Math 5 - Act. 08: Building Patterns

Summary

As students build designs with pattern blocks they will discover relationships in growing patterns.

Materials

Activity A

- *The Book That Jack Wrote*
  by Jon Scieszka (or a copy of the story *The House that Jack Built*)
  One-inch square tiles or one-inch paper squares (for each student or pair of students)
  Paper and pencil (for each student or pair of students)

Activity B

Pattern block sets for each student or pair of students
Colored pencils or crayons
Pencil and paper
An overhead set of pattern blocks for the teacher

Additional Resources

Books

Hands On Math by Frances M. Thompson
Challenge Math by Edward Zaccaro
Elementary School Mathematics by John A. Van De Walle

Background for Teachers

In a pattern, repetition occurs in predictable ways. Patterns are fundamental to understanding place value, multiplication, and many other mathematical topics. They are especially important in understanding that a function is an important aspect of developing algebraic thinking. You may want to have calculators available as students discover relationships in growing patterns. That way, students can easily calculate large scale number relationships.

Intended Learning Outcomes

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

Instructional Procedures

Activity A

Invitation to Learn

Read the book *The Book That Jack Wrote* by Jon Scieszka and help students recognize that it is a growing pattern. Discuss how growing patterns are different than growing patterns and that today we will work with growing patterns and math.
Use the square tiles on the overhead to build the following designs (or just draw them) and have students predict the next design in the sequence.

Instructional Procedures

Give each team a plastic bag with 50 square tiles.
Have students build "windmills" with their tiles, building them in order of size with the smallest one first. Show them the following shapes already drawn on a transparency. The students must decide how to build each new windmill for themselves.

Have students record their work in a two-column table to record their work with the headings "Shape" and "Total tiles in shape." The left column for "Shape" should show 1,2,3…and the right column should show the totals 3,6,9…

Ask several teams to describe how the first and second shapes are alike and how they are different. Do the same for the second and third windmill.

Ask them to build the fourth windmill (it should have three blades with four tiles per blade) to the right of the first three.

Have students describe in their own words what each of the windmills looks like. Encourage the following type of details: The first blade has one tile per blade for three blades, the second has two tiles per blade for three blades, etc.

Now ask the students to predict how the tenth windmill might look based on their descriptions given in step six. (Example: Number ten has ten tiles per blade for three blades.) Have them complete the table through the tenth shape. Some students may need to build a few more.

Discuss how the numbers in the "Total" column change (increase by three each time).

Ask them to try to describe how to find the total tiles needed for making the Nth windmill. The algebraic expression should follow the language pattern used in step six: "The Nth shape will use N tiles per blade for three blades or three times N tiles total."

Activity B

Instructional Procedures

Begin by using overhead pattern blocks to build the following designs on the overhead.

Students should draw these three designs and color them with colored pencils or crayons. Then have them draw and color the next three designs, using 4 squares with 10 triangles around them, 5 squares with 12 triangles, and 6 squares with 14 triangles.

Have students make a table recording their results.

Example:

How many squares?	1	2	3	4	5	6
How many triangles?	4	6	8	10	12	14

Ask students what they notice about the numbers in the table. How do the number of triangles relate to the number of squares used in each design? Several answers are acceptable if they seem reasonable and apply to all designs drawn or all pairs of numbers in the table. One relationship might be as follows: For N squares in a row, there are N triangles above and N triangles below the squares with and extra triangle on the left and right ends of the row of squares. Another way to say this is, double the number of squares used and add two more to find the number of triangles needed each time. An algebraic expression would be "If N is the number of squares, then the triangles would be (2 x N) + 2 or 2N+2.

For independent practice, have students explore and create new growing patterns using two different shapes from their pattern blocks. Then they should create the tables and find the relationship rule. They could share their patterns with the class by drawing the first three designs on the overhead and allowing the class to try to describe the pattern that occurs between the two shapes used.

Curriculum Integration with Science

Fibonacci numbers can be found in many different living things. The sequence occurs in the seeds of a sunflower or the spirals that go in opposite directions on a pineapple. The two numbers will be

adjacent numbers in the Fibonacci sequence, usually 8 and 13 for a pineapple and 55 and 89 for sunflowers.

Extensions

Possible Extensions/Adaptations
Advanced students could go on to explore the patterns that emerge in square numbers, triangular numbers, Pascal's triangle, or Fibonacci numbers. Tessellations could be researched, explored, and created as an added connection to art.
Homework & Family Connections
Students can take home graph paper and draw growing patterns using the letters in the alphabet. For example a "t" can grow like this:
Then have students determine the pattern by placing it on a T-chart.

Assessment Plan

Watch as students build their patterns and create their T-charts. Observe whether they have created patterns that are consistent in following a rule, and can enter the correct numbers on their T-charts. Have students come to the overhead or board to draw their pattern designs and lead discussions about how their pattern grows. This will give good insight into their understanding. Make sure to have students move from building patterns to writing down an equation describing it mathematically.

Authors

Utah LessonPlans