Using Manipulatives to Show What We Know

The "Math by the Month" activities are designed to appeal directly to students. Students may work on the activities individually or in small groups. No solutions are suggested so that students will look to themselves as the mathematical authority, thereby developing the confidence to validate their work. This month's activities focus on students' using various manipulative materials to demonstrate their understandings related to a variety of topics across the mathematics curriculum. Using manipulatives helps students understand and explain the mathematical concepts and the related skills that they are expected to master at their grade levels.

Their use also gives teachers valuable insights into students' mastery of these same concepts and skills. ▲

Regina Mistretta and Joseph A. Porzio

Edited by **Regina Mistretta,** *cmistr5293@aol.com, Saint John's University, Jamaica, NY 11439, and* **Joseph Porzio,** *joseph.porzio@nyu.edu, New York University, New York, NY 10003. Readers are encouraged to send manuscripts appropriate for "Math by the Month" to the editors.*

WEEKLY ACTIVITIES

MANIPULATIVES: K–2 **SEPTEMBER 2000**

4 **Attribute sort.** Make your own set of manipulatives, and place them in a bag. Make four different shapes (a circle, a square, a triangle, and a rectangle) in four different colors each (red, yellow, blue, and green). Take turns picking pieces from the bag, and sort and classify them by color. Sort and classify them by other attributes.

11 **Sticks and place value.** Grab a handful of sticks, and estimate the number. Bundle your sticks into groups of ten, and place them in the tens position on a place-value mat. Place the leftovers in the ones position. How did the total number compare with your estimate? Use other manipulatives, such as linking cubes, to model your number. Can you explain your number using expanded notation (24 is 2 tens and 4 ones or 20 + 4)?

18 **Dominos?** Place a set of dominos in a box. Work with a partner, and take turns reaching in and picking a domino. Describe your domino, for example, "The left side has two more dots than the right side, and the right side has three dots." How many number sentences can you model using the domino? Hint: 5 + 3 = 8, and 3 + 5 = 8. What other dominos have eight dots?

25 **Measurement.** Think of words ending in "er" (e.g., longer) that you can use to compare two objects. How do you use words ending in "est" (e.g., widest)? Estimate first, and then measure an object in your room using an item that you select, such as a pencil, eraser, and so on. Make the same measurement using a different object. How will the answers compare? Why is selecting a standard unit necessary when measuring?

WEEKLY ACTIVITIES

MANIPULATIVES: 3–4 **SEPTEMBER 2000**

4 **Pentominoes.** To form a pentomino, put five squares together so that the squares meet only along full sides. Use square tiles to make pentominoes, and draw them on grid paper. Can you find all twelve pentominoes? Compare the areas and perimeters of the pentominoes. Describe what you notice.

11 **Fraction models.** Use grid paper or centimeter pieces to create a 10 cm × 10 cm square region. How can you divide the square into halves, fourths, and eighths? How are the fractional parts the same or different? Pretend that one-fourth of the region weighs 48 grams. Find the weights of the other pieces. Use the model to explain what is one-half of one-half or what is one-half of one-fourth? Make up other questions to model.

18 **Tangrams.** Use tangram pieces, or make a set from a square that measures 12 cm × 12 cm. Suppose that the smallest triangle has an area of 1 square unit. Find the area of each of the other pieces. Suppose that the smallest triangle is worth $0.50. What would be the value of each of the other tangram pieces?

25 **Models for decimals**. Cut out six 10 × 10 squares of grid paper. Shade boxes on each piece to make models showing the following: 1 out of 100, 10 out of 100, 25 out of 100, 50 out of 100, 75 out of 100, and 99 out of 100. Make a set of decimal number cards to match the models. Place both sets of cards face-down, and create your own matching game.

WEEKLY ACTIVITIES

MANIPULATIVES: 5–6 **SEPTEMBER 2000**

4 **Pattern-block fractions.** Use pattern blocks, or trace sets on cardboard to create your own blocks. Explore combinations of shapes that make up other shapes. How many trapezoid pieces are needed to form a hexagon piece? What fraction name should you give to the red pattern block if the hexagon block has a value of 1? Pick another piece to represent a value of 1. What would be the values of the remaining shapes?

11 **Permutations.** Place three different buttons in a row. How many *permutations,* or arrangements, of these buttons are possible? (Answer: 3! = 3 × 2 × 1.) Share your problem-solving strategy with the other members of your group. Repeat this activity using four buttons. (Answer: 4! = 4 × 3 × 2 × 1.) How can you calculate the number of possible arrangements of other numbers of buttons without creating the models?

18 **Metric units.** Work in small groups using a 30 cm ruler and a meterstick. Make a copy of the chart below to record your work. For each object you choose, decide what unit of measure you will use (e.g., millimeter, centimeter, decimeter). Fill in the chart for five or more objects. Measure and record each length using another unit. For example, a pencil might measure 18 cm, or 180 mm. After you have measured at least five objects, review your chart. What did you discover about your guesses? What helps you decide which unit to use when measuring?

Object	Unit	Estimate	Actual	Difference

25 **Polyhedra.** Using small straws (or coffee stirrers) and pipe-cleaner connectors (or toothpicks and mini-marshmallows or raisins), work with your classmates to build the following three-dimensional shapes: a triangular pyramid, a square pyramid, a pentagonal pyramid, and a hexagonal pyramid. Next build a collection of prisms: a triangular prism, a square prism, a pentagonal prism, and a hexagonal prism. For each shape, record the number of faces, edges, and vertices. Look for a pattern. The mathematician Leonhard Euler discovered the relationship among the number of faces, edges, and vertices as vertices + faces – edges = 2.