PATTERNS AND FUNCTIONS

- Sequences
- Predicting
- Patterns

Getting Ready

What You'll Need

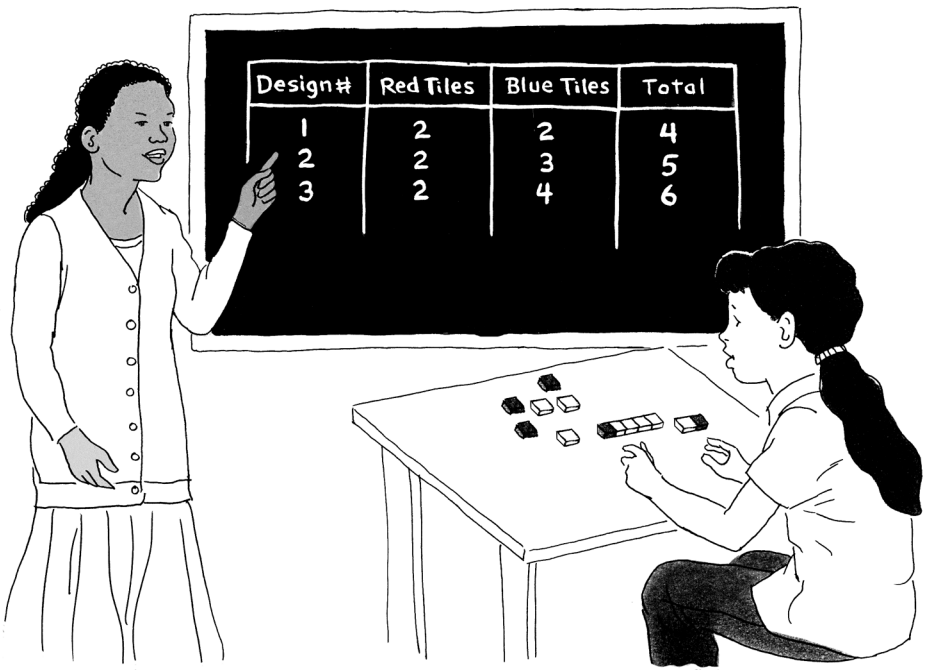
Color Tiles, at least 40 blue and 22 red per pair

Overhead Color Tiles and/or Color Tile grid paper transparency (optional)

Overview

Children figure out how to determine the number of Color Tiles needed for designs in a sequence without actually creating the designs. In this activity, children have the opportunity to:

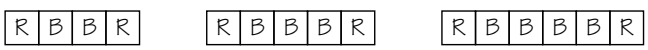
- look for patterns in both numbers and designs
- collect and organize data
- use patterns to make predictions



The Activity

Introducing

- Display the following sequence of Color Tiles.

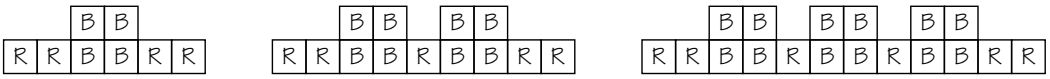


- Have children make the next two designs in the sequence with their Color Tiles.
- Ask children how many tiles of each color it takes to create each of these new designs.
- Call on volunteers to explain how they decided what the two new designs should be.

On Their Own

When you know how a sequence of designs begins, can you figure out how many tiles of each color will be needed to build any design in that sequence?

- Look at the following sequence of designs:



- Predict how many Color Tiles you would need for the 10th design in this sequence without building all 10 designs. Here's how.
  - Investigate by creating as many more designs in the sequence as you need.
  - Keep track of the number of tiles of each color and the total number of tiles you use in each design.
  - Look for patterns in your data.
  - Create designs in the sequence until you can use your findings to describe, in detail, the 10th design in the sequence without building it.
- Be ready to talk about how you made your prediction.

The Bigger Picture

Thinking and Sharing

Invite children to share their solutions and their reasoning. Then have them help you create a class chart with these column headings: *Design Number, Red Tiles, Blue Tiles, Total.*

Use prompts such as these to promote class discussion:

- Did you notice any patterns in your designs? If so, describe them.
- What patterns did you find in your data?
- What did you do to find the number of tiles of each color in the tenth design in the sequence?
- How can you use the numbers in the first column of the chart to determine the numbers in the other columns?
- How would you use your data to predict the fifteenth design? the hundredth design?

Extending the Activity

Have pairs use Color Tiles to build the first three or four designs in a sequence of their own creation. They can then exchange their designs and try to predict the number of tiles of each color and the total number of tiles that will be needed to build the tenth, fifteenth, and hundredth designs in each other's sequences.

Teacher Talk

Where's the Mathematics?

On a purely visual level, children will note that the designs have two reds at each end, square groups of four blue tiles in the middle, and single red tiles separating the blue groups. They may see that for each new design in the sequence, a blue group is added and a red tile is added to separate it from the other blue groups.

By studying their actual designs and the patterns in their data, children may be able to make connections among the design number, the numbers of red and blue tiles, and the total number of tiles in the design. Here is a chart showing the data for the first ten designs:

Design Number	Red Tiles	Blue Tiles	Total
1	4	4	8
2	5	8	13
3	6	12	18
4	7	16	23
5	8	20	28
6	9	24	33
7	10	28	38
8	11	32	43
9	12	36	48
10	13	40	53

In looking at the data within columns, children can observe that the numbers in the *Red Tiles* column increase by 1 and that the numbers in the *Blue Tiles* column increase by 4; they may even say that the numbers of blue tiles are a set of multiples of 4. In the *Total* column, children may note that the numbers have an even-odd pattern, that the units digits alternate between 8 and 3, and that the numbers increase by 5. By continuing the patterns they find within the columns, children may be able to determine the data for the fifteenth design (red tiles: 18; blue tiles: 60; total tiles: 78). It would be tedious, though, to find the data for the hundredth design in this way. It is by looking for patterns across the columns that children can discover a way to make predictions about the hundredth design.

In looking at the data across columns, most children will recognize that the numbers in the *Red Tiles* column are three more than the numbers in the *Design Number* column. They should also see that the numbers in the *Blue*

Tiles column are four times the numbers in the *Design Number* column. With this information, children can determine that the hundredth design has 100 + 3, or 103 red tiles; 100 x 4, or 400 blue tiles; and 103 + 400, or 503 tiles in all.

Children who are more experienced at finding patterns might enjoy the challenge of finding a pattern that connects the numbers in the *Design Number* column with those in the *Total* column. One way to do this is through addition:

Design Number	Add		Total
1	7	=	8
2	11	=	13
3	15	=	18
4	19	=	23

Each number added is four times the design number plus three. So the tenth design has 10 + (4 x 10) + 3, or 53 tiles, and the fifteenth has 15 + (4 x 15) + 3, or 78 tiles.

A less complicated but harder-to-discover pattern is to multiply the design number by 5 and then add 3.

Design Number		Total
1	1(5) + 3	8
2	2(5) + 3	13
3	3(5) + 3	18
15	15(5) + 3	78
100	100(5) + 3	503

For children who are ready, this activity provides a springboard for writing algebraic expressions. If the design number is represented by the variable n, the number of red tiles is $n + 3$, the number of blue tiles is $4n$, and the total number of tiles is $5n + 3$.