Patterns – myths and not myths

The Patterns and Relations strand concerns two related processes - sorting and patterning. There are myths attached to these two processes. Sorting and patterning are not mathematical processes in and of themselves. Mathematics is a cultural invention – an organized set of concepts, symbols, relationships, and procedures created by people. Sorting and patterning are fundamental thinking processes that we are born with to a greater or lesser extent. The processes are hard-wired in us, if you will. We use them in our daily lives: when parenting, when reading a book, when going shopping, when learning a language, and so on. As a parent I detected a pattern when my baby son was hungry - he cried. Is the detection of that regularity doing mathematics? My wife normally sorts the laundry according to colour. I sort it according to aroma. Are we doing mathematics when we sort the laundry?

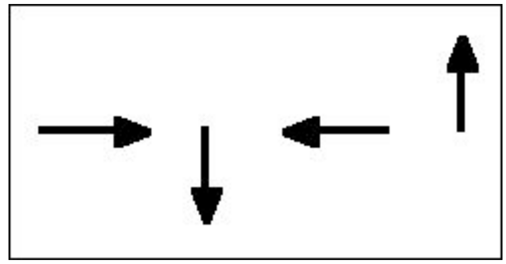
While children certainly classify and sort things, seek and identify patterns, and reason logically about events in their lives, those things do not necessarily involve mathematics. For example, when my daughter was seven years old, she classified her teachers into three categories: jelly fish, backbones, and brick walls. She preferred backbones. Jelly fish always let you do what you want. Backbones sometimes let you do what you want but they are firm about some things. Brick walls are mean. They never let you do what you want. Classifying her teachers in that way is not mathematical thinking; it is something else.

When we sort and look for patterns in ways that involve mathematical objects (e. g., numbers, shapes) and/or attributes (e. g., length, thickness) then we are working in the domain of mathematics with the help of the processes of sorting and patterning. When we sort and look for patterns in ways that involve science notions such as plant species then we are working in the domain of science with the help of these processes.

Patterning concerns a kind of thinking generally referred to as inductive reasoning - searching for a consistent feature in something and having faith that it will continue. We are able to think in that way from birth. And patterning is not unique to humans. Animals look for patterns as well. Any one who has a pet dog can attest to that. Being able to identify patterns is one of our mental survival tools but it is not necessarily mathematical thinking.

What is a pattern from the perspective of mathematics? First of all a pattern is not something that must repeat three times. Nor is a mathematical pattern equivalent to a pretty visual design or equivalent to a template such as a dress pattern. Mathematically speaking, a pattern concerns something that remains constant about a collection of numbers, shapes, or mathematical symbols, concepts, or attributes. The critical matter is ‘remains constant’.

Consider the series of arrows shown here. What is the pattern?



There is a regularity in the way the arrows point. The direction of each subsequent arrow involves a constant rotation or turn. One way to describe the pattern is the change in direction is always 1/4 of a turn clockwise.

Patterns do not shrink or grow. The elements of a pattern may shrink or grow but the pattern does not. Consider the series of numbers: 23, 19, 15, 11, 7. The numbers (the elements) in the series decrease (shrink) but the pattern does not. One way to describe the pattern is that each successive number is 4 less than the number before it. This pattern does not shrink for the series of numbers. It remains the same.

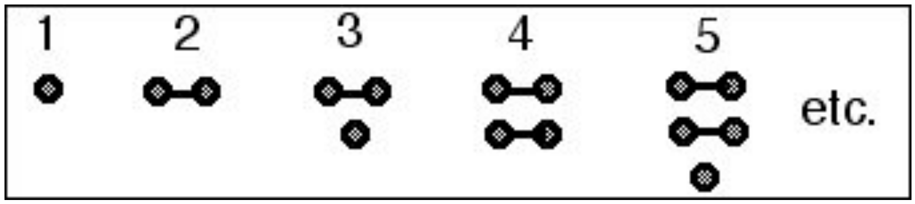
With respect to early years curricula, the identification of pattern types should not become an important goal for teaching patterning. For example, consider the following sequences: RED YELLOW YELLOW RED RED YELLOW YELLOW RED RED YELLOW YELLOW RED, and 1331133113311331. An underlying pattern can be identified in the two sequences; some call it the ABBA pattern (not to be confused with the 1970's Swedish pop group, Abba). The underlying pattern can certainly be viewed in an ABBA way but that is not really the point of doing patterning activities. Being able to recognize the "ABBA" pattern is of dubious benefit to the student or society at large. What can be of benefit is the student becoming comfortable with the processes of making and testing hypotheses when searching for patterns.

Having said this, nevertheless some identification of underlying patterns should be pursued as that can assist students in making generalizations. For example it is useful, to a point, that students recognize that the sequences, RED YELLOW YELLOW RED RED YELLOW YELLOW RED and 133113311331, have something in common even though one concerns colour and the other concerns number. One way to describe what they have in common is to call it the ABBA pattern.

While the mental process of searching for and identifying patterns is hard-wired in us, the language associated with that process is not. Students do need to learn language descriptors for a process they can do naturally. For this reason, it is good pedagogy for teachers to make use of things that are familiar to students to help them understand the language descriptors. Such non-mathematical things as shoes and teddy bears are quite appropriate contexts for developing Kindergarten and grade one students' understanding of language. However, once they understand the meaning of such words as 'pattern', patterning activities should involve reasonable to significant mathematics and serve two important purposes. They help students learn mathematics and they help stimulate the fundamental thinking process of patterning so that it can grow in depth and scope.

Patterning activities can be integrated with other strands of the mathematics curriculum in two ways: (1) using patterns to learn concepts/skills from other mathematics strands and (2) solving patterning problems that involve concepts/skills from other strands. Examples follow.

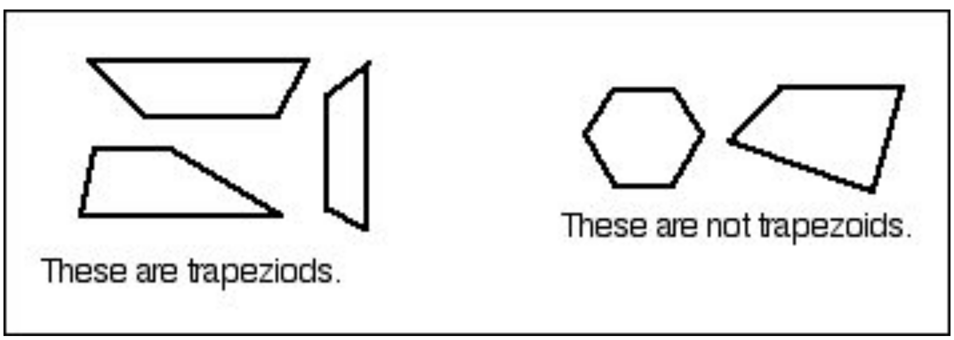
Example 1.



Early years children learn about odd and even numbers. Patterns can be used to help them understand these kinds of numbers in an activity that involves using actual objects and the symbols for numbers. For each represented number, children could be asked to make pairs in some way (lines segments are used in the diagram).

Children could then be asked to look for a pattern. With discussion, they would likely come to the conclusion that the numbers 2, 4, 6, . . . always can be paired while the numbers 1, 3, 5, . . . always have an unpaired object left over. All that remains is for the teacher to attach the name 'even' to the numbers 2, 4, 6, . . . and the name 'odd' to the numbers 1, 3, 5, . . .

Example 2.



Patterns can be used to help students understand geometry terminology. For example, a teacher can display two collections of shapes and ask students to look for a pattern and then provide a definition for a trapezoid. One pattern is that trapezoids have 4 sides, one pair of opposite sides is parallel and the other pair is not parallel.

Having students solve problems that involve patterns and concepts/skills from other strands is the other way to integrate patterning within the mathematics curriculum. For some of these problems teaching attention can be paid to additional matters such as constructing tables and using systematic ways to look for patterns in numbers. Many problems are possible. Mathematics curriculum documents contain good examples of such problems.

This reading is an abridged version of an article published in a journal: [J. Ameis., 2001, delta-K, May].