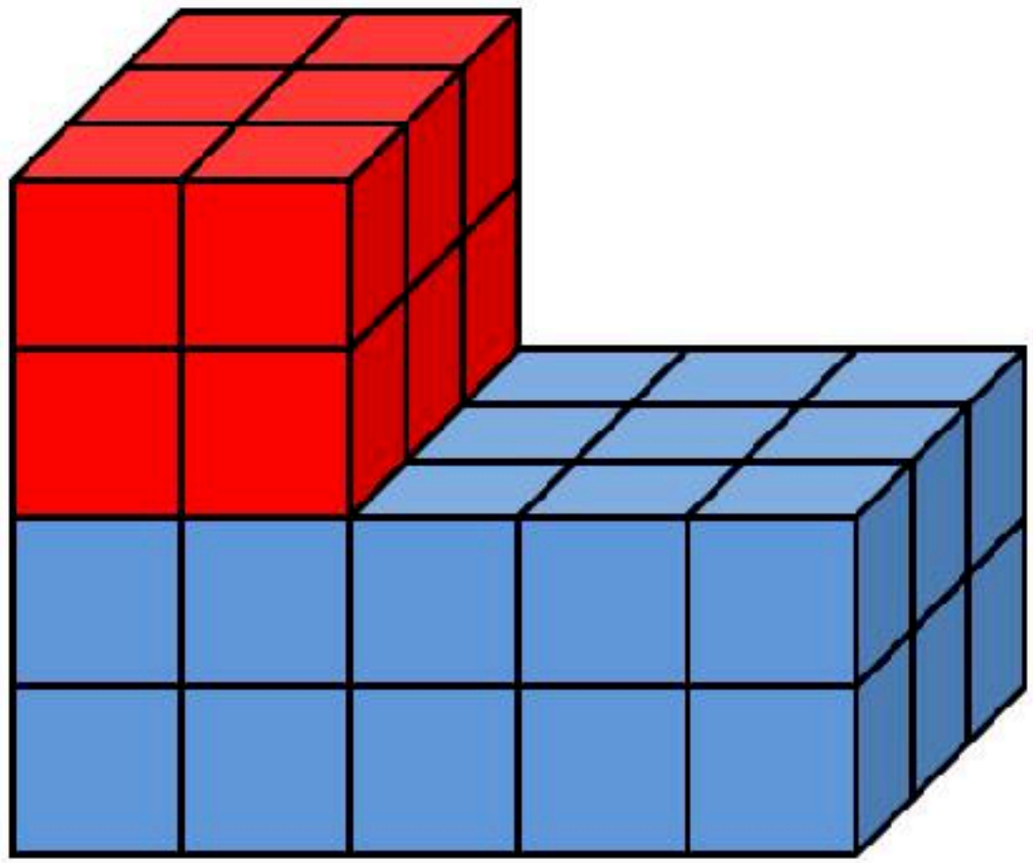
Encouraging Sense Making

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

A: Give the answer and let the students do the work.

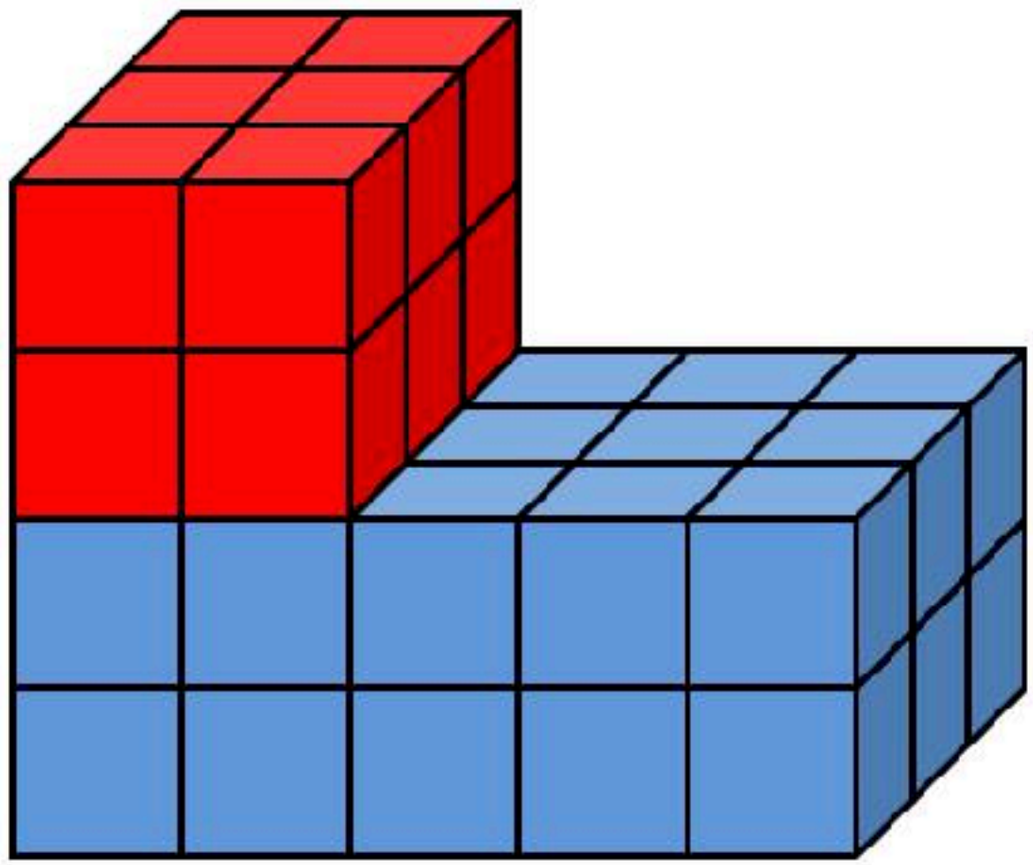
Give the Answer

What is the volume?



42 cubic units

Give the Answer



42 cubic units

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?

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?"

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.

Reflections & Questions

Thank you!

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