Working with Pattern Blocks

I. Initial Explorations with Pattern Blocks

A. Comparing and contrasting the pieces

Have one student in a group choose one pattern block piece to serve as the Target piece. Each of the other children describes how their piece is like the Target piece and how it is different. Use their descriptions as a starting point for the introduction of appropriate vocabulary -- names of the figures, vertices, etc.

Create puzzles whose clues lead to a specific piece, such as the following:

> I am thinking of a piece with more than three sides.
> The opposite sides of this piece are parallel.
> Opposite angles of this piece are congruent.
> There are no right angles.
> What piece am I?

B. Finding relationships among the pieces

Give students some free time to explore and find relationships among the pieces. These relationships will be used many times in future activities.

C. Problem solving with the blocks

Have students build a figure that you specify (such as a hexagon or something more elaborate) in as many different ways as possible. What determines when two figures are different? What is the minimum number or maximum number of pieces it takes to build the design? Have students record their results and then display them in an organized fashion -- using a chart or bar graph for example.

D. Communication

Have one student build a figure out of sight of a second student. Then have the student provide oral directions so that the second student builds an exact duplicate copy. Use an answering machine analogy when describing the activity to solve the issue of questions being asked and answers being given. Depending on the students, place some restrictions on the number of pieces that can be used in building the design.

In journals, draw a sketch of a figure using pattern blocks. On another page, write a set of directions so that someone in your class can build your figure. Have students read written directions and then check their answers with the "student generator" of the picture.

Read ***A Secret Birthday Message***. Have students write a set of directions to their favorite place in school. Be sure to set a specified starting point.

II. Number Ideas

A. Multiplication Ideas

Build several copies of a figure. Have the students write sentences dealing with the number of figures, the number of pieces in each figure, and the total number of pieces. (For instance, 4 turtles made with 7 pieces each use a total of 28 pieces.) Record the data in a table to help generate the multiplication table.

B. Values for the pieces and creating number sentences

Use only the yellow, green, blue, and red pieces. Assign a value to one of these pieces and determine the appropriate values for the other pieces. Then build a figure with a specified value in as many different ways as possible. Write the number sentences associated with your figures. (Later, extend this to problems done without pattern blocks. Have different groups try to represent different numbers in different ways. Use both familiar numbers and numbers that will be challenging for your students.)

Build a figure and call it a cake. Assign a total value to your cake. What should you charge for each piece, where the pieces are the different pattern blocks that build the cake? (You can choose to have the value of each piece be an integer or a fraction depending on your choice of the total value of the cake.)

C. Fraction representation

Use only the yellow, green, blue, and red pieces. Assign the value of 1 to the yellow hexagon. Identify the values of the other pieces.

Adjust the value of 1 -- that is, redefining which piece is equivalent to 1. Find the values of the other pieces.

D. Problem solving with fractions

Build figures with specified proportions for each color. For instance, build a hexagon which is 1/2 red, 1/3 blue, and 1/6 green. Make up your own such problem.

E. Fraction operations

Use only the yellow, green, blue, and red pieces. Determine the arrangement of pieces that represents 1. Use the pieces to develop ideas related to equivalence and to changing an improper fraction to a mixed number and vice versa.

Now consider using the pattern block pieces to develop rules and procedures for adding and subtracting fractions.

Use the pattern blocks to help give meaning to division of fractions. For instance, one interpretation for a ÷ b is "how many of b are in a"? So, if the yellow hexagon represents 1, then $\frac{1}{2} \div \frac{1}{6}$ means how many $\frac{1}{6}$ pieces are in $\frac{1}{2}$? Because 3 green triangles (each with value $\frac{1}{6}$) are in the red trapezoid (with value $\frac{1}{2}$), then $\frac{1}{2} \div \frac{1}{6} = 3$.

F. Angle Measures

Determine which pieces have the same angles. Use the white rhombus together with the square to determine the measure of one of the angles in the white rhombus. Use this relationship to find the measures of the angles of the other pieces. Make a conjecture: what seems to be the sum of the angle measures of any quadrilateral? How could you prove this?

Use these pieces, particularly the white rhombus, to measure the angles of other objects around the room. You will often need to give an estimate or an interval in which the true measure lies.

G. Factors, prime numbers, and composite numbers

Use only the orange pieces. Take a group of the squares. Determine how many different rectangles you can make. Record the dimensions. Try the same process for a different number of squares. Combine results from all the members of the class. Use the results to introduce the terms ***factor***, ***prime***, and ***composite***.

Reinforce these numbers with the Opening the Gate activity (a Florida project for building algebraic thinking), entitled ***Step Forward and Take a Bow***. Give each student a number. Have them line themselves up in numerical order. Generate a series of number descriptions. If your number specifies the condition, you must step forward and take a bow. For instance, if your number is a factor of 12, step forward and take a bow.

H. Odd and even

Use only the orange squares. Take several different numbers of squares. Can you make a rectangle with the squares? For which numbers can you make rectangles? For which can you not make a rectangle? How does this idea help you with even and odd?

III. Transformations and Related Concepts

A. Creating Flips

Draw a line and use the pattern blocks to build a figure on one side of the line. Build what you think will be its image after being flipped over the line. Check your work with a MIRA or a mirror. You could also check your work by tracing around the blocks in your original figure and its image and then folding the paper along the reflection line to determine if the two tracings match up. Are the figures congruent? Why or why not?

B. Lines of symmetry

Build a figure with a line of symmetry. Check your result using one of the strategies in A.

Determine the number of lines of symmetry for each of the pattern block pieces. Build a figure with a line of symmetry. Check your result using one of the strategies in A. Build figures with more than one line of symmetry.

C. Turning symmetry

Build a figure with turning symmetry. Trace your figure on paper. Use your tracing together with the built figure to verify that your creation has turning symmetry.

Build a figure with turning or rotation symmetry. Determine the number of degrees necessary to have turning symmetry. Trace your figure on paper. Use your tracing together with the built figure to verify that your creation has turning symmetry.

D. Similar figures

Build two figures that are similar. How do you know that they are similar?

IV. Area and perimeter ideas

A. Find perimeters

Identify a unit to serve as the unit of length. Build figures and determine their perimeters.

B. Find areas

Identify a unit to serve as the unit of area. Build figures and determine their areas.

C. Relationships between area and perimeter

Build two or more figures with the same area but different perimeters. Justify your answer.

Build two figures with the same perimeter but different areas. Justify your answer.

Compare the perimeters and areas of figures that are similar. What conjectures can you make about the ratio of the perimeters or the ratio of the areas of similar figures?

V. Algebraic Ideas

A. Patterns

Build a pattern with the blocks. Have students duplicate and then extend the pattern. Have students design their own patterns. Which ones have the same structure? How could you describe that structure?

B. Marshalls and non-Marshalls

Create at least three examples of some category of figure called a Marshall (or whatever crazy name you choose.) Create three non-examples. Give students other figures and have them determine which satisfy the requirements and which do not. Have students then create their own categories.

C. Problem solving with patterns

Suppose you put 100 squares in a row. What would be the perimeter? What would be the area? Suppose you had n squares. Now find the perimeter and the area.

Build some other figure in a logical manner that can be extended. Determine how many pieces would be used in 2, 3, or 4 copies of the figure or in 2, 3, or 4 extensions of the pattern. How many pieces would be used in n copies of the figure or n extensions?

D. Graphing

Have students select a handful of blocks and then create graphs that illustrate the number of blocks of each type selected. What questions can you ask about your graph? Compare your graph to that of another student. What questions can you ask when you use both graphs?

VI. Miscellaneous

A. Tessellations and tiling

Read ***A Cloak for the Dreamer***. Have students create cloak patterns.

Read ***Sam Johnson and the Blue Ribbon Quilt***. Have students use the blocks to create quilt patterns.

B. Polyominoes

How many figures can you make using just 1 square, 2 squares, 3 squares, and 4 squares? What about 5 squares (pentominoes)?

References

Charles, Linda Holden and Micaelia Randolph Brummett. ***Connections: Linking Mathematics with Manipulatives***. Sunnyvale, CA: Creative Publications, 1989.

Marilyn Burns Manipulative Videos (Pattern Blocks)

Learning with Pattern Blocks by Cuisenaire