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Lesson in Action

Visual Representation: Mixed Numbers

AT A GLANCE

Launch
- Review the displayed lesson goal so students can refer to it throughout the lesson.
- Show the two problems for the learning task, along with two visual representations.
- Explain that students will work in small groups to find a way to solve these problems.
- Discuss the connection between the visual representation and the problem.
- Check for understanding by using the thumbs up/down/sideways method.
- Repeat the process for subtraction.
- Discuss the connection between the second visual representation and the problems, checking for understanding.

Learning Task
- Direct students to begin working in groups on the problems.
- Circulate around to listen carefully to each group and look at their representations.

Closure
- Bring the class back together for a discussion.
- Walk students through the necessary steps by using both types of representation.
- Discuss how to work with the problems without using visual representations.
- Have students self-assess, gauging their confidence in meeting the lesson goal.

Context

Mr. Simpson's Grade 5 class is in the middle of a fractions and mixed numbers unit. So far, students have reviewed equivalent fractions and used them to add and subtract fractions with unlike denominators. Most of the class remembers the process of writing fractions with common denominators, and he wants to build on that in this lesson. Mr. Simpson wants his students to learn how to work with mixed numbers by working with fractions and whole numbers separately, regrouping as needed (regrouping one unit into fractional parts or regrouping part of an improper fraction into one unit).

Common Core State Standards

- CCSS.Math.5.NF.A.1 (http://www.corestandards.org/Math/Content/5/NF/A/1) Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.
- CCSS.Math.MP2 (http://www.corestandards.org/Math/Practice/MP2) Reason abstractly and quantitatively.

Lesson Objective

Students will learn about adding and subtracting mixed numbers. To solve the problems, they will need to add and subtract fractions with unlike denominators. Students will learn how to use a visual representation of the mixed numbers to assist them.

Technology

- Interactive whiteboard to show students how they can manipulate visual representations
- GeoGebra (http://www.geogebra.org/cms/en/) (dynamic geometry software) for students to use as they solve problems

Assessment

- Question students to determine whether they understand the representations and how to use them
- Observe application of strategies
- Check students' confidence in their ability to find answers and explain strategies

Mr. Simpson's Class in Action

Launch

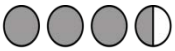
Mr. Simpson starts the lesson by reviewing the goal (posted on the wall) and what students need to do to demonstrate their learning.

Goal: I will learn at least one strategy for adding and subtracting mixed numbers with unlike denominators.

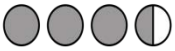
1. Add and subtract mixed numbers with unlike denominators.
2. Explain at least one strategy for adding and subtracting mixed numbers with unlike denominators.

On the interactive whiteboard, Mr. Simpson puts up two problems, paired with visual representations.

$$3\tfrac{1}{2} + 1\tfrac{3}{4}$$



$$3\tfrac{1}{2} - 1\tfrac{3}{4}$$



He says, "I'm going to have you work in groups to find a way to solve these problems." He points to the representations, "You may find these helpful. Let's take a look at them."

He points to the circle and asks, "Can anyone tell me what this picture has to do with the problems?" Andrea raises her hand, "The three shaded circles are the 3 in the top mixed number, and the last circle with one half shaded is the 1/2."

Mr. Simpson tells the class, "Hold your thumb up if you know how to use this representation to show addition and hold it down if you don't know. You can put your thumb to the side if you aren't sure." Three students hold their thumbs to the side, everyone else has them up. When he asks about subtraction, a few more students put their thumbs to the side and several put their thumbs down. He makes a note to follow up with the students who don't know or are unsure.

Mr. Simpson calls on a few students to give their ideas about using the representation for subtraction. Todd suggests erasing circles to "take away." Emily suggests putting marks through the circles.

"Now, let's look at the number lines," Mr. Simpson says. "How can you use this representation?"

Raj responds, "The first number in each problem is shown on the line. You could add by moving to the right the same number of units as the second number and you could subtract by moving to the left." When Mr. Simpson asks how many students agree with Raj, most students raise their hands.

Learning Task

As students work in groups on the problems, Mr. Simpson circulates around the room, listening to their conversations and looking at the representations.

Belinda's group is using the number line for the addition problem, but they don't seem to know what to do next. Jerry points to the second addend, "I can see that 1 and 3/4 is here on the number line, but how do we add it to 3 and a 1/2?" Belinda adds her observation, "If we were using the circles, then we could show adding by drawing more circles."

Mr. Simpson asks, "If you had zero circles, what would be the equivalent on the number line?" Jerry points to 0.

"Good," Mr. Simpson replies. "With the circles you would add by drawing three and a half more circles. What do you do on the number line?" Jerry moves his finger to 3 and a 1/2 and Belinda says, "You move right, so you move more to the right to add?"

Jorge's group is struggling with the subtraction problem. They can't agree what to do with the fraction. Mr. Simpson suggests they try the circle representation, then walks over to another group.

When he returns, he sees that they were able to get an answer. "But how can we do it without using the representation?" Jorge asks. "Good question," Mr. Simpson says. "We'll talk about that later. In the meantime, think about this: How do you solve 45 – 17? The minuend is 40 and 5, while here we have 3 and a 1/2."

Closure

After all the groups have worked on both problems, he brings them together for discussion. Mr. Simpson notes that a few students are still struggling, though all groups managed to find a solution.

He asks Kayla to come up to the interactive whiteboard and explain her group's solution. She draws circles to represent 3 and a 1/2.

"To add 1 and 3/4," she says while drawing, "we first added one full circle.

Then, we added the fraction 3/4. Filling in the half in this circle is two-fourths,

and we need one more fourth."

When Kayla has finished, Mr. Simpson asks Will to show how the second addend is shown in Kayla's representation. Will goes to the board and points to the extra circle and the additional 1/2 and 1/4.

Mr. Simpson calls on several more students to demonstrate the addition problem with the number line and to demonstrate the subtraction problem using the circles and the number line.

"I noticed when Kayla showed us addition, her first step was to draw a whole circle. When Jorge used the number line, his first step was to move one whole unit to the right. What is the same about both of these methods?" Mr. Simpson asks. Stephanie says "Oh! They both worked with the whole number first. We did that, too."

"Good," Mr. Simpson says. "You don't have to work with the whole numbers first; the main thing is that you worked with whole numbers and fractions separately. Let's think about what this might mean for working without a visual representation."

He puts the addition problem on the board, but without the representations. "Stephanie said their first step was to add the whole number. So, what would that mean for this problem?" he asks. With prompting from the class, he adds 3 and 1 and writes 4 under the whole numbers, then does the same for the fractions. They end up with 4 and 5/4, which they rewrite as a proper mixed number.

The class goes through a similar process with the subtraction problem. Mr. Simpson notes that here students need to rewrite the minuend before subtracting. For addition, they needed to rewrite after adding. He brings up both representations and asks students to find where the rewriting happened.

To wrap up the lesson, Mr. Simpson asks the students for thumbs up or down about their confidence in solving mixed number problems and their confidence in explaining their strategies.

Reflection

After class, Mr. Simpson thinks about what he observed during the lesson. He enters a few items in his Lesson Plan Builder:

Some students chose a representation they didn't seem to understand. In the future, work on choosing appropriate representations.

A few groups were already trying to connect the representation to an algorithmic process. Encourage that with more groups; see what they can get on their own.

Check in with Lily, Ben, and Jorge. They had trouble with fractions with unlike denominators earlier and seemed uncertain (thumbs to the side) during class.