

## Providing Challenge in Pattern Work in the Infant Classes

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### Introduction

This article addresses the use of strategies such as concrete materials and literature in developing the concept of growing patterns among children in the infant classroom. While children of this age are familiar with repeating patterns (e.g. red, green, red, green), the Primary School Mathematics Curriculum (PSMC) also intends that pupils are enabled to ‘...identify, copy and extend simple increasing and decreasing number patterns e.g. 2, 3, 4’ (Government of Ireland, 1999: 26).

This article outlines a sample lesson developed by student teachers in Mary Immaculate College who were studying mathematics education as their curriculum specialisation (Sinéad O’ Loughlin, Emer Fahy, Orry Ryan, Maeve O’Reilly and Aidan Foley). This *Lesson Study* group, in conjunction with the authors of this report, developed an initial lesson through a process of research and preparation and drawing on literature focusing on the development of algebraic reasoning in young children. Considering the age group of the primary children, the student teachers set about addressing the concept of growing patterns utilising various strategies ranging from literature to concrete materials to methods of discourse. It was intended that the various activities would provide ‘multiple embodiments’ of the relevant context e.g. action rhymes, poem, visual images. While guided discovery predominated, primary children would have opportunities to explore, demonstrate and work in pairs. The lesson moved from the known (repeated patterns) to the unknown (growing patterns).

The student teachers taught the initial lesson to senior infant children in a local primary school. In the initial lesson, while the various strategies and resources were deemed

appropriate, a lack of open-ended questioning (e.g. Why?; How did you know that?) which promoted higher order thinking and the development of mathematical language was identified as the main challenge for the subsequent lesson. Modifications to the first lesson, based on observations of the lesson study group and the researchers, focused on incorporating opportunities to probe the reasoning of children and encourage and promote justifications for reasoning. Subsequently, in the second teaching of the lesson, to a different senior infant class, the student teachers noted that on posing appropriate questions, many pupils independently demonstrated an ability to compare and describe the characteristics of the respective patterns.

### Lesson Exemplar

#### Introduction

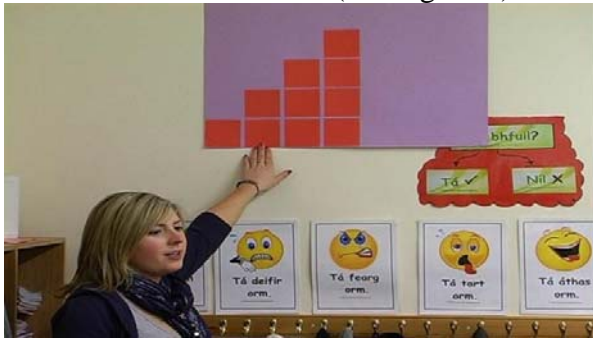
The lesson began by the revision of repeating patterns in three different contexts. The children were encouraged to put on their ‘magic glasses’ and ‘listening ears’ to discover patterns around the room (posters placed before the lesson). The three introductory contexts were:

1. Colour Pattern (discs of same size red, blue, red, blue).
2. Rhythm Pattern (initiated by teacher- clap, tap, stamp).
3. Animal Pattern (pictures of dog, cat, cat, dog, cat, cat).

In each case exploratory questions were asked which included:

- What do you notice about the pattern?
- What comes next in the pattern?
- How did you know that?
- How is the colour pattern different from the animal pattern?

A growing pattern was subsequently introduced and discussed (see Figure 1).



**Figure 1: Discussing a growing pattern**

Probing questions included:

- What do you think this pattern looks like?
- How do you know the pattern is getting bigger?
- How is this pattern different from the last pattern?

### Lesson Development

#### Step 1: Use of Literature

Students adapted the story of *'The Very Hungry Caterpillar'* to develop the concept of growing patterns (Integration). In this context, the story reported on the eating patterns of 'Freddy the Frog' over a week (linkage). The teacher told the story as follows:

*'On Monday Freddy ate an apple; On Tuesday Freddy ate an apple and an orange... On Sunday Freddy ate an apple, an orange, a pear, a banana, a kiwi, a plum and some grapes'.*

At each stage a puppet of Freddy eating various pieces of fruit was used. The pupils were involved in the presentation of the story on the whiteboard (using pictures of the fruit, see Figure 2).



**Figure 2: Constructing a pattern from a story**

Throughout, pupils were given opportunities to recall and predict Freddy's fruit. Questions which promoted use of number and reasoning skills included:

- 'How many pieces of fruit did Freddy eat on Tuesday?'
- 'On what day did Freddy eat more fruit? 'How do you know?'
- 'How many pieces of fruit will Freddy eat on Wednesday?'
- 'What do you notice about our pattern on the board?'
- 'What day did he eat the most/least/5 fruit?'
- 'What does the pattern remind you of?'

#### Step 2: Use of Poem & Concrete Materials

In the next step of the lesson, children were provided with an opportunity to work in pairs. After the initial reciting of the poem *'Napping Snakes'* (NCTM, 2005: 14) and teacher demonstration of the initial 2 steps (See Appendix A), each pair received a plastic cup containing 15 counters and an activity sheet (NCTM, 2005: 75) in order for them to complete the remaining steps of the growing pattern (see Figure 3).



**Figure 3: Making a growing pattern**

Questions used during this stage of the lesson included:

- ‘How many snakes will be on the last rock?’ ‘How do you know this?’
- ‘How many snakes on this rock?’ (Teacher covers one of the rocks) ‘How do you know this?’

### Step 3: Kinesthetic (Hula Hoop Activity)

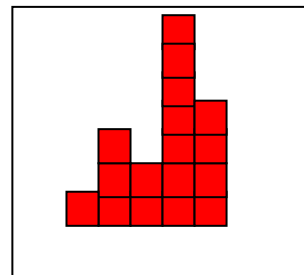
This step of the lesson enabled the children to gain a new perception of growing patterns in an active manner. The children were asked to sit in a semi-circle at the front of the room. Four different coloured hula hoops were placed in a row on the floor (red, green, blue and yellow). Pupils were selected and asked to stand into the respective hoops (one in red, two in green, three in blue and four in yellow). Children were encouraged to predict at each stage and questioned regarding the number in each hoop. They were asked if they noticed anything special about the arrangement.

All the children were asked to sit back in their original places. The teacher asked 1 child to stand in the (first) red hoop, 3 children in the (third) blue hoop and 4 children in the (fourth) yellow hoop. Pupils were asked ‘How many children should be in the (second) green hoop?’ and ‘How do you know that?’ This activity can be repeated with different hoops and numbers. Children were also asked ‘If we had another hula hoop and placed it after the yellow hoop, how many people would go in it?’ and ‘How do you know this?’ Extending patterns, as described above, is an important process in algebraic thinking.

### Lesson Conclusion

A variety of repeating and growing patterns on posters were presented to the children at the end of the lesson. The children had to identify whether each was a repeating or a growing pattern and justify their answer.

Following this a game of ‘Thumbs Up, Thumbs Down’ was played. A number of posters (see Figure 4 below) were presented to the children and they had to identify whether or not a pattern existed.



**Figure 4.**

If the children put their thumbs up when a poster was shown this indicated that they felt the poster displayed a pattern and if they put their thumbs down this indicated that they felt the poster did not display a pattern. For every poster the children had to justify their response by answering questions such as:

- Why do you think it is a pattern/not a pattern?
- Can you describe this pattern?
- How do you know it is a pattern/is not a pattern?

### Reflections

Both formal and informal feedback from the student teachers involved concurred that the children learned best when they were active. The group also believed that the opportunity to engage with relevant literature and poetry motivated children and maximized the opportunity for learning. It was also perceived that the focus on the ‘language of pattern’ facilitated pupils to describe, explain and compare the characteristics of the patterns in question i.e. develop conceptual understanding.

## Appendix A

### *Napping Snakes*

A family of snakes went out to play  
One fine and sunny day in May.  
They saw some rocks, decided to stay  
And nap for the rest of the day.

One small snake slithered up the first rock,  
Gave a hiss and fell sound asleep.  
Then two snakes went to the next big rock  
And slithered up without a peep.

Three small snakes went to the next big rock,  
Slithered up and made not a sound.  
Four small snakes went to the next big rock.  
They slithered up and looked around.

Some small snakes wiggled to the next rock.  
They slithered up and came to a stop.  
“Hmmm,” said the other snakes to  
themselves,  
“How many snakes are on the top?”  
by Carole Greenes

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