
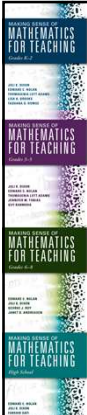


Making Sense of Mathematics for Teaching

**Amplifying Students' Mathematical Brilliance:
Centering Student Voice to Formalize Fraction Concepts**



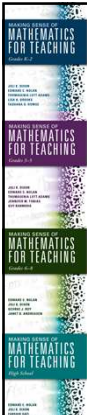
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Session Goals

- Examine how fraction and ratio concepts and procedures are developed with understanding.
- 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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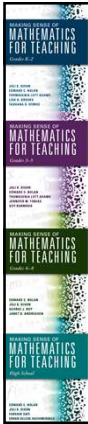


Plan with the TQE Process in Mind



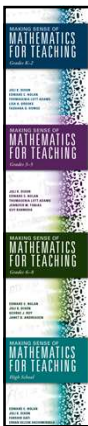
- **Tasks** connect to learning goals and help identify student errors.
- **Questions** elicit mathematical understandings and common errors.
- **Evidence** drives scaffolding and guides extensions.

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Comparing Fractions and Comparing Ratios

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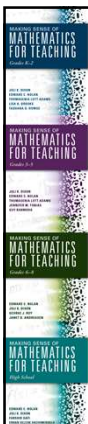
Comparing Fractions and Ratios

Compare these quantities using the set model.

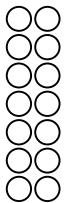
$$\frac{3}{7} \text{ and } \frac{6}{13}$$

Discuss the process you used with someone near you.


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Compare Sets



$$\frac{3}{7} = \frac{6}{14}$$



$$\frac{6}{13}$$

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MATHEMATICS FOR TEACHING

Compare Sets

$\frac{3}{7} = \frac{6}{14}$ $\frac{6}{13}$

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Comparing Fractions and Ratios

Compare these quantities using the set model.

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

Discuss the process you used with someone near you.

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Compare Sets

$\frac{5}{6}$ $\frac{2}{3} = \frac{4}{6}$

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MATHEMATICS FOR TEACHING

Compare Sets

$\frac{2}{3} = \frac{4}{6}$

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Formalize Comparison

Compare these quantities without using manipulatives.

$\frac{11}{15}$ and $\frac{17}{30}$

$\frac{7}{9}$ and $\frac{21}{25}$

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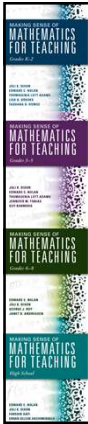
Formalize Comparison

Explain and justify the process you used with someone near you.

$\frac{11}{15}$ and $\frac{17}{30}$

$\frac{7}{9}$ and $\frac{21}{25}$

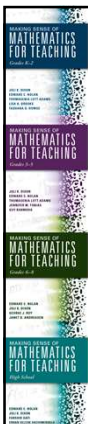
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Fraction Operations

- What tasks might provide opportunities for students to make sense of fraction operations?
- Let's explore the case of fraction division!

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The Pizza Sale Task: Version 1

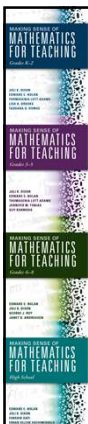
Douglas ordered 5 pizzas at the Great Pizza Sale. He decides to freeze the pizza in serving-sized bags. How many servings can he make if he uses up all the pizza and a serving size is:

$\frac{1}{3}$ of a pizza? $\frac{1}{5}$ of a pizza

$\frac{2}{3}$ of a pizza? $\frac{3}{5}$ of a pizza?

Can you come up with a short-cut to determine the number of servings for any size serving a/b ?

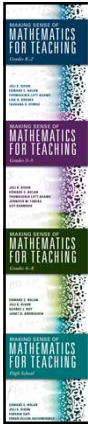
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Reflecting on the Task

- In what mathematical content did you engage?
- In what mathematical processes did you engage?
 - What types of thinking and reasoning did the task elicit?
- In what ways did the task encourage student voice?

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Revisiting the Task

How would your experience with the opening task have been different if it looked like this:

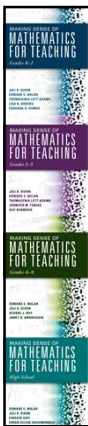
Solve:

1) $5 \div \frac{1}{4} =$

2) $5 \div \frac{2}{3} =$

3) $5 \div \frac{3}{5} =$

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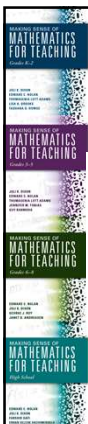


The TQE Process



- Select appropriate **T**asks to support identified learning goals,
- Facilitate productive **Q**uestioning during instruction to engage students in the Mathematical Practices, and
- Collect and use student **E**vidence in the formative assessment process during instruction.

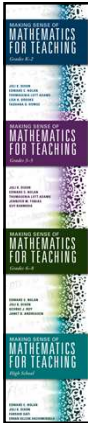
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The Pizza Sale Task, Version 2

Douglas ordered 5 small pizzas during the great pizza sale. He ate $\frac{1}{8}$ of one pizza and wants to freeze the remaining $4 \frac{7}{8}$ pizzas. Douglas decides to freeze the remaining pizza in serving-size bags. A serving of pizza is $\frac{2}{3}$ of a pizza. How many servings can he make if he uses up all the pizza?

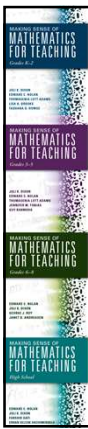

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Formalizing Fraction Operations

- How did the first version of the Pizza Sale task support you to think about fraction division?
- How did the second version of the Pizza Sale Task support you to think about fraction division?
- How do the tasks support students to understand and (eventually) formalize fraction division?

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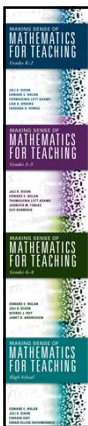




Reflections (Look Fors)

How did the teacher set up the lesson to support mathematical discourse?

What did you observe about the ways students engaged in mathematical discourse?

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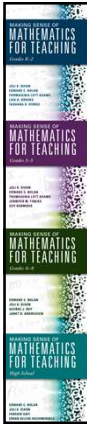



Five Instructional Shifts

How did we see the Five Shifts in the videos?

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

How did we see these norms in the videos?

- 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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Session Goals

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

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