
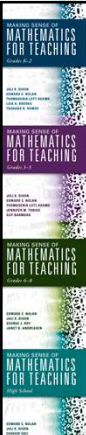


Making Sense of Mathematics for Teaching

Amplifying Students' Mathematical Brilliance: Empowering Student Voice Through Fraction Exploration



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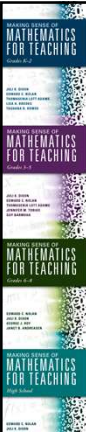


What is the story?

$$\frac{5}{6} + \frac{2}{3}$$

Create a story that represents the expression

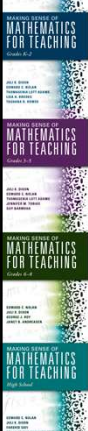
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Session Goals

- Examine how fraction and ratio concepts are developed in rigorous standards.
- Explore how different representations impact the understanding of fractions and ratios.
- Explore how to encourage and support student voice in mathematics classrooms


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Explore...

What part of a yellow hexagon is 5 green triangles and 2 blue rhombuses?

Link to [Pattern Blocks](#)

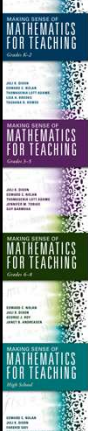


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What about these?

- Connor got five baskets out of six tries in the first game of the season. He made two out of three baskets in the second game. How would you describe how he did over both games combined?
- Nate ate $\frac{5}{6}$ of a pizza and his sister Nancy ate $\frac{2}{3}$ of the same size pizza. How much pizza did they eat?

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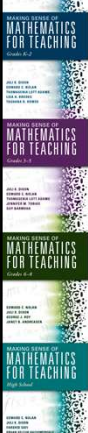


What if we asked students to create a story for $\frac{5}{6} + \frac{2}{3}$?


What type of story do you think they would create?

In what ways would this create opportunities for student voice vs. giving them a "story problem" to solve?

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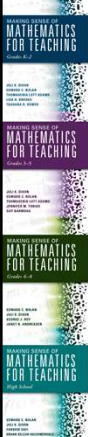


Plan with the TQE Process in Mind



- **Tasks** connect to learning goals and help identify student errors.
- **Questions** elicit mathematical understandings and common errors.
- **Evidence** drives scaffolding and guides extensions.

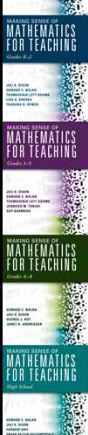
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Five Instructional Shifts

1. Students provide strategies rather than learning them from the teacher.
2. Teacher provides strategies “as if” from students.
3. Students create the context.
4. Students do the sense making.
5. Students talk to students.

(Dixon, 2019)
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Discourse Norms

- Provide explanations and justifications with solutions.
- Make sense of others' solutions.
- Communicate when you don't understand or don't agree.

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Identifying the **whole**,
the **part**, and the
fraction

Teacher Hat:
As you solve these
problems, think
about how they
might help
students'
understanding of
fractions and ratios




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Using an Area Model

Consider how to tell the “**whole**”
story with pattern blocks.

Now use 2 yellow hexagons
as the whole.




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Using an Area Model

What **fraction** is represented by
each **part**:

- 4 blue rhombuses? 2 rhombuses?
- 2 green triangles? 9 triangles?

What other fraction questions could
you ask?




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Using an Area Model

Consider how to tell the **“whole”** story with pattern blocks.

Now use 1 red trapezoid and 1 blue rhombus as the whole.




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Using an Area Model

What **fraction** is represented by **2 red trapezoids**?

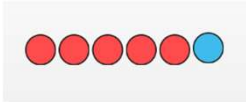
What other **fraction** questions can you ask?



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Using a Set Model

Determine the **whole** given the **parts** using **two color counters**.

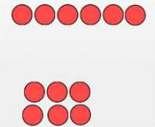


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Using a Set Model

Determine the **whole** given the **parts** using two color counters.

If **6 counters** represent $\frac{2}{3}$ of the whole set, how many counters are in the **entire set**?

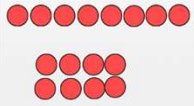


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Using a Set Model

Determine the **whole** given the **parts** using two color counters.

If **8 counters** represent $\frac{4}{5}$ of the whole set, how many counters are in the **entire set**?

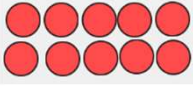


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Using a Set Model

Determine the **whole** given the **parts**.

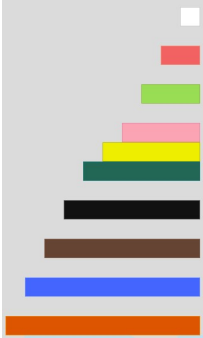
If **10 counters** represent $\frac{2}{9}$ of the whole set, how many counters are in the **entire set**?



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Using a Length Model

Determine the **whole** given the **part** and **fraction** using Cuisenaire rods



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Using a Length Model

Determine the **whole** given the **part** and **fraction** using Cuisenaire rods

If **light green** represents $\frac{1}{3}$, what color is the **whole**?

If **brown** represents $\frac{4}{5}$, what color is the **whole**?

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Using a Length Model

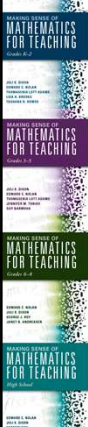
Determine the **part** or **fraction** given the **whole** using Cuisenaire rods

If dark green is the **whole**, what **color** represent $\frac{2}{3}$?

If dark green is the **whole**, what **color** represent $\frac{3}{2}$?

If dark green is the **whole**, what **fraction** is the **blue rod**?

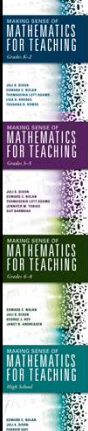
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Using Models

How might students' understanding of fractions and ratios influence their performance with this task?

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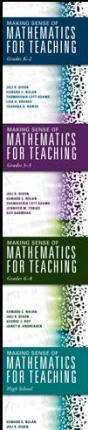
Reflection

- How do the tasks and representations help provide opportunities for discourse and support the discourse norms?

Discourse Norms

- Provide explanations and justifications with solutions.
- Make sense of others' solutions.
- Communicate when you don't understand or don't agree.

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Equivalent Fractions and Equivalent Ratios

Use a diagram to find a quantity equivalent to $\frac{3}{4}$.

Try to use an area model, a set model, and a length model.

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Formalize Equivalence

Use a procedure to find a quantity equivalent to $\frac{3}{4}$.

Work with your group to use your pictures to explain and justify the procedure you used.

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Formalize Equivalence

How does this picture represent equivalence?

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Formalize Equivalence

Use a procedure to find a quantity equivalent to $\frac{3}{4}$.

Now represent the procedure you used with two-color counters.

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Formalize Equivalence

Which representation would you use to support students to make sense of the algorithm for finding equivalent quantities? Support your thinking.

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Formalize Equivalence

Now, repeat the same process with $6/9$.

- Use a diagram to find an equivalent fraction.
- Use a procedure to find an equivalent fraction.
- Make connections between your diagram and procedure.
- Show the procedure two-color counters.

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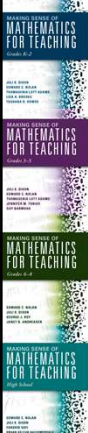
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Now, repeat the same process with $6/9$.

- Use a diagram to find an equivalent fraction.
- Use a procedure to find an equivalent fraction.
- Make connections between your diagram and procedure.
- Show the procedure two-color counters.

What was different about beginning with a fraction not in lowest terms? What would the set model or the part-part representation add to students' understanding of fractions and ratios?

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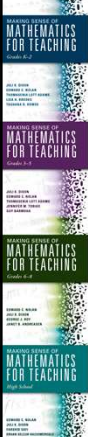
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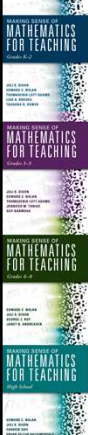


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Session Goals

- Examine how fraction and ratio concepts are developed in rigorous standards.
- Explore how different representations impact the understanding of ratios.
- Apply ratios to real world situations.

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