

## SEEING THE PATTERN AND SEEING THE POINT

Jenny Houssart

Open University

*This work arises from interviews with key stage two teachers who were shown a task based on the Fibonacci sequence and asked whether they would use it with their current class or mathematics set. Mentions of the word 'pattern' and related ideas were extracted from the resulting discussions and considered in more detail. The word 'pattern' was used fairly frequently, though with differing degrees of enthusiasm. There were also differences in whether teachers felt all children could be helped to see patterns, with a tendency to regard pattern spotting as a top set activity.*

### **Background**

Sequences are related to pattern by many writers (eg DfEE 1999, Owen 1995). Mason et al (1985) talk about 'seeing a pattern' as a step towards expressing generality.

Hargreaves et al (1999) suggest ten processes which may be involved in handling number sequences, with searching for patterns topping their list.

Pattern in mathematical investigations is also relevant to this work. Garrard (1986) advocates encouraging primary children to look for patterns and relationships when carrying out mathematical investigations. Bird (1986) talks about encouraging children to carry out mathematical activities and gives searching for patterns as an example of such activities.

### **Method**

The work described here arises from analysis of interviews held with Key Stage 2 teachers. The interviews were about tasks in mathematics and the section used here was based on a published task. This was one of a selection of tasks which teachers were

shown and asked whether they would use it, with or without changes, with their current class or mathematics set.

The task was taken from a book of starting points designed to generate mathematical activity (Bird 1986 page 47). This task starts by asking children to continue the Fibonacci sequence. They are then asked to choose three adjacent numbers from the sequence and explore what happens when they multiply the two outer numbers and square the middle one.

The discussions of the task were tape recorded. Key words and phrases were identified from the transcripts. The work described here arises from analysis of those responses containing the key word 'pattern'.

## Findings

This activity led to plenty of discussion of pattern. Of the 26 teachers interviewed, ten used the word pattern and four discussed related issues without using the word. Many of the mentions of patterns and of seeing and finding patterns were fairly brief.

*Try and investigate the different patterns (Ruth)*

*...bring up number patterns (Val)*

*Could look at patterns and work it out (Sally)*

*...is about seeing patterns (Colin)*

*...like the idea of finding patterns (Bill)*

Some teachers talked specifically about patterns related to sequences.

*We do quite a bit...What is the pattern? What is the sequence? So they'd be used to that...(Colin)*

*Well that again, that's something we go on to do and we do quite a lot of, is – is looking for patterns in numbers and um, you know, fiddling with sequences until you, you know, find a common link. ... (Sharon)*

Others talked about looking for relationships or patterns in results. There was less certainty about this with one teacher making it clear that he was not sure about the reasons for doing this.

*...There must be a relationship there somewhere. ... (John)*

*This one you're telling them what to do and looking for patterns in results which – unless you can actually, I can't actually see what the outcome would be so it's very difficult for me to say.... (Sharon)*

*It's O.K., but, things I find with investigations like this is that the children perhaps will understand that, for example, one number is 1 greater than the other one, but they can't always understand why and they don't always see the need to know why, they think, O.K. fair enough, it does, but - big deal! ...I'd use it, but I'd have to kind of really read up - and some instructions, to see why, what the point of it is.. (Steven)*

There were some aspects of pattern on which teachers seemed to hold different views. The first was what could be done to help children to see patterns. Whereas some teachers seemed to think that the seeing of patterns was something which either happened or not, there were others who were clear about what they would do to help and encourage children looking for patterns. A related issue was whether or not all children could see patterns, with some teachers seeing this as an activity for the more able and suggesting that some children simply could not do it.

When it came to helping children see patterns, Colin teacher of a Y4 mixed ability class talked about the role of discussion. Carol, who taught a Y5&6 bottom set, talked about her expectation that children explain in writing what they notice.

*... A lot of discussion can come out of that. Somebody who doesn't see the pattern can be told - and then realise by looking more carefully, or listening to what different people*

*have to say because some see different patterns in different number sequences as well.*  
(Colin)

*They have to work out what's happening to the numbers and they have to write that down and explain that.* (Carol)

Mary, who talked in detail about pattern and related issues, explained how she would help her middle set to overcome difficulties in seeing patterns:

*...We just build up patterns where they connect things... And that's what we were doing with the consecutives this week, again it's just letting them play with numbers and using what they know and looking into it.... Play around and see what happens and can they get a rule? Because they don't, they don't know how to do it. I've got them using speech bubbles. Every time they think of something, imagine you've said it. So write it down in a speech bubble and we pull all the bubbles together and between the whole class when we come back to discuss it usually sorts it all out and somebody's - that's when the discussion is really good. ...* (Mary)

There were some differences in views about patterns expressed by teachers of different sets. Three teachers associated patterns with fun or excitement and these were all talking at least partly about top sets.

*I do these a lot with my class, they love these - with my set and with my class. Children love this sort of thing.* (Sally)

*...like finding patterns, quite exciting* (Bill)

*We did loads of work on Fibonacci last year... we had some great fun with patterns*  
(Malcolm)

In contrast, a bottom set teacher talked about the difficulty her children had with patterns:

*They find number patterns very hard anyway. We've just recently been doing our CAT test and it starts with 1,2,3,4,5...What's the next number? Then 5,4,3,2, What's the next number? ... and we're struggling with that.* (Jane)

A teacher of a mixed ability class talked about how he felt different children responded to the search for patterns.

*Some children will see patterns and sequences in numbers, others will never see them, because of their - I suppose, understanding and, you know, development, in certain aspects of number. That to some will be very easy, but to some children, even though you explain it and discuss it, they won't see that pattern. They won't see it whatsoever, because some - they, you know, children do have stumbling blocks with numbers. ... Some have a number block and that might prove a difficulty to those. But to some it's a pattern and they like playing with patterns and seeing patterns in numbers and, you know, able children in particular like to see what they can get out of it. (Colin)*

## **Discussion**

The fact that so many teachers used the word pattern in discussing sequences represents an overlap between their discussion and that of 'experts'. This demonstrates a marked contrast to many other aspects of their discussion. On the whole they were enthusiastic about looking for patterns and saw it as a familiar activity. Although this represents a starting point, there is clearly potential for extending teachers' ideas about pattern. In particular, many would benefit from a consideration of how children can be assisted in looking for patterns.

Perhaps most striking however was the way seeing patterns was viewed by teachers of different sets. This is in line with some other findings. Allebone (1998) asked class teachers of year 5 children to identify characteristics they felt were demonstrated by able mathematicians. Looking for patterns is the first characteristic listed. Watson (1996) analyses comments about mathematical ability made by 25 teachers. Her list of

mathematical activities mentioned by teachers includes 'showing interest in pattern and structure'.

In viewing pattern spotting as an activity for mathematically able children, the teachers interviewed are confirming the findings of previous studies. Their views are particularly significant however in view of recent moves towards setting in primary schools and suggest that pattern spotting is regarded by some as a top set activity.

### References

Allebone, B. (1998) 'Providing for able children in the Primary Classroom', *Education 3-13*, 26(1) 64-69

Bird, M (1986) *Mathematics with Nine and Ten Year Olds*, Mathematical Association, Leicester

DfEE (1999) *The National Numeracy Strategy, Framework for Teaching Mathematics from Reception to Year 6*, DfEE

Garrard, W (1986) *I Don't Know, Let's Find Out*, Mathematical Association, Leicester

Hargreaves, M., Threlfall, J., Frobisher, L., Shorrocks-Taylor, D (1999) 'Children's Strategies with Linear and Quadratic Sequences' in Orton, A. (ed) *Pattern in the Teaching and Learning of Mathematics*, Cassell, London

Mason, J., Graham, A., Pimm, D. and Gowar, N. (1985) *Routes to / Roots of Algebra*, Open University Press, Milton Keynes

Owen, A. (1995) 'In Search of the Unknown: A Review of Primary Algebra' in Anghileri, J. (ed) *Children's Mathematical Thinking in the Primary Years*, Cassell, London

Watson, A (1996) 'Teachers' Notions of Mathematical Ability in their Pupils' *Mathematics Education Review*, 8, p27-35