(Information adapted from the Noyce Foundation, Problems of the Month)

Constructing Task: Ribbon Fractions

Approximately 2 Days

This lesson is adapted from State of Victoria, Australia :Teaching Resources. Activity 6
http://www.education.vic.gov.au/studentlearning/teachingresources/maths/mathscontinuum/number/N25001P_2.htm

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.2 Partition a rectangle into rows and columns of same-size squares to find the total number of them.

MCC.2.G.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, page 253-254)

"During the discussions of students' solutions (and discussions are essential!) is a good time to introduce the vocabulary of fractional parts. This can be quite casual and, at least for younger children, should not involve fraction symbolism. When a brownie or other region has been broken into equal shares, simply say, "We call these *fourths*. The whole is cut into four parts. All of the parts are the same size- fourths.

Children need to be aware of two aspects or components of fractional parts: (1) the number of parts and (2) the equality of the parts (in size, not necessarily in shape). Emphasize that the number of equal parts or fair shares that make up a whole determines the name of the fractional

parts or shares. They will be familiar with halves but should quickly learn to describe thirds, fourths, fifths, and so on."

ESSENTIAL QUESTIONS

- Why is it important to identify, label, and compare fractions (halves, thirds, fourths) as representations of equal parts of a whole or of a set?
- If you have two fractions, how do you know which is greater or has more value?

MATERIALS

- For the teacher
  - Several pieces of ribbon cut into 1 yard pieces (these pieces will be used for student demonstration, 3-5 pieces may be necessary)
- For each group
  - 1 yard of ribbon (string or adding machine tape would also work)
  - String
  - paper clips
  - ruler
  - scissors
  - unifix cubes or snapping cubes
- For Differentiation groups
  - Adding machine tape
  - Unifix cubes

GROUPING

Large group, Small groups of 3 or 4

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Part I

Show the class a length of ribbon that is one yard long and ask how to divide it into two equal pieces. You may wish to have volunteers come up and demonstrate their strategies. Some might suggest folding the ribbon in half so the two parts match and then cutting on the fold. Ask, "how do you know this will work?" Make sure to have them explain their strategies, even if they are wrong! Make sure to demonstrate **ALL** strategies so those that are incorrect can see why what they are thinking does not work, (this is why the teacher will need so many pieces).Allow them an opportunity to change their thinking and have them explain **WHY** they changed their mind!

Once the class has come to an agreement about how to cut the ribbon then cut it. **Make sure to tape an original uncut ribbon (the unit) to the board for comparison.** Label it as 1. Discuss how each section is one half of the original ribbon. Have someone hold up the cut pieces (separately) and compare them to the uncut piece (the unit). Tape them to the board and label

them with half written above each section. Ask students "Why does it take both parts to make one whole piece?" The goal of this task is to have students understand the terms "halves, thirds, and fourths".

Part II
Divide the class into groups, with some groups of three and some groups of three or four children. Give each group a piece of ribbon that is one yard long and present them with this problem: How could you divide this ribbon so that each person in your group gets an equal piece? You might use string or adding machine tape depending on what you have available. Make it clear that all of the students in the group should get pieces that are the same length. Suggest that students do not cut the ribbon until the whole group agrees that they can make equal parts. If a group cuts their ribbon and then sees that the pieces are not of equal size, provide them with another ribbon and have them try again. **Make sure they can explain to you WHY they need another ribbon and what their new strategy will be for cutting it this time!**

After ample work time is given, allow groups to share the strategies they used. Some might fold the ribbon into 3 or 4 pieces and then cut it. Others might use something to measure the ribbon and make equal parts using a ruler. The measuring could also be done with other non-standard measures – such as Unifix cubes, snapping cubes etc. During the discussion ask the following questions:

- Does each person in the group have a ribbon that is the same size?
- What fraction could be used to explain how much of the whole each person in the group received?

*Some might fold the ribbon in half and then in half again to create 4 equal parts. If this happens be sure to have those students explain why this strategy works for creating fourths. If the students demonstrate an understating of this then you pose the following question: "Now that this ribbon is folded into fourths could I use the same strategy to create another fraction? (i.e. eighths). If I use this strategy on a ribbon folded in thirds what would I create? (i.e. sixths). Can you think of other examples of this same kind of thinking?"

After the group discussion, allow all students to carry their ribbon pieces back to their desk (or floor) and ask the following questions:

- Does each person in the class now have a piece of ribbon the same size? (no)
- Why are some ribbon pieces longer than others?
- What would you expect the pieces to be like for the members of a group of 6? 10? (Pieces would be smaller)

Part III
Write the fraction words halves, thirds, quarters, and fourths on the board and have a student come up and tape their piece of ribbon underneath the correct spot. Have the students explain which fractional piece they think is the largest and smallest and how they decided. Listen for them to say that if the ribbon is only shared two ways the piece is larger. If it is shared four

ways, it is smaller. Make sure that the students can explain that this is because more people need a piece of the ribbon.

Draw a number line that is the length of one uncut piece of ribbon on the board with zero at one end and 1 and the other. Tape an uncut piece of ribbon underneath the one. Ask, "Why did I place this uncut piece of ribbon here? (*because it is one whole piece of ribbon*) RIGHT! So where should we tape the half piece of ribbon? How about the third piece and the fourth piece? Listen and look for student recognition and understanding that there are numbers that live in-between other (whole) numbers. Check for transfer of understanding by asking if they can show the placement of halves, thirds, quarters, and fourths on a number line (the line goes from zero to one, so halfway would be 1/2.)

FORMATIVE ASSESSMENT QUESTIONS

- Does each person in the group have a ribbon that is the same size? How do you know for sure?
- What fraction could be used to explain how much of the whole each person in the group received?
- Does each person in the class now have a piece of ribbon the same size? (no)
- Why are some ribbon pieces longer or shorter than others?
- What would you expect the pieces to be like for the members of a group of 6? 10? 100? (Pieces would be smaller)

DIFFERENTIATION

Extension

Give students a new length of ribbon, and tell them it is 1/2 of a length. Allow them to decide what the whole length would be.
Make a connection to candy bars. Ask students whether they would rather have a half, third , or a fourth of a candy bar. Again have them explain their thinking. This would be a great topic for journal writing!

Intervention

If students are having difficulty, try going back to using sets of whole objects, such as a collection of counters, color tiles, pennies. Also, using examples that are greater than one, for example $2\frac{1}{2}$ apples or $3\frac{1}{2}$ cookies, may help because the unit they are working with is made explicit.