

The Exploration of Patterns

Chelsey Bonnett

During my studies to become a teacher, I became interested in how children think about patterns. I designed a series of tasks that would help early learning students demonstrate the following outcomes from Alberta's K-9 mathematics program of studies (Alberta Education 2007, 53):

- Distinguish between repeating patterns and non-repeating sequences in a given set by identifying the part that repeats.
- Copy a given repeating pattern, e.g., actions, sound, colour, size, shape, orientation, and describe the pattern.
- Extend a variety of given repeating patterns by two more repetitions.
- Create a repeating pattern, using manipulatives, musical instruments or actions, and describe the pattern.
- Identify and describe a repeating pattern in the classroom, school and outdoors; e.g., in a familiar song, in a nursery rhyme.

The goal was to have students recognize how patterns allow them to make predictions and justify their reasoning when solving routine and nonroutine problems.

I chose to work with Dave,¹ a five-year-old who attended kindergarten at a public elementary school in Slave Lake. This boy was rather bright, tended to catch on quickly, was already showing a great interest in the area of science, and was enthusiastic when approaching new tasks.

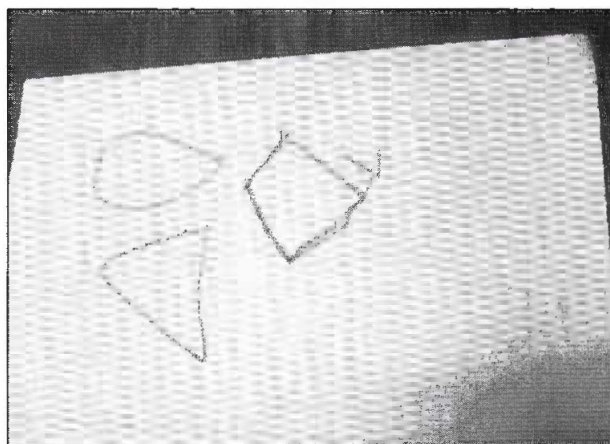
We worked together for approximately 30 minutes, going through the tasks I had planned. He was able to follow my instructions without much elaboration; he took his time thinking through what I had asked of him before responding; and, as he worked, he talked through his thinking, which is a helpful strategy he had developed for himself but which also helped me understand and follow his thought process. Dave was confident in creating and extending patterns with the use of colours, but he had great difficulty applying the same concept to shapes and number patterns.

What follows are my observations and reflective notes as I learned more about Dave's understanding of patterns.

The Tasks

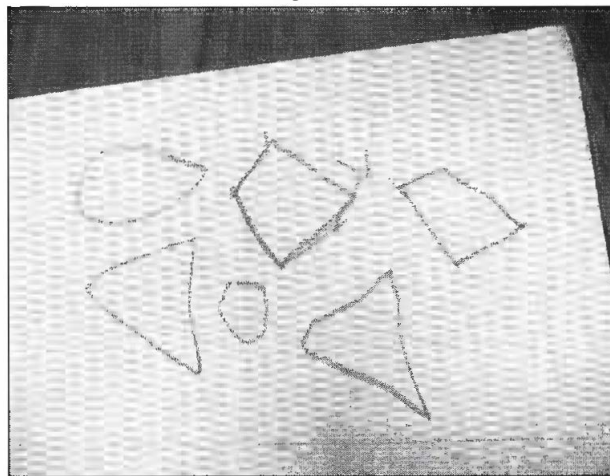
I asked Dave to draw three different shapes. He first drew a triangle and a circle. As he drew the shapes, he said their names out loud. He then said "diamond" and began drawing one, but then he paused and asked for help. I helped him finish drawing the diamond. See Figure 1.

Figure 1



I then asked Dave to repeat the pattern of those three shapes. He drew them again, although not in a particular sequence or size. See Figure 2.

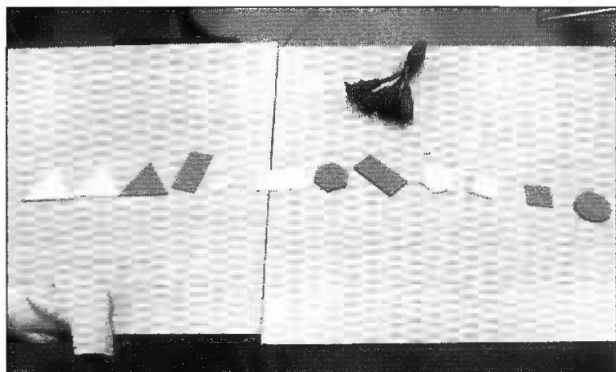
Figure 2



I asked Dave to use the manipulatives (various shapes, in various colours and sizes) to make a pattern. He asked if he should use colours or shapes, and

I allowed him to make the choice. He then created the pattern in Figure 3, focusing only on colours (yellow and blue). Dave successfully made the pattern three times.

Figure 3



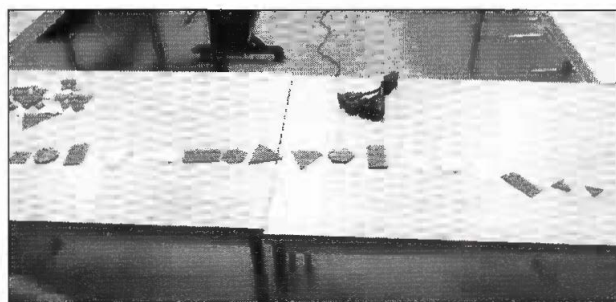
To extend this task, I asked Dave if he could make a repeating pattern using three variables. Figure 4 shows the pattern he created: blue, yellow, red, yellow, blue, red, yellow. I asked him if everything was in order, and he began going through each set of three, saying the colours. When he said "yellow" the second time, he stopped and went through the first three colours again before correcting himself and saying it should be blue, yellow, red, blue (rather than blue, yellow, red, yellow).

Figure 4



My response to him was, "Can you change this to repeat the pattern in sequence?" Figure 5 shows his solution. He rearranged the manipulatives to demonstrate a repeating pattern using three different colours (blue, yellow, red).

Figure 5



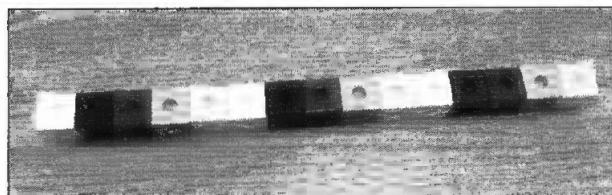
Changing manipulatives, Dave attempted to create another repeating pattern (see Figure 6). When I asked him why the end looked different from the beginning, he paused, thinking. After a moment, he responded, "I don't know. I just changed the pattern. Now it's not the same."

Figure 6



Dave pulled the blocks off the end and tried again. He said, "I just look at the beginning and know what is next." As he did this portion, he said each colour aloud and ended up with the pattern in Figure 7.

Figure 7



I then showed the repeating pattern in Figure 8 (blue, blue, orange, brown, red, blue, blue, orange, red, brown) to Dave, and asked him to continue it. He first went through, saying each colour, and he quickly recognized the mistake I had included in the pattern. I was pleased and surprised by this.

Figure 8

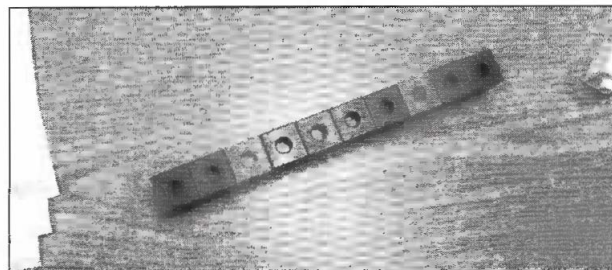


Figure 9 shows the correction Dave made to the repeating pattern (switching the red and brown blocks at the end).

Figure 9

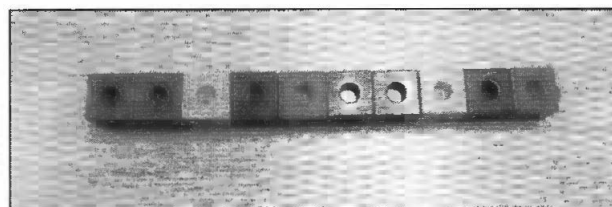


Figure 10 shows Dave checking his work after correcting and expanding the pattern I presented him with.

Figure 10



My Reflections

My work with Dave prompted me to consider whether the ability to form patterns and to develop understanding of patterns on the basis of colour or number is influenced by age or by learning style—or perhaps by both.

When I asked Dave to identify three different shapes, I was surprised that he included a diamond (although he did need assistance drawing it the first time). This demonstrated to me that he had a fairly good grasp of various shapes, and it makes me curious about how many other children would select diamond as a shape without any prompting.

Yet, when the activity transitioned into using shapes of various colours and sizes, Dave continued to work with colour-based patterns. This made it apparent that colours were much easier for him and were within his identifying comfort zone, and that he would need to spend more time transitioning his knowledge of colour patterns to be applied to shape patterns. This could also be attributed in part to his being more comfortable with drawing the patterns than with using manipulatives, but after one pattern with manipulatives, he began to grasp how he could use and manipulate them. When Dave was first presented with the manipulatives, he asked if I wanted a shape or a colour pattern. I let him make this choice as I felt it would indicate where he was more comfortable beginning a pattern lesson.

I was surprised with the strategies Dave came prepared with. As problem-solving strategies, he used talking aloud and crossing off on his fingers as he called out the colours. These strategies helped him to correct his own mistakes, to correct the mistake I had left for him to find (without letting him know it was there) and to extend the pattern. He seemed to be

visual, as he could identify the patterns on the wall and the one on his sweater, but he had difficulty with shapes, numbers and physical/oral patterns. If I were to work with Dave again, I could use the talk-aloud and the physical motions he used to problem solve as a way of modelling patterns using shapes and gradually moving his thinking about patterns to include symbols, shapes, numbers, and oral and physical patterns. Working with another child his age would be beneficial for Dave, as they could communicate how they see and problem solve patterns in their environment.

A modification I would make to this lesson would be to exclude an oral or a physical pattern. I underestimated the amount of time it would take to perform this task with Dave. For Dave to develop a good grasp of patterns, I felt it necessary to have him draw a repeating pattern once, and then build it using two types of manipulatives, working with each set of manipulatives more than once. Developing these skills was crucial in order for him to move on to completing a pattern that had already been started. Because Dave spent time focusing on patterns with colours, I may need additional sessions to work toward developing patterns with shapes and numbers and oral/physical patterns. I could work with a student of this young age only so long before valuable learning stopped happening. Recognizing this, I pulled back and decided to include these tasks in separate lessons.

Dave focused on colours but lacked the ability at this point to transfer his knowledge to shapes, numbers, and oral/physical patterns. Although he had little experience with addition and subtraction, when I presented (orally and in writing) the pattern of 1, 2, 1, 2, 1, 2, he could not recognize the pattern, only that it was “wrong,” and he gave me an answer of 3. Curious, I prompted him to explain this to me. In this area he could not communicate his understanding as clearly as he had with colour patterns and simply responded, “1 and 2 is always 3.” While this does not indicate any understanding of number patterns, it does show that Dave has great potential to understand number operations and relationships. I don’t yet know how I can use this to develop a connection to patterns. I have, however, recognized a teachable moment that I let pass by. As we wrapped up the task, Dave noticed a large calendar drawn on the whiteboard in the room. He made a connection to this and even wanted me to help him write an important event for him on the calendar, which I did. Not until later did it occur to me that this was an opportunity to make a connection to patterns, using the calendar as a medium. This showed me an important strategy I can use to move Dave’s learning forward.

Note

1. Name has been changed.

Reference

Alberta Education. 2007. *The Alberta K–9 Mathematics Program of Studies with Achievement Indicators*. Edmonton, Alta: Alberta Education. Also available at http://education.alberta.ca/media/645598/kto9math_ind.pdf (accessed September 25, 2013).

Chelsey Bonnett is a recent graduate of the Aboriginal Teacher Education Program, which allowed her to earn a BEd through the University of Alberta while working and remaining in her home community of Slave Lake, Alberta. She has had many teachers in her life, not all in the field of education, who have inspired her to become a teacher. She loves learning for the sake of learning and working with children, and is thrilled to be embarking on her next journey in life as an educator.