Flexible Fractions

Summary

Students will learn about fractions.

Materials

- Region, set, and line model manipulatives
- Jelly beans (12 beans per pair; use no more than 3 or 4 colors of beans per cup)
- Small paper cup for each pair
- *Activity Record Sheet*
- Colored pencils
- Journals
- Art paper
- Jelly beans
- Cup

Background for Teachers

Fractional numbers can be demonstrated with three types of models: the area model, length model, and set model. Creating physical models generates a concrete representation, and in turn, establishes a long-lasting nonlinguistic image of this knowledge in the student's mind. In this activity, students use a variety of different methods to record their fractional set. Students should learn to equate the numerator of a fraction with the "count"--number of items in the whole set--and the denominator with the "size"--as in how big is this portion. In other words, a fraction is the count/size. So a fraction such as four-fifths means we have four of something and each one of the pieces or sections is sized at one-fifth of the unit whole. Throughout this activity, student pairs record and summarize their information on a structured activity sheet. This graphic organizer allows students to manipulate new ideas and see how these ideas are related to concepts they already know. The brain has a natural capacity to organize, and the graphic organizer allows us to teach to that ability.

Intended Learning Outcomes

2. Become mathematical problem solvers.
3. Reason mathematically.
4. Communicate mathematically.

Instructional Procedures

Invitation to Learn

Provide a variety of materials for groups to sort into three groups-- region, set, and line models (e.g., ruler, length of yarn, piece of material, sheet of paper, strip of paper, geoboard, base ten rods, golf tees, erasers, 2-colored chips, centimeter cubes, etc.).

Instructional Procedures

Demonstrate how each pair will draw the specified number of beans from the cup and record the selections on the *Activity Record Sheet* by coloring in their beans. Then color the graph to show the number and color of each bean in the group.

Distribute the cups, *Activity Record Sheets* , and colored pencils to each group.

Advise the students that in the last round, they will be using all 12 jelly beans (so don't eat any). The students can either return the beans to the cup after each round, or simply draw the necessary number of new beans to complete the next round.

Example: When moving on to round four, the students could draw just one bean and add it to the beans used in round three to equal 5 total beans, or they could return all the beans to the cup and draw out 5 new beans to record.

After the beans have been colored and the circle graph has been constructed, the students should summarize the data by writing the fractional portion each color represented of the entire group of beans (the unit whole).

Example: If they drew 2 white and 1 yellow in round two, the group would write 2/3 to represent the white beans and 1/3 to represent the yellow bean, with 3 being the unit whole.

In round six, the students need to group their beans by color and then color them on the strip. The strip will work as a template to construct the circle graph. After they have completed the coloring, they can cut it out and curl one end around the circumference of the circle. Use this as a guide to mark the sectors on the circle graph.

Students should compare and generalize the data in their math journals.

Discuss why 1 red bean in round one equals 1/2, but after drawing 1 red bean in round three, its value drops down to equal only 1/4.

What was the relationship between the colors most often drawn to the color mix in their cup?

Part 2

Partner A puts a selected number of beans in the cup, without letting partner B know how many beans are in the cup.

Partner A then draws a few of the beans out and gives them to partner B along with a clue and a challenge. Partner A gives the clue of telling partner B what fraction of the beans are now out on the desk.

Partner B is then challenged to calculate how many total beans are in the cup.

Partner B must prove their answer is correct by illustrating the whole set, showing the fractional part of the set which was drawn out of the cup.

Partners change roles and continue.

Extensions

Small groups draw quick stick figure drawings of their whole group, calling attention to specific attributes that some members share. Attributes should be observable, or verifiable by conversation, such as wearing watches or owning a dog.

As a group, write four observational sentences about the group, using fractions to express the findings.

Example: 3/4 of the students in our group are wearing shoes with shoelaces.

Discuss how the complementary, or shadow, fraction (1/4 of the students are not wearing shoes with shoelaces) relates to the unit whole.

Create equations by listing a portion of the students with an observable trait that is equal to 1/2 of the students with that trait. How many total students share that attribute?

Example: These three students have braces, that is 1/2 of our group that has braces. How many total students have braces? Continue by changing the fractional part (1/4 of our group, 1/6 of our group, etc.).

Family Connections

Students can discuss inherited traits with family members and then recreate a group picture using exaggerated attributes as outlined in the extension. Be sensitive to students who may not be

living with birth families and instead suggest that they find other common attributes (3/4 of our family members made their bed this morning).
Using items found in the home, draw fractional parts of sets used to prepare the family meal and write a sentence describing the fractional part and a question/answer about the unit whole.

Example: A student would draw three forks and a sentence such as "This is 1/3 of the forks used to set the table for dinner. How many forks did we use all together?" (9)

Assessment Plan

Provide students with a collection of related items that includes at least one variable (color, length, etc.). Items could include cm cubes and base ten rods, tangram pieces, several different crayons in two or three colors, etc. Have students sort the items, write statements about the similarities and differences using fractions in their statements, and represent the group with fractions and a set illustration.

Sample answer: There are 5 cm cubes and 3 base ten rods, so 3/8 of the set are base ten rods and 5/8 of the set are cm cubes

Show students an area model that is divided into three sections. Two of the parts are colored, one is not. Have students write an explanation on how to find the fraction that describes the shaded part of the area model. Explain that you don't want to know the fraction, but *how they would decide* what the fraction is.

Sample answer: First you count how many total parts there are. That is the denominator. Then count how many parts are different (shaded). That is the numerator. Write the fraction by putting the numerator on top and the denominator on the bottom.

Using the school population, have the students write three to five questions that could be used to highlight certain portions of the population. They could survey and find which students fit their highlighted category, and represent that information in fractional form and illustrated form.

Sample question: How many fifth graders are left handed?

Bibliography

Research Basis

Barton, M., Heidema, C., (2002) *Teaching Reading in Mathematics*. Aurora, CO. McREL
This supplement to *Teaching Reading in the Content Areas* explains the terminology of "reading mathematics" and the skills needed to comprehend the words, symbols and text structures associated with mathematics. The manual also presents suggestions and strategies to help students become more proficient in mathematics literacy.
Marzano, R., Pickering, D., Pollock, J., (2001) *Classroom Instruction that Works*, Alexandria, VA. ASCD.
This K-12 guide provides extensive research evidence, statistical data, and case studies that support nine critical teaching strategies, one of which is nonlinguistic representations. The chapter on nonlinguistic representations stresses the use of a variety of activities and elaboration on acquired knowledge.

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