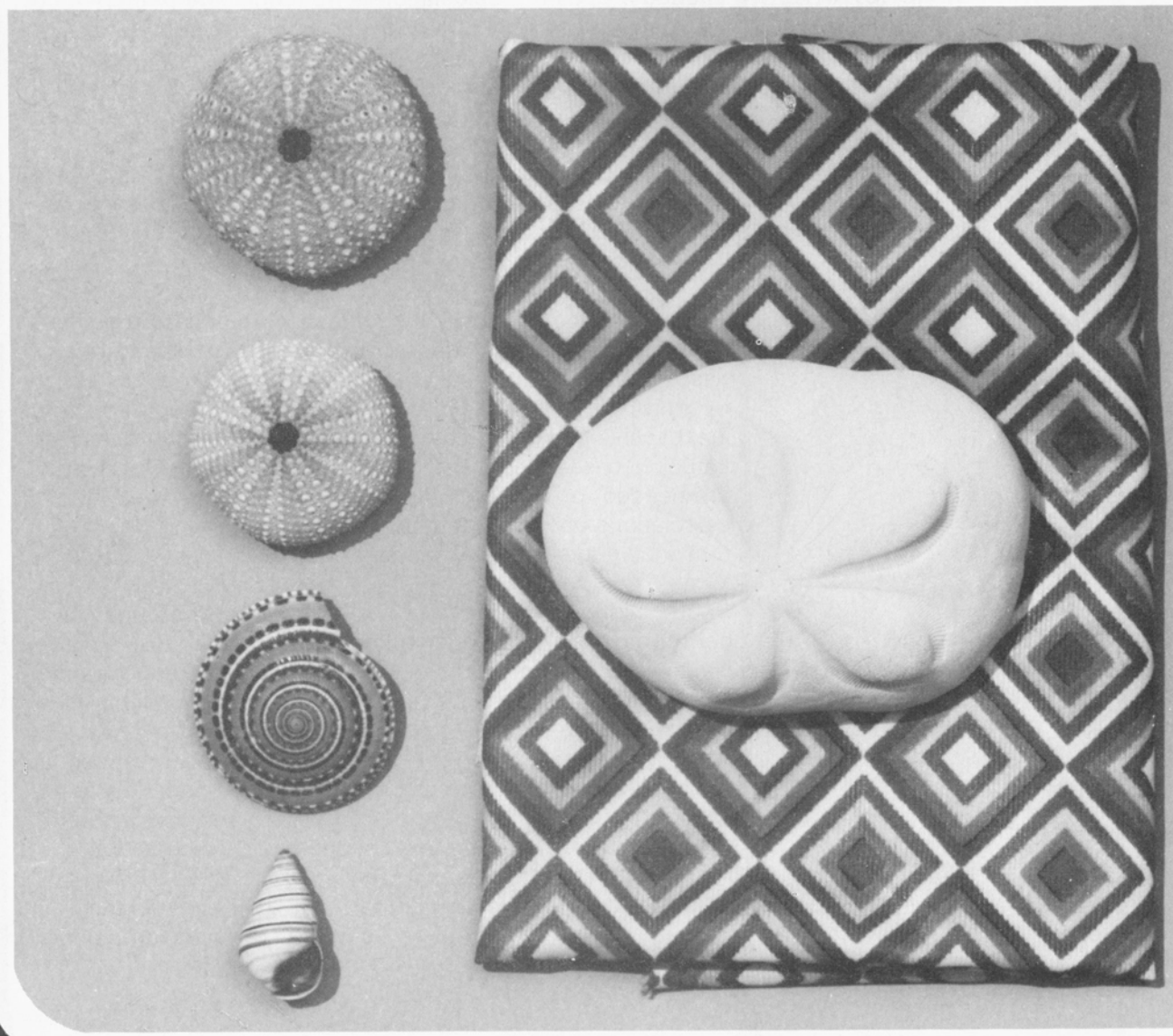


PATTERN TWO



SKILLS AND CONCEPTS _____ Examining and analyzing patterns in the real world
Observing symmetry
Reinforcing and applying the concept of number
Comparing size, shape, and quantity
Observing proportional relationships
Making and testing predictions

SELF CONCEPT AND SOCIAL INTERACTION _____ Increasing an awareness of self and others through analyzing clothing patterns
Sensing the value of one's own and others' ideas as these are used as the core of the curriculum

FUTURE APPLICATIONS _____ Recognizing pattern in the real world
Understanding functions
Understanding proportional design

PREREQUISITE CHAPTERS _____ Pattern I
Number at the Concept Level



INTRODUCTION

The activities in this chapter extend and enrich the children's previous experiences with patterns. In these activities the children look for natural patterns and man-made patterns. They create patterns of their own design using one another and a variety of structured material such as tiles, geoboards, and Unifix cubes.

Fruit and
Vegetable
Patterns

SKILLS _____

Pattern
Connecting an abstract idea to the real world
Describing patterns creatively
Comparing

MATERIALS _____

A purple cabbage, an onion, an orange, an apple, and a walnut

ACTIVITY _____

Have the children look at the outside of each piece of fruit or vegetable. Encourage them to describe the shape, texture, and markings.

Ask the children questions to force them to examine each piece carefully: Which one is purple? Red? Brown? Which ones are smooth? Bumpy? Which one pulls apart? Which one is crackly and feels like paper? Which one has tiny spots on its skin?

Place the items on a table with a magnifying glass and encourage the children to examine them closely during their free time and, if they wish, to draw each one.





In a few days, when the children begin to lose interest in looking at the exterior of the fruits and vegetables, it is time to gather the class together and encourage them to predict what each piece will look like when it is cut open. Ask which ones the children think will be the same color inside as outside. Ask if they expect to find a few seeds, a great many seeds, or none at all in each piece. Discuss the lines and the proportion and the different shades of color.

Now cut each item open and talk together about what you discover. Look at the different patterns inside each piece.



Again, place these materials at a station where the children who are interested in drawing the interior can have an opportunity to do so.

Leaf Patterns

SKILLS _____ Pattern
 Comparing
 Connecting an abstract idea to the real world
 Sorting

MATERIALS _____ A branch of leaves cut from a bush

ACTIVITY _____ As the children examine a branch of leaves, ask



them to describe whatever they notice. Ask the children questions to encourage them to examine the branch more closely: Do you see different shades of color? Do you see any places where there are different thicknesses? Do these always occur in the same place? What do you notice about the spaces between the leaves? Are all the leaves the same size? How are they attached to the branch? Are they like your arms, straight across, or do they zig zag? Are all the lines straight? Are any of them diagonals? Are all the parts the same color? The same texture?

If you cut the leaves off the branch, the children can sort them.



Clothing Patterns

SKILLS _____

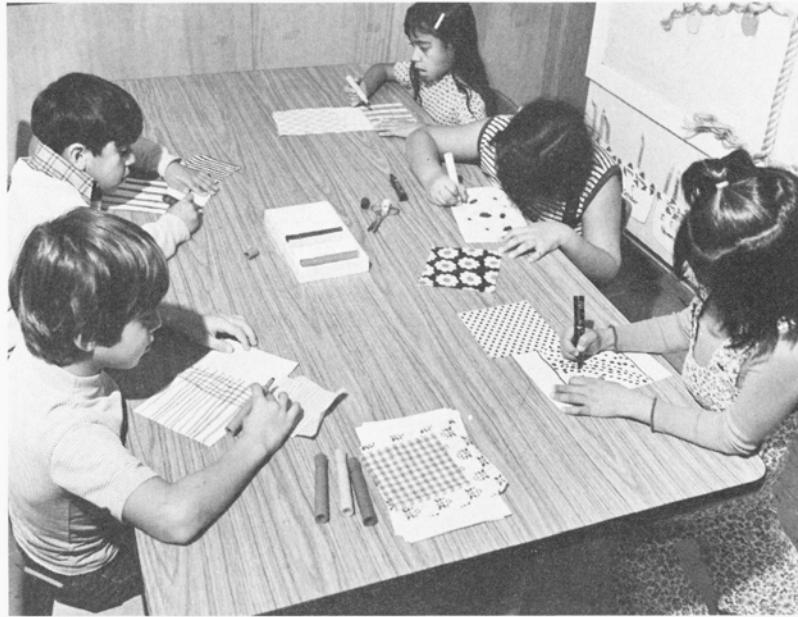
Comparing
Connecting an abstract idea to the real world
Reproducing and extending pattern

MATERIALS _____

Paper, crayons, 15 cm or 6" square swatches of material brought from the children's homes

ACTIVITY _____

The children examine the design on a piece of fabric and copy this pattern onto paper.



In a few weeks when the children are reproducing the material confidently, they can team up in twos and attempt to reproduce the pattern on their partner's clothing. No attempt should be made to copy the shape of the clothing or to draw the person; the children's focus should be only on the design of the material. When the children finish, collect patterns from six or eight children at a time and ask those children to stand apart from the rest of the group. Mix up the papers and then show them one at a time to the class. See if the class can guess which child each paper represents.

On the following day ask the children to recall the clothing worn by one child the day before. This kind of practice develops the children's visual memory and increases their awareness of one another.

If you find this is too difficult for your students, have them study a child in class for one minute. Then have the class turn away and try to describe the clothing of this child. When they finish, they turn around again and compare their description with the child. When this is successful for several days, try to have them recall from memory what children wore the day before.

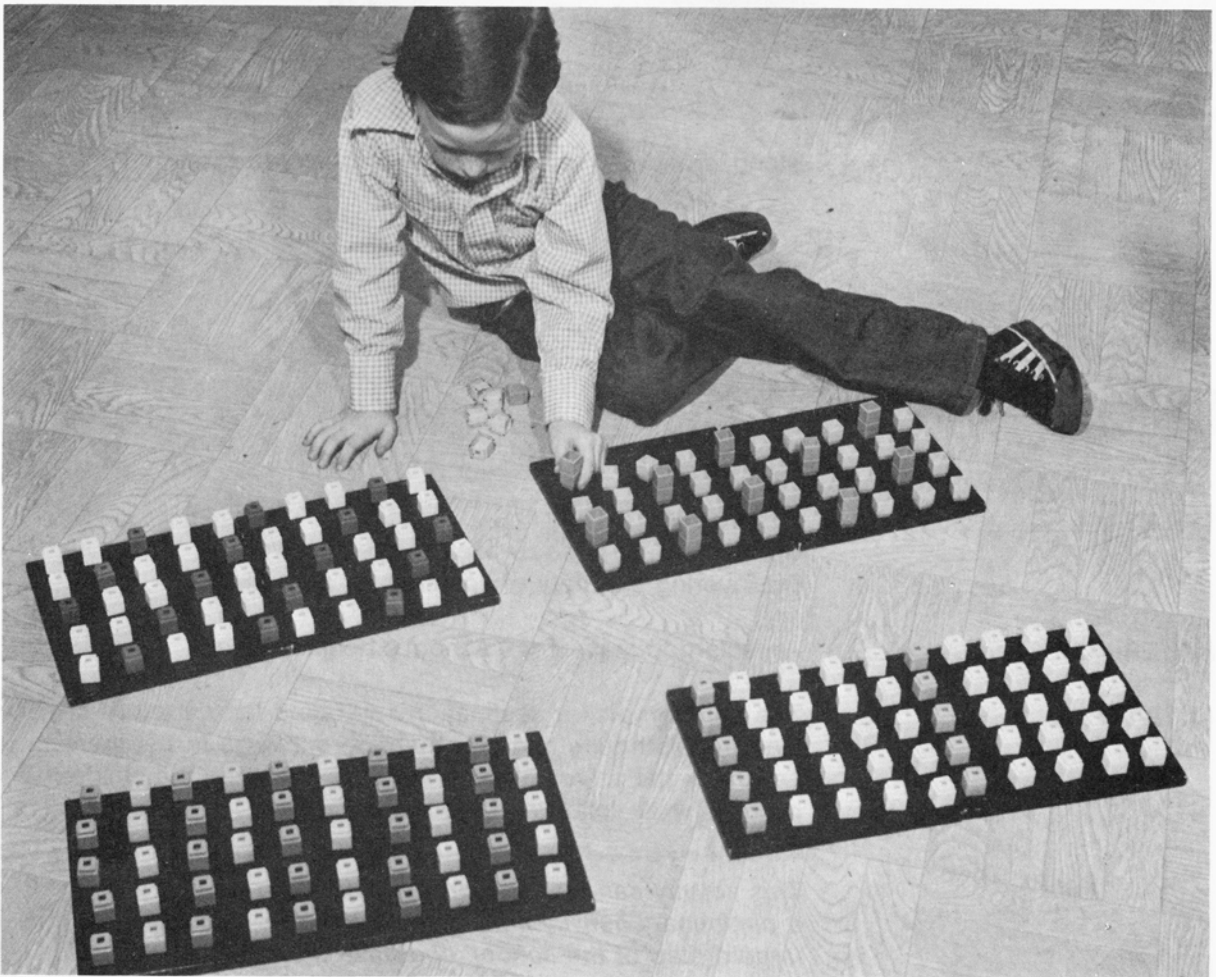
Geoboard Number Patterns

SKILLS _____ Pattern
Comparing
Counting

MATERIALS _____ Geoboards*, Unifix cubes*

ACTIVITY _____ Two children work together on four geoboards arranged in a square.

The children select a number from one to ten to explore. They should begin counting at the top left-hand nail and move across and down the board as though they were reading. Each time a child says the number being explored, she or he drops a Unifix cube over that nail. The children continue counting and capping the appropriate nails until each row is completed.



When the children finish their pattern, discuss how the cubes are arranged and how they form patterns in the rows, columns, and diagonals.



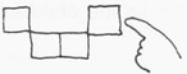

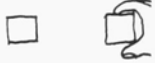
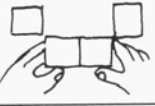
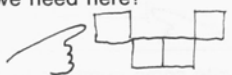
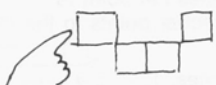
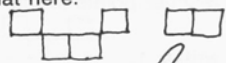



Tile Patterns






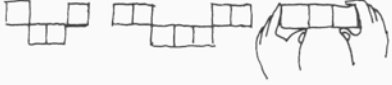



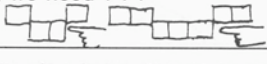
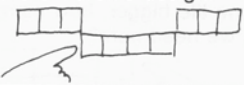


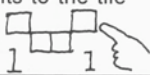


SKILLS _____ Problem solving
Counting
Comparing patterns
Labeling concepts with mathematical symbols

MATERIALS _____ Ceramic tiles*

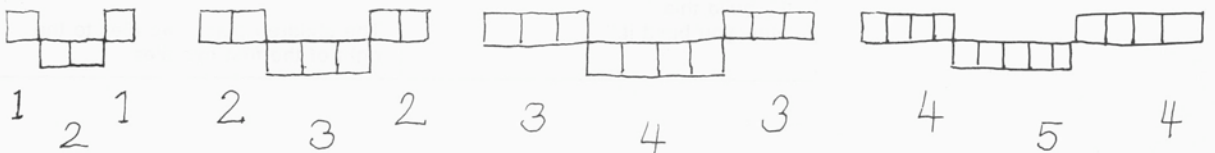
ACTIVITY _____ A group of children work together constructing a pattern in a sequence. The teacher asks one child to make a design on the overhead projector using four tiles. Then each child copies the design. The teacher questions the children to help them focus on each step, starting at the top of the design and working down.

SAMPLE TEACHING STRATEGY _____

TEACHER	CHILDREN
<p>"How many tiles are there here?"</p> 	<p>"One."</p> 
<p>"And here?"</p>  <p>"And here?"</p> 	<p>"One."</p>  <p>"Two."</p> 
<p>"If we were going to add a tile in each place in order to make this design one tile bigger, how many tiles would we need here?"</p> 	<p>(The children act confused.)</p>
<p>"If there's one here, one more would be . . ."</p> 	<p>"Oh, two."</p>
<p>"I'll build that here."</p>  <p>"Now you build it."</p> 	 <p>The children place two tiles in front of them.</p>
<p>"If we want to make this part of the design one bigger, we'd need how many tiles?"</p> 	<p>"Two."</p>
<p>"I'll build this." "Now you build it."</p>	<p>The children place two tiles to the right of the first two tiles.</p>

 <p>"And for this part, we need . . ."</p>	"Three."
<p>"I'll build it and now you build it."</p> 	The children place three tiles in the appropriate place.
<p>"Let's try making the next step of the design together. If we have one here and two here, how many do we need here?"</p> 	
	"Three."
<p>The teacher builds and then checks each child's design.</p> 	
<p>"And if we have one here and two here, we need . . ."</p> 	"Three."
<p>The teacher builds this step and checks the children's design.</p> 	
<p>"If we have two here and three here, we need . . ."</p> 	"Four."
<p>The teacher builds this step and checks the children's design.</p> 	
<p>"Let's write some numbers to describe our pattern so far. Tell me how many tiles I'm point to." The teacher points to the tile and writes: 1.</p> 	"One."
<p>The teacher points to the tile and writes: 1.</p> 	"One."
<p>The teacher points again and writes: 2.</p> 	"Two."
<p>and writes: 2.</p> 	

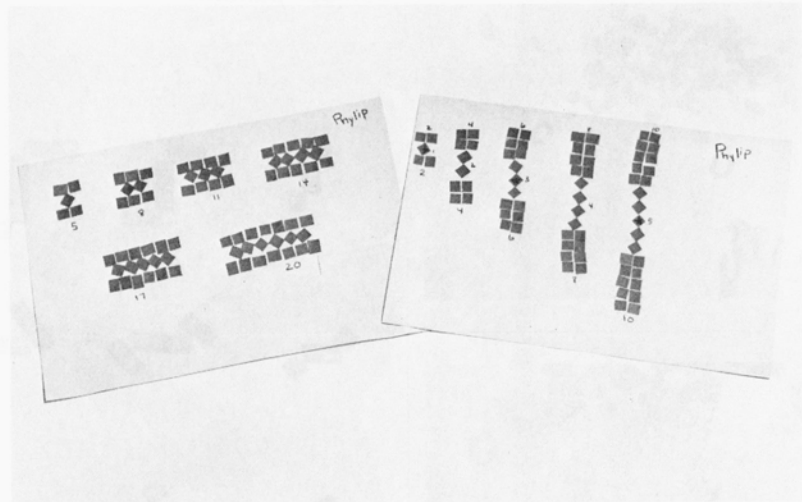
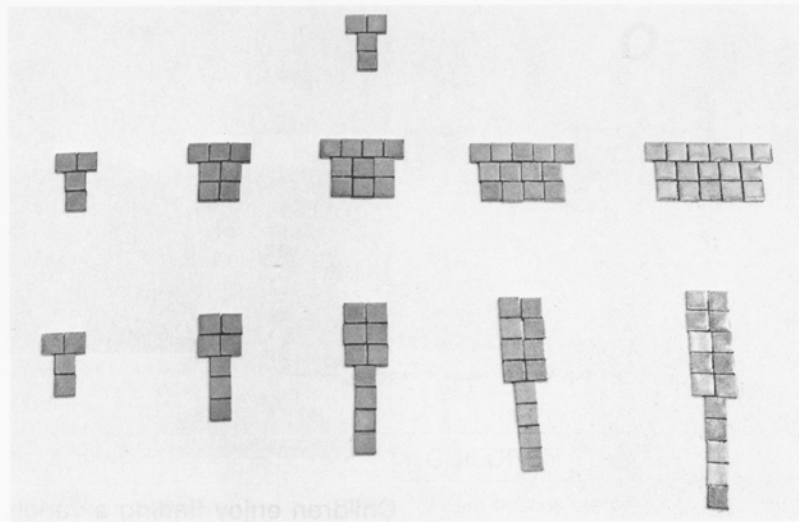
Continue pointing to one step at a time and generate the following pattern on the overhead projector:



Ask the children to predict from the symbols what the next step will be, and then build the step to check their prediction. Predict and build until five or six steps of the pattern are completed.

Using this same format, repeat the activity several times changing the original pattern each day. The first step can gradually increase from four tiles to five or six tiles. As the children become skilled, they can copy their design by cutting 1 cm or 1/2" strips of construction paper into small squares and then either pasting them on paper in the appropriate design or the square template may also be used to record designs.

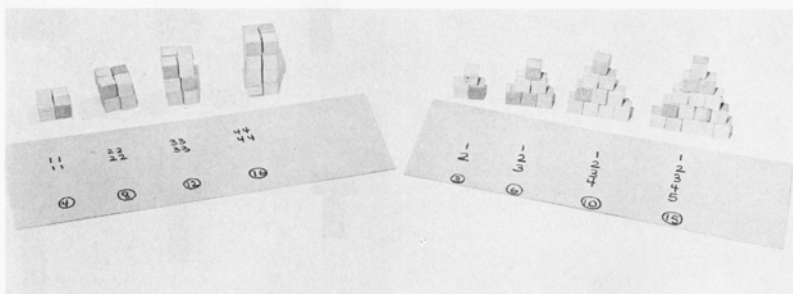
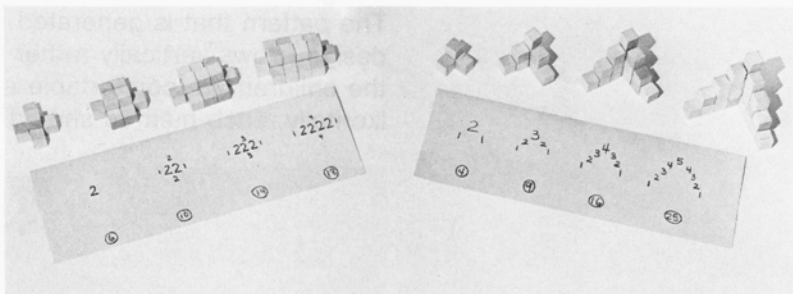
The pattern that is generated will be different if the original design grows vertically rather than horizontally. As soon as the children are comfortable approaching the pattern horizontally, each method should receive equal attention.



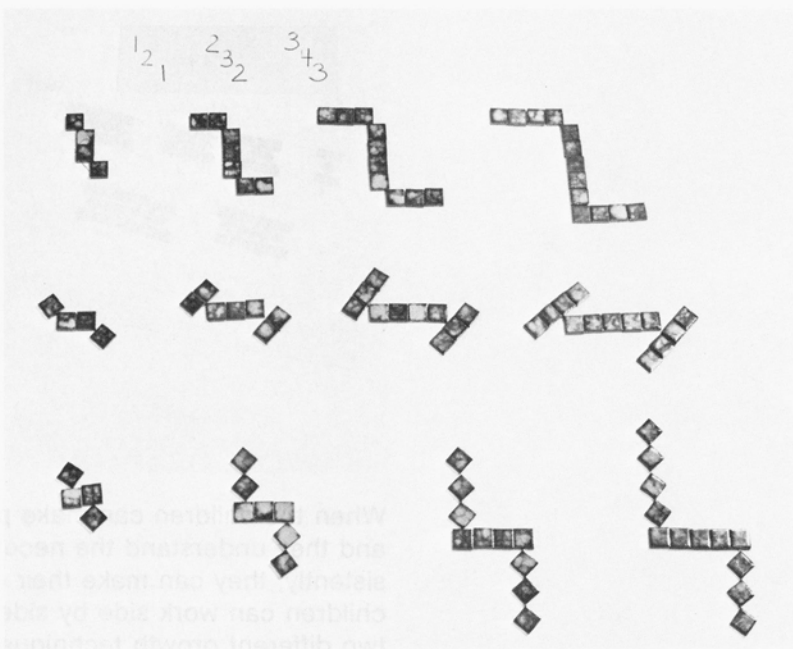
When the children can make patterns using both methods and they understand the necessity to use one method consistently, they can make their own choice of methods. Two children can work side by side to compare the effect of the two different growth techniques on one design.

When children make a pattern with more than five objects, it is often possible to make the pattern decrease as well as increase. If this is possible, it should be done. The written record, rather than the tiles, often suggests this possibility to the children.

The same activity can be done with wooden cubes but the resulting patterns are more advanced and some will be difficult to record on paper. It is, nevertheless, a very worthwhile activity which can be done at the concrete level, without making any written records of the patterns.



Children enjoy finding a variety of ways to interpret a given number pattern.

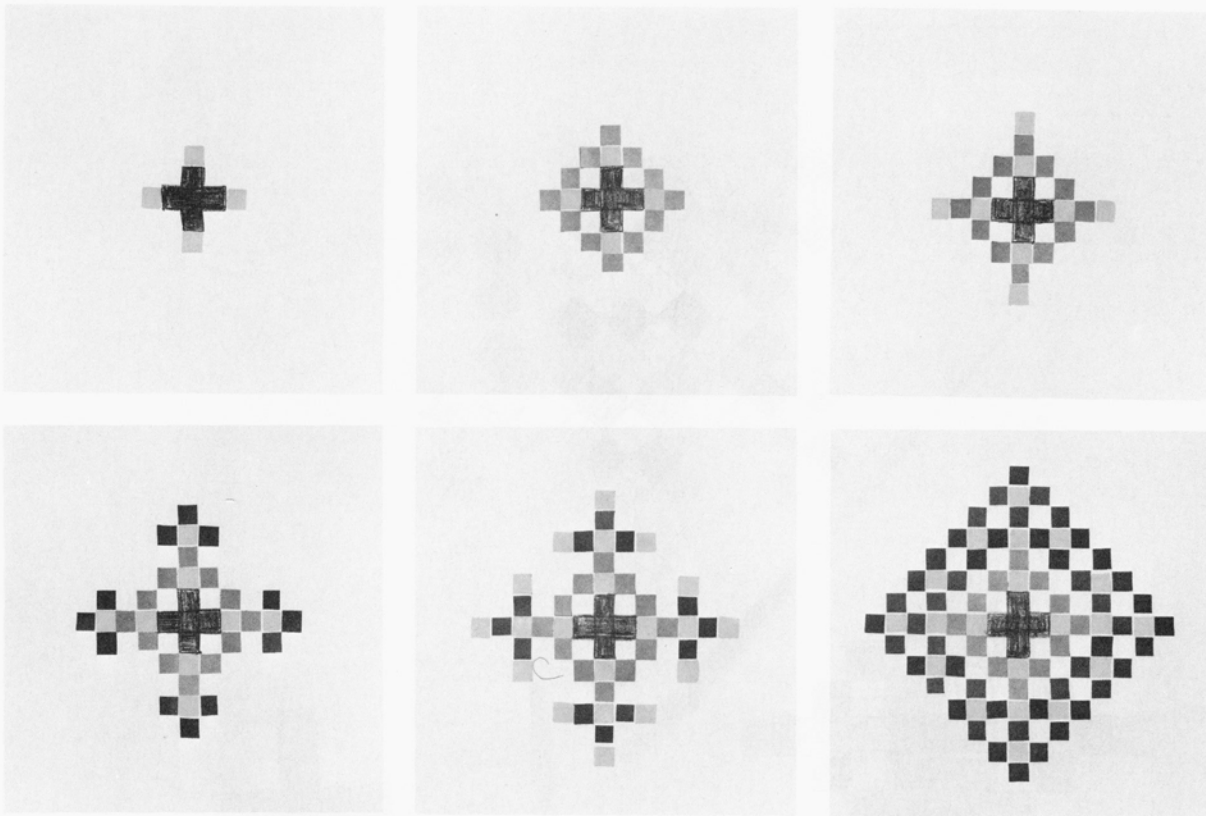


Surrounding Patterns

SKILLS _____ Pattern
Problem solving
Comparing
Making and checking predictions

MATERIALS _____ Wooden cubes,* two sheets of squared paper taped together (see Worksheet 55)

ACTIVITY _____ The children work in teams of three or four. They make a base design, surround it with another design according to a specific rule, and observe how the pattern grows.



Have the children make a design with five or six blocks on a piece of graph paper.

The children remove one block at a time and color the design onto their graph paper.

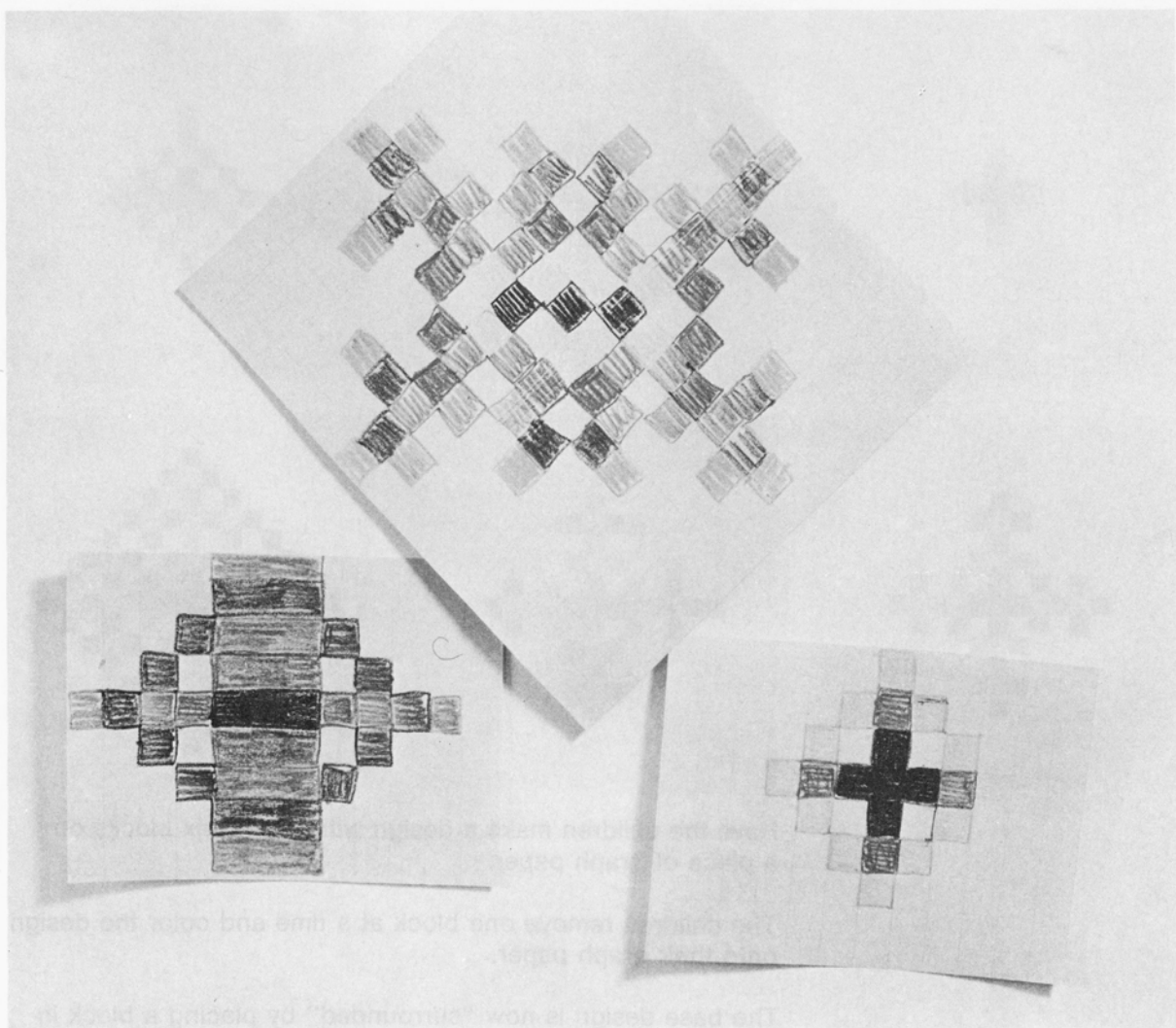
The base design is now “surrounded” by placing a block in each space that touches only one side of the base design.

When the new blocks have been added, the children ask the teacher to ascertain whether each block is placed according to the rule. (The children use cubes rather than coloring

directly onto the graph paper because it is easier to fix mistakes by moving a cube than to erase coloring.) When the "surrounding" design has been checked, the children remove one block at a time and color the graph paper accordingly.

The children make as many surroundings of each design as they find interesting. Some designs are quickly played out or become predictable and, therefore, are interesting for a shorter period of time. Other patterns interest a group of children for several work periods. It is important that the *children* be the ones to decide when they want to change to a new base design. Do not require them to work for a certain length of time or to create a particular number of patterns. When they make this decision themselves, each pattern has a unique impact on the group of children exploring it.

The children repeat this activity many times keeping records of their patterns.



Some children enjoy recording each step of the pattern. This can be done by gluing small squares cut by the children from 1 cm or $\frac{1}{2}$ " strips of construction paper to large sheets of paper or by using the square template.

Some children enjoy making up rules to try. There is no magic to selecting a rule; any procedure that is applied *consistently* will result in the growth of a unique pattern. The following suggestions give an idea of the possibilities: What sort of pattern results if a red cube is added whenever a cube touches one side of the base design; if blue is used when a cube touches two sides; if yellow is used when a cube touches three sides; and if green is used when a cube touches four sides? How do the patterns come out when a cube is added *only* when it touches *two* sides? What about removal rules, such as removing a cube when it is surrounded on three sides? Are three dimensional constructions possible? How about a rule such as adding a double decker when a cube touches two sides, a triple decker when a cube touches three sides, etc. The possibilities for rules are limitless, and all will create patterns which are worth exploring.

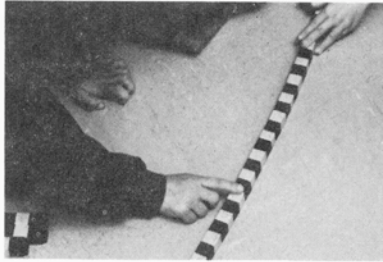
Row, Column, and Diagonal Patterns with Unifix Cubes

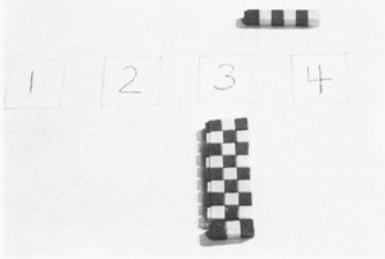
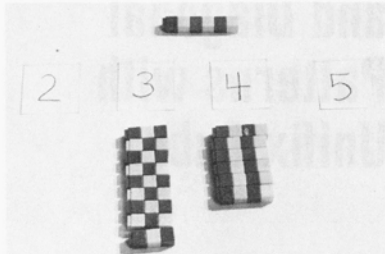
SKILLS _____ Counting
Comparing
Using pattern
Sorting

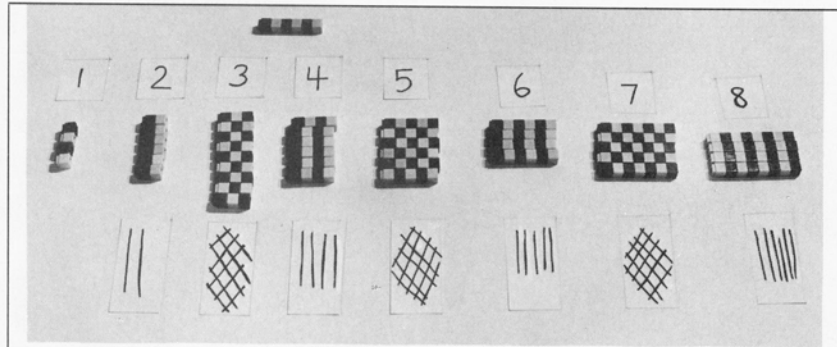
MATERIALS _____ Unifix cubes*

ACTIVITY _____ The teacher breaks an extended pattern of Unifix cubes into various lengths and the children describe the new patterns.

SAMPLE TEACHING STRATEGY _____

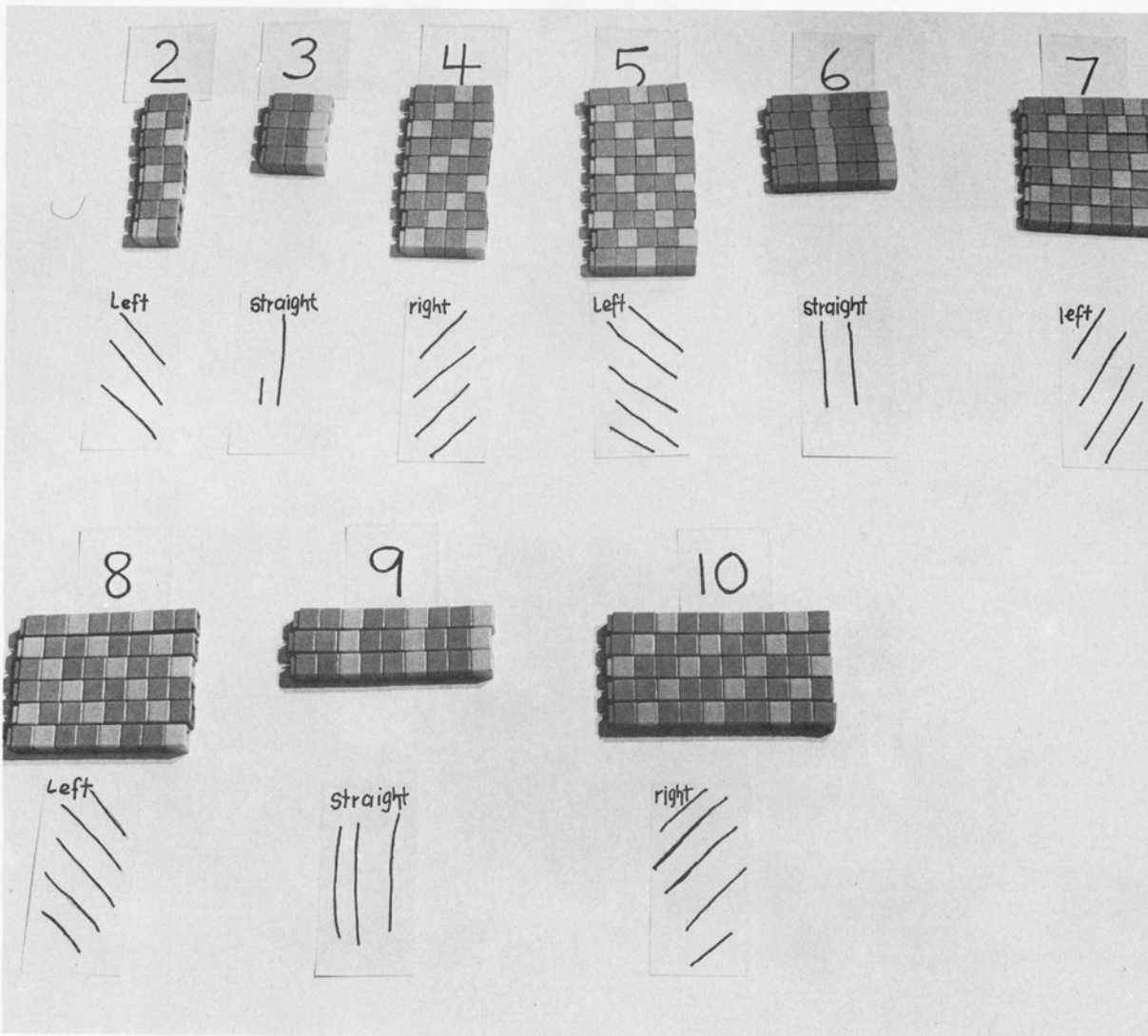
TEACHER	ACTIVITY:
<p>"Work together to make a train of Unifix cubes alternating, red, green, red, green, red, green," (While the children work the teacher puts out the numbers from one to ten on the table or rug.)</p>	<p>The children prepare a long train of cubes according to directions.</p> 

<p>"We are going to break our train into smaller trains and look for patterns. What shall we try first . . . breaking our train into groups of two, three, four, or five?"</p>	<p>A child suggests groups of three.</p>
<p>The teacher breaks a group of three cubes from the left end of the train and places it under the numeral three. Then she quickly breaks the next group of three from the train, sliding this group into place beneath the first group. This is repeated until nine or ten groups of three have been placed together. It is important not to get the groups mixed up and to place them one after another in the same direction as they were facing in the original train. This is easily accomplished by breaking and sliding one group at a time. At this stage, the children are observing, not helping.</p> <p>"Does anyone see any patterns?"</p>	 <p>"The reds are sideways." "That's called the diagonal." "They go the other way too!" "Hey, so do the greens!" "It goes ABABAB on the up and down part just like the long train."</p>
<p>"That time we broke our train into groups of threes. How shall we break it up this time?"</p>	<p>A child suggests groups of four.</p>
<p>The teacher breaks four cubes from the remainder of the train and slides one group after another into place until there are nine or ten groups lined up.</p> <p>"What patterns do you see?"</p>	 <p>"It's all the same up and down!" "They're stripes just like Mike's shirts." "The stripes are ABABAB." "Yeah, but it's different from the long train—that's ABAB too." "It's okay, it's still ABAB, just more." "Red, red, red, red, red, red . . ."</p>
<p>"How should we break our train this time?"</p>	<p>A child suggests groups of eight.</p>
<p>The teacher breaks groups of eight from the train.</p>	
<p>The teacher breaks groups of eight from the train.</p>	<p>"Look, it's just like the last one." "You're right, it's the same pattern as the fours. How about that." "Yeah, man, weird." "Let's try nines, we haven't done them yet."</p>



The teacher and children continue working together, breaking off various lengths and describing the patterns which are formed.

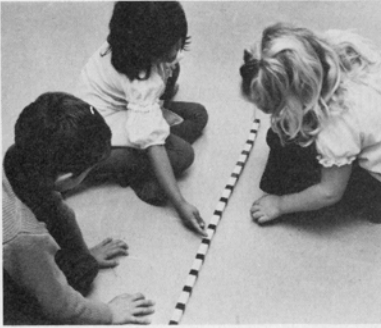
This activity can be repeated often using a different pattern for the original train each time. Any pattern will produce a unique design when it is broken into ones, twos, threes, and so on. If the children are interested in recording their patterns, they can do so by coloring the patterns on Unifix paper. (See Worksheet 55.)



10

PATTERN TWO

Row, Column, and Diagonal Patterns with

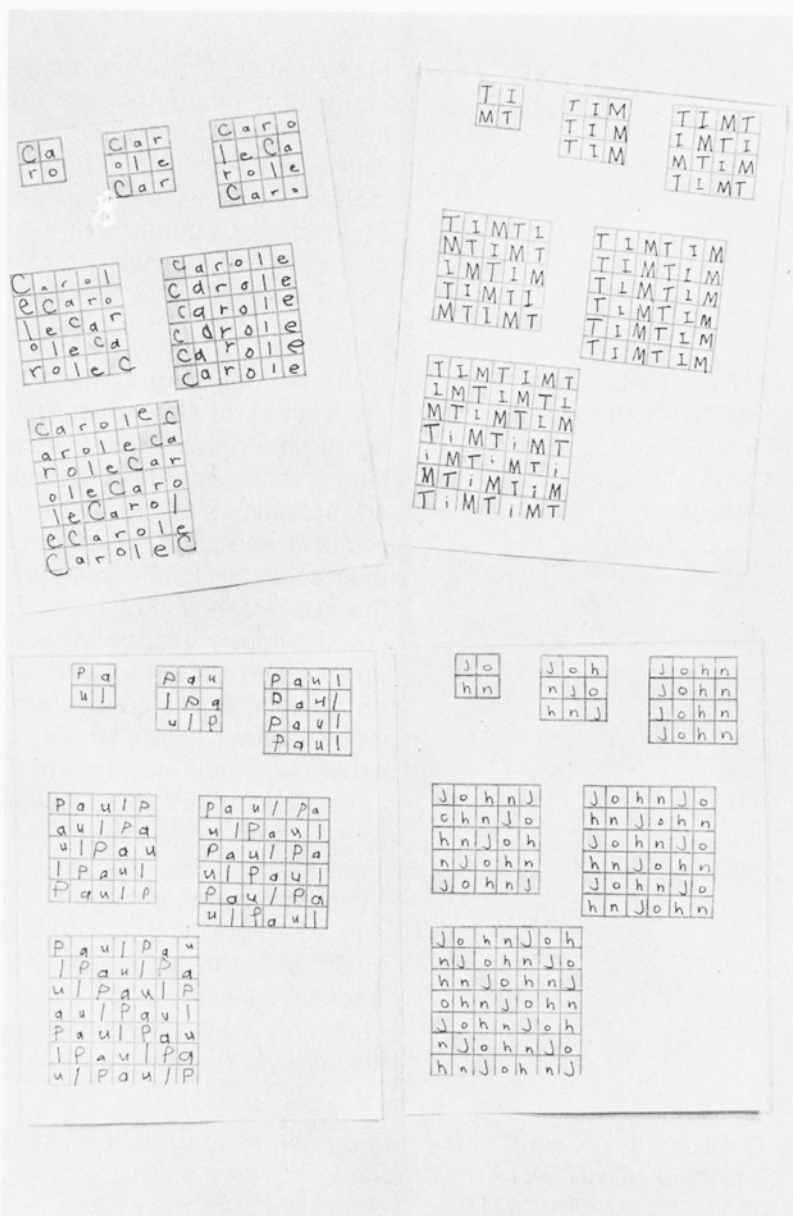


Names

SKILLS _____ Following directions
Pattern
Comparing

MATERIALS _____ Worksheet 54, crayons

ACTIVITY _____ The children write their name in the square arrays, beginning each one with the first letter of their name and leaving no spaces between letters or names. Then they color in the first letter of their name and look for patterns.



The children can sort their patterns, looking for other children in class with the same pattern and attempt to explain why this occurs.

QUESTIONS FROM TEACHERS

WHY ARE THERE SO MANY DIFFERENT KINDS OF PATTERNS IN THIS CHAPTER? ARE ALL PATTERNS PATTERNS?

I CAN'T FIT ALL I WANT TO DO INTO AN HOUR'S BLOCK OF MATH TIME. IS THIS SUPPOSED TO BE POSSIBLE?

IS IT OKAY IF A CHILD COMBINES HORIZONTAL AND VERTICAL GROWTH WITHIN THE SAME DESIGN

Patterns are everywhere. Science, mathematics, psychology, sociology, economics, history, medicine, and even law are all based on recognizing patterns. Patterns help us understand our world; they help us anticipate the next step rather than our experiencing each step as a new and isolated phenomenon.

Mathematics evolved as man's and woman's way of describing (with numbers instead of words) the patterns observed in the natural world. Galileo said, "Mathematics is the language with which God has written the universe." Pythagoras also mentions this saying, "numbers are the language of nature." By looking for patterns in many different forms, we help children have a broader picture of the existence of pattern in the world.

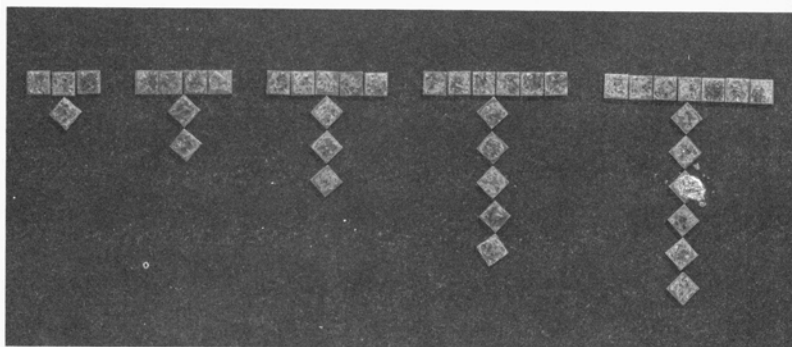
There is a lot more than math going on in these activities. Try to think of your whole day as learning time and plan the entire time rather than dividing separate isolated parts into time blocks. With these activities children are reading, doing art, sometimes doing health or physical education, exploring science, and all the time they are working on improving their social skills and self-concept. To do all this as well as the mathematics is obviously going to take more time than you previously allotted to working on the textbook. Some days you may want to work an hour and a half or even more on these activities spaced out at different times during the day. On other days you may only work twenty minutes. The schedule should not control the teacher, the teacher should control the schedule, adjusting it according to his or her professional judgement.

Children's needs change dramatically from September to June and, therefore, the schedule should, too. The important thing, again, is not to get locked into any *one* way. Retaining flexibility allows you to remain sensitive to your students' changing needs. Nothing is more important than that sensitivity.

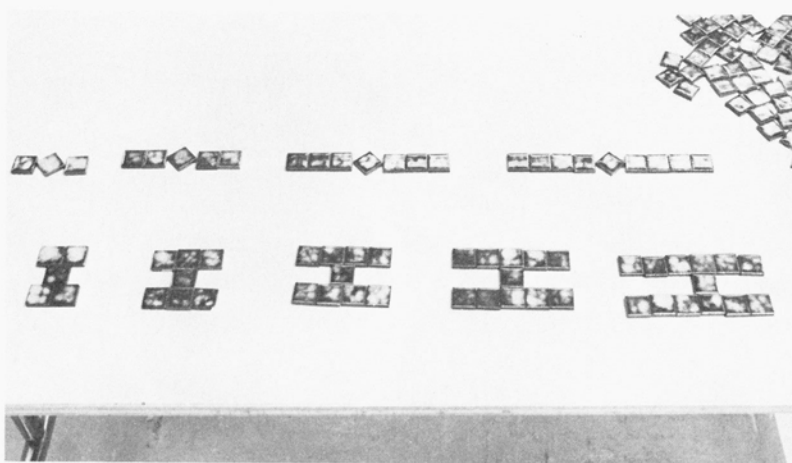
Any rule, as long as it is applied consistently, is "right" and will produce a unique growth pattern that is worth exploring. Some children will keep one area constant as other areas grow horizontally or vertically. Accept any variations your

WHEN MAKING TILE PATTERNS?

students want to try. The only rule is that the idea must be applied consistently.



Combining horizontal and vertical growth



Horizontal growth with one part of the design kept constant

HOW DO I ENCOURAGE STUDENTS TO LOOK FOR PATTERNS IN THE REAL WORLD ON THEIR OWN?

Your question is a very perceptive one, for if what the children learn at school does not help them in the real world, what was the point of it? Whenever a child spontaneously volunteers that she or he saw a "pattern" on the way home or on the way to the movie, etc., try to turn it into a project.

While counting the number of two door and four door cars in the parking lots for a graphing activity, a child in my class got sidetracked noticing the hubcaps on the cars. So we started looking for all the different hub cap patterns we could find. The children cut circles from paper and took them home whenever they wanted to look for hubcap patterns. We collected over a hundred variations. That sparked an interest in foot print patterns made by soles of shoes and we started collecting those. In the middle of that project someone told us about the different "garage door" patterns and some kids started bringing in those variations. Soon kids were looking for different signs, different fences, and even different floor plans in their houses.