

Young and Reckless. A Teacher Cohort Studies the Messiness of Inquiry-based Math

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Highlights for the Demonstration Teacher Study Group

- Expert in elementary mathematics brought in to take master teachers to a new level
- Intentional lesson planning with expert for a group observation
- Day of lesson: pre-brief, lesson demo, post-brief
- Journals kept and collected
- Study educational research together
- Teachers reflections through surveys and interviews.
- Reading topics for Demonstration Teachers

Sample of readings for teacher discussions

- Clements, D. (1999). Concrete manipulatives, concrete ideas. *Contemporary Issues in Early Children*, 1, 45 – 60.
- Boaler, J. (2015). Fluency without fear. <https://www.youcubed.org/evidence/fluency-without-fear/>
- Foote, M. Q. (2008). Addressing the needs of the struggling learners. *Teaching Children Mathematics*, 14, 340 -343.
- Gersten, R. & Clarke, B. (2007) Effective Strategies for Teaching Students with Difficulties in Mathematics. NCTM Research Brief.
- Karp, K., Bush S., Dougherty B.J. (2014). 13 Rules that expire. *Teaching Children Mathematics* 21, 18-25.
- Munson, J. (2018). Two instructional moves to promote student competence. *Teaching Children Mathematics*, 24, 244 -249.
- Smith, M.S., Hughes E., Engle R., Stein M. (2009). Orchestrating Discussions. *Teaching Children Mathematics*, 14, 549 -556.



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- Embrace Inclusion
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Name: _____

There was $\frac{1}{2}$ of a tub of ice cream in the freezer. Ashley came into the kitchen and ate $\frac{1}{2}$ of what was in the tub.

How much is left of the whole tub?

Share your thinking with pictures, numbers, and words.

Must complete the other side first:
Challenge

Ashley's little brother, Jackson, entered the kitchen and ate $\frac{2}{3}$ of what was left in the tub.

How much of the whole tub did Jackson eat?

Share your thinking with pictures, numbers, and words.

Ashley's mom enters the kitchen and wants to eat $\frac{1}{6}$ of the tub of ice cream. Will there be enough for her to eat her share? Why or why not?

Share your thinking with pictures, numbers, and words.

Ice Cream Problem

Fifth Grade- Multiplying Fractions of Fractions

Background

We have worked on multiplying fractions of a whole number this year, but this was our first attempt at solving fractions of fractions.

Start by brainstorming a list of manipulatives that we have available in order to encourage the usage of them in today's lesson.

Present the Problem

- Present students with the first problem, without the question. Have them turn and talk about what they know and what they wonder. Give prompts, "I know..." and "I wonder..." Then share out whole class.
- Show the problem with the question. Tell students that they may use manipulatives, but they must draw a picture of their model.

Students begin working on Question 1 in partners.

Possible Misconceptions (Q1)

- $1/2 - 1/2 = 0$
- $1/2$ of $1/2 = 1/2$ (Students are ignoring the whole)
- $1/2$ of $1/2 = 1/3$ (Students do not have equal sized parts)

Questions to Ask during Conferring (Q1)

- How did you choose this model//tool?
- Can you draw a picture of the story?
- How much of the whole tub did she eat?
- What does [this part] of your model represent?

Students begin working on Question 2 when they finish Question 1.

Possible Misconceptions (Q2)

- There is no ice cream left in the tub. Let's look back at Question 1.
- He ate $2/3$ of the tub. (Students are ignoring the whole)
- He ate $2/6$ of the tub. (Students do not have equal sized parts)
- Students are trying to use subtraction, which is what we have worked a lot on this year.
 $1/4 - 2/3 = 3/12 - 8/12 = -5/12$ (Does that make sense?)

Questions to Ask during Conferring (Q2)

- What does [this part] of your model represent?
- Does this mean that he ate $2/3$ of the tub?
- Are your parts all the same size?
- Does your answer make sense?
- Could you use a drawing or manipulatives to show your thinking?

Students begin working on Question 3 after finishing Question 2.

Possible Misconceptions (Q3)

- Students think it is asking for $\frac{1}{6}$ of $\frac{1}{12}$. (Attend to precision when reading.)
- Think $\frac{1}{12}$ is greater than $\frac{1}{6}$ because 12 is a bigger number.

Questions to Ask during Conferring (Q3)

- How much ice cream is left after Jackson eats?
- What is the question asking?
- How can you use a drawing or manipulatives to show your thinking?

Extension (as needed): Create your own word problem involving fractions of fractions.

Student Share (5-10 minutes)

- Intermittently during work time, have students share their models in pairs with other students to help with misconceptions throughout the lesson.
- Whole group share- choose specific students to share a variety of models/tools with the class. *The students should be doing a majority of the talking. The teacher is the facilitator at this point.*
- How/why did you choose this model?
- What does [this part] represent?
- Why do we have to split up ice cream that isn't there?

Teach (5-8 minutes) Uncover an anchor chart step-by-step.

$\frac{1}{2}$ of $\frac{1}{2}$ is telling us to do $\frac{1}{2} \times \frac{1}{2}$. Show an array using a sticky note to be 1 unit. Draw in and label the area model for $\frac{1}{2} \times \frac{1}{2}$.

Connect this to:

2 groups of 2 = 2×2 . Show an array using 2 sticky notes by 2 sticky notes = 4 sticky notes.

Connect back to Question 2:

$\frac{2}{3}$ of $\frac{1}{4}$ = $\frac{2}{3} \times \frac{1}{4}$. Show an array using 1 sticky note to be 1 unit. Draw in labels and shading.

Student Reflection

Ask students, "How did you grow as a mathematician today?" Give them 2-4 minutes to silently write a reflection in their journals. Students share out with a partner.

Bring them all back together and uncover the learning targets on the anchor chart.

MP1: "I can persevere when solving problems."

5.NF.B.7 (5.NF.4): "I can calculate the product of 2 fractions less than one and interpret the answer." (Together, talk through what this means).

Camp Menu Task
3rd grade
Addition and Subtraction with Estimating

Standard: 3.RA.D.9; 3.RA.D.10
Solve 2-step word problems involving all four operations
and assess reasonableness of solutions

Mathematical Practices: Make sense of problems and persevere in solving them
Model with mathematics
Conduct viable arguments and critique others; thinking

Mathematical Norm: Math is about creativity, communication, and sense
making

*****Task*****

You are going to a day camp for your **favorite sport**. Your mom has
given you **money** for your breakfast, lunch, and dinner for the day.

Here is what Mom has given you:

Breakfast: \$5.00
Lunch: \$7.00
Dinner: \$10.00

You may choose whatever you like for your meals!

However, you must stay within the price limits for each meal.

Note: There is no tax.

Since you are playing for your favorite sport and need the **energy**,
you will want to have 3 or more items for each meal.

What will you choose for your 3 meals?

Possible Misconceptions Considered and Teaching Opportunities

- A. Student does not estimate before making food choices
 - a. Encourage student to round or use ballpark estimates
- B. Student is not able to assess reasonableness of answer
 - b. Ask the student: Does this answer make sense? How do you know?
- C. Student has no entry point
 - c. Encourage student to visualize, retell, or act out story
- D. Student adds or subtracts numbers without understanding context of story
 - d. Ask the student: Is there a picture, diagram, or model you can use?
- E. Student only writes answers with no work shown
 - e. Encourage student to prove their thinking to a partner using written work

Questions for Discourse and Student Reflection

- A. How did you as a mathematician make your thinking visible? (SMP 1)
- B. Discuss how you know your answers are reasonable. (SMP 1)
- C. How does one mathematician's strategy compare to yours? (SMP 1)

Opportunity for Differentiation (Modified Task)

You are going to a day camp for your **favorite sport**. Your mom has given you **money** for your breakfast, lunch, and dinner for the day.

She has given you **\$22.00** for the entire day's meals.

You may choose whatever you like for your meals!

However, you must stay within the price limit of \$22.00 for the day.

Note: There is no tax.