Scaffolding Task: Fraction Kits

Inspired by Math Solutions Publications Teaching Arithmetic: Lessons for Introducing Fractions by Marilyn Burns

STANDARDS FOR MATHEMATICAL CONTENT

MCC4.NF.1 Explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

MCC4.NF.2 Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Constructing the idea that fractions are relationships, and that the size or amount of the whole matters, is a critical step in understanding fractions. Fair sharing contexts also provide learners with opportunities to explore how fractional parts can be equivalent without necessarily being congruent. They may look different but still be the same amount. Students have worked with the concept of fair share or partitioning from 2nd grade, with standards which refer to same-sized shares or equal shares. Students should have knowledge of vocabulary terms such as: *numerator and denominator*.

Some common misconceptions, found in *Math Misconceptions,* that children have include:

- Dividing nontraditional shapes into thirds, such as triangles, is the same as dividing a rectangle into thirds. If they are only used to dividing traditional shapes – circles, squares, and rectangles – they begin to think that all shapes are divided similarly.
- Children often do not recognize groups of objects as a whole unit. Instead they will incorrectly identify the objects. For example, there may be 2 cars and 4 trucks in a set

of 6 vehicles. The student may mistakenly confuse the set of cars as 2/4 of the unit instead of 2/6 or 1/3 (Bamberger, Oberdorf, & Schultz-Ferrell, 2010).

Therefore, it is important that students are exposed to multiple units of measure, various shapes, and denominators other than halves, thirds, and fourths. Additionally, the denominator used as an expression of the whole is a key concept to express for mastery.

ESSENTIAL QUESTIONS

- What is a fraction and how can it be represented?
- How can equivalent fractions be identified?

MATERIALS

- Construction paper strips of equal length (8 different colors prepared prior to beginning task with students)

GROUPING

Individual

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Comments: Be sure to cut the strips of construction paper accurately before asking students to make kits. Students should create their own kits since there are basic concepts about fractions to be learned from the process of creating the kit. It is important to discuss the concept of fair sharing. Ask them how they would share the strips of colored paper among various groups of people (two, three, four, six, eight, and sixteen). It is important that you allow time for students to determine the appropriate way to equally share the strips of paper among the various groups. For students who are unable to determine the appropriate measures, ensure they are exposed to strategies discovered by their peers through classroom discussions.

- To cut fourths, first have students cut halves, then fold and cut each half into fourths.
- To cut eighths, first have students cut fourths (as above), then cut each fourth in half to make eighths.
- To cut sixteenths, have students cut eighths (as above), then cut each eighth in half to make sixteenths.
- To cut thirds, use the concept of measurement. Tell students that the strip is 18 inches long. How many inches for each piece if we want thirds (shares with three people)? Students should have time for small group discussion and sharing.
- To cut sixths, follow the same idea as with thirds, but for sharing with six people. Again, students should have time for small group discussion and sharing.

This task is one that enables the construction of a manipulative that can be used with subsequent tasks. Therefore, it is important that all students are provided with an opportunity to construct their own fraction kit.

Task Directions:

Cut 12-by-18-inch construction paper lengthwise into 3-by-18-inch strips. For the fractions 1 whole, 1/2, 1/4, 1/8, and 1/16, you will need 5 different colors. To include 1/3, 1/6, and 1/12, you will need an additional 3 colors (for a total of 8 colors.)

- Ask students to take a strip of a particular color (that you choose/ or the class agrees upon), fold it in half, and cut it into two pieces. Have them label each piece 1/2 (and possibly also with the name 'one half') and discuss why this label is appropriate (because the pieces are the same size, each is one of the two pieces, which we represent as 1/2).

- Choose a color for a second strip and have the students fold and cut it into four equal pieces. Instruct students to label each piece 1/4 (and possibly with the name 'one fourth'). Have students explain why the label is appropriate.

- Have students fold, cut, and label a third strip in eighths and a fourth strip in sixteenths. (For the sixteenths, students may need to fold a strip in half, cut it, and then fold each half into eighths.)

- Students leave one of the strips whole and label it 1 or 1/1 (ask students first what they should label it).

- For creating thirds, students would probably be inaccurate in folding. One strategy is to measure the strip, divide the length into three equal segments, and then measure and cut and label. For sixths, they can cut thirds and then fold the thirds in half. (The issue of why this works would be a good topic for class discussion.) Use a similar process for twelfths.

FORMATIVE ASSESSMENT QUESTIONS

- What was the initial cut you made to your colored strips? Why?
- Are your labels appropriate? Why or why not? How do you know?
- Could you use the strips for halves or fourths as a template for making thirds or sixths? Why or why not?
- Which fraction piece is bigger, 1/2 or 1/4? Next, 1/3 or 1/6?

DIFFERENTIATION

Extension

- Ask students to explain why making other fractions such as 1/7 would be difficult. Can you name other fractions that would be difficult? How would you go about making them?

Intervention

- Begin by having students work only with halves, thirds, and fourths only.
- Discuss how these pieces compare to the whole.