

Using Questions to Build Understanding About Fractions in Grades 3-5

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Game plan

We will do some mathematical tasks and consider how to support students thinking through the discussions of tasks

Going on the premise:

Worthwhile Tasks + Discussion increases potential for learning

Let's think about fractions

- I have more than $\frac{1}{2}$ of a pack of gum but less than $\frac{7}{8}$ of a pack of gum. How much gum could I have?
- Think about multiple solutions.
- Write them down.
- Draw a picture to prove your solutions.

Let's think about fractions

- I have more than $\frac{3}{4}$ of a pack of gum but less than $\frac{7}{8}$ of a pack of gum. How much gum could I have?
- Think about multiple solutions.
- Write them down.
- Draw a picture to prove your solutions.

Let's think about fractions

- What are some ways that we could add or subtraction fractions to equal $\frac{5}{8}$?
- Think about multiple solutions.
- Write them down.
- Draw a picture to prove your solutions.
- Now think about 3 fractions that you must add AND subtract to equal $\frac{5}{8}$?

Number Talks vs. Discussions

- Number Talks are the "Taylor Swift of math"
 - Very very popular!
 - "Number talks were developed for classroom teachers to engage students in "mental math" through grappling with interesting mathematics problems." (Inside Mathematics)
 - Mental math tasks, lots of reasoning and thinking about numbers
 - Typically done whole class but....
 - Small group number talks may engage some students more
 - Accountability tends to vary
 - Recording work, strategies, reflecting on what students learn

Math Discussions

- More broad view than Number Talks
- Anytime, yes anytime...
 - Students are sharing or discussing strategies or concepts
- Research tidbits...
 - Teachers say that math discussions are important
 - Teachers leave out discussions or trim their time greatly
 - Teachers tend to resort to “telling” instead of facilitating a discussion

Please order from easiest to hardest

Use repeated addition to explore the multiply a fraction by a whole number

Add and subtract fractions with unlike denominators

Multiply fractions by fractions

Add and subtract fractions with like denominators

Compare fractions with the same numerator or denominator

Partitioning a rectangle or circle into halves, thirds, or fourths

Compare all fractions (e.g., $\frac{2}{4} - \frac{5}{8}$)

Plot fractions on a number line

Grade Levels

Use repeated addition to explore the multiply a fraction by a whole number

Add and subtract fractions with unlike denominators

Multiply fractions by fractions

Add and subtract fractions with like denominators

Compare fractions with the same numerator or denominator

Partitioning a rectangle or circle into halves, thirds, or fourths

Compare all fractions (e.g., $\frac{2}{4} - \frac{5}{8}$)

How could this influence:
The order that I teach concepts?
The mathematical connections that we can make in class?

Plot fractions on a number line

Mathematical Discussions

- Share strategies
- Compare strategies
- Reason about the mathematics
- Ask questions about concepts
- Pose another task

Twizzler Snack

Tyrone ate $\frac{7}{12}$ of a Twizzler

Catie ate $\frac{5}{8}$ of a Twizzler

Mitch ate $\frac{2}{3}$ of a Twizzler

Use pictures and reasoning to determine:
Who ate the most? Who ate the least?
Samuel ate $\frac{3}{4}$ of a Twizzler. How does his amount compare to everyone else?

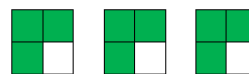
Shopping for Sandwich Meat

- You are buying packs of sandwich meat and each package contains $\frac{3}{4}$ of a pound of meat. Use a picture to show:
how many pounds of meat do you buy in 3 packs
how many pounds of meat do you buy in 5 packs
how many pounds of meat you buy in 10 packs

Extension:
If you need 6 packs of sandwich meat how many packs do you need to buy?

Shopping for Sandwich Meat

- Approaches?
- As you worked on this what are things that you talked about (could have talked about)?
- What are some representations that we can make connections to?
- What are some mathematical concepts that we can make connections to?



$$\frac{3}{4} \times 10 = \frac{30}{4}$$

$$7 \times 4 = 28 \text{ and I have 2 left}$$

$$7 \frac{2}{4}$$

What strategy did they use?
What could we talk about?

Mathematical Discussions

- Share strategies
- Compare strategies
- Reason about the mathematics
- Ask questions about concepts
- Pose another task

What does this look like?



In a fourth grade class:

Susan: When I multiplied $\frac{3}{4}$ by 3 I got $9/12$.

Teacher: Explain what you did.

Susan: I drew 3 rectangles and shaded $\frac{3}{4}$ of each. 9 were shaded out of 12 so that is $9/12$.

Teacher: What does everyone think about this strategy?

Devonte: The picture makes sense to me. But I think the number needs to get bigger since multiplying always makes things bigger.

Teacher: Other thoughts from anyone else?

Darnell: If each box were $\frac{3}{4}$ of a pack of gum and we put them together we would have more than $9/12$ of a pack of gum. $9/12$ doesn't make sense.

Thoughts on what has happened?

As a teacher what is your next move?

Mathematical Discussions

- Share strategies
 - What possible strategies would we expect?
- Compare strategies
 - What would this look like?
- Reflect and discuss the mathematics
 - What math concepts do we want students to reflect?
- Ask questions about concepts
 - What questions can I ask about the concepts?
- Pose another task
 - What is a follow up task that I can give?

Task work vs. Discussion Time

- As students are talking with classmates what would we expect them to be talking about?
- In a whole class discussion what questions should I ask related to these tasks?

Task work vs. discussion

Task work

- Brainstorming strategies
- Discussing calculations
- Checking reasonableness of answers

Whole class discussion

- Sharing a variety of strategies in a timely manner
- Comparing strategies
- Digging deeper at the mathematical concepts

Mathematical Discussions

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Distracting Marks on a Line

- Based on the line below draw:
- $\frac{1}{8}$
- $\frac{3}{4}$
- $\frac{1}{2}$
- $\frac{3}{8}$
- 1 whole



Distracting Marks on a Line

- Based on the line below draw:
- $\frac{1}{6}$
- $\frac{3}{6}$
- $\frac{1}{3}$
- $\frac{5}{6}$
- 1 whole



Mathematical Discussions

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 - What possible strategies would we expect?
- Compare strategies
 - What would this look like?
- Reflect and discuss the mathematics
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Organizing your classroom

Multiple options... potentially overwhelming

Engage: Engaging, Ten minute math Activity (10 minutes)

Explore: Exploration of a task

Explain: Explanation and discussion of strategies and mathematics

Elaboration: Follow-up activity, targeted differentiation, small groups, math games

Looking at Student Work

- Step 1: Look at and describe students' strategies
- Step 2: Analyze student work for strategies and accuracy
- Step 3: Sort the student work by levels– meets benchmark, progressing, does not meet
- Step 4: Identify next steps for each...

Grade 5 student work...

Take aways....

- How rich can discussions be if we pose low-level tasks to our students?
- If students struggle with high-level, rigorous tasks we need strategies to support them without doing it for them.
- Questions should elicit discussion and mathematical connections, not just answers.

Continue your learning...

- State-wide math add-on license
 - UNC Charlotte, 100% online with not online meetings
 - NC State, face-to-face cohorts
 - UNC/ECU/UNC-W- 100% online with some online meetings
- NCCTM- Greensboro in early November
- NCTM
 - Writers for Teaching Children Mathematics and the TCM blog- <http://nctm.org/tcm-blog/>
 - Reviewers for articles
- Drew.Polly@unc.edu