

## Patterning in the F-3 Classroom

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This session explores early patterning ideas to develop logical thinking, algebraic thinking and how to solve word problems using manipulative mathematics materials. Materials such as counters, unifix blocks, pattern blocks, attribute blocks, three bear family, connecting people, 2 cm cube coloured blocks, coloured square counters, mass balances and the number balance. This session will link to the Australian Curriculum

*In this session you will:*

- Develop a sense of what is needed before children become proficient at pre-algebra thinking with a focus on recognise, copy, continue, create, count and describe (communicate) patterns
- Use materials to make linear and growing patterns and develop the idea of the idea of a rule to explain the pattern.

## ALGEBRAIC THINKING

Algebra Outcome	Algebra 'big ideas'	Pre-Algebra Thinking: Big Ideas
Recognise and describe the nature of variation in situations, interpreting and using verbal, symbolic, tabular and graphical ways of representing variation	Function	<p><b>Variation</b></p> <p>Through sorting and classifying activities students will learn to make statements based on individual differences and, as they develop they will look at relationships on a boarder scale.</p>
Read, write and understand the meaning of symbolic expressions, moving flexibly between equivalent expressions	Expressing generality	<p><b>Pattern</b></p> <p>The recognition and descriptions of patterns are extremely important for the achievement of algebra. Being able to recognize a pattern and describe it, students develop the ability to generalise about pattern and is able to say what is happening from one postion (element) to the next or one cycle to the next regardless of the specific element or cycle.</p>
Write equations and inequalities to describe the constraints in situations and choose and use appropriate solution strategies, interpreting solutions in the original context	Equation	<p><b>Equivalence</b></p> <p>At level four (age 12-14) students have a deeper understanding of the inverse operations for all four of the operations, addition, subtraction, multiplication.</p>

Ref : T Perso (2003) Everything you want to know about Algebra Outcomes in your class, K-9

## Algebra in Australian Curriculum Mathematics Foundation Year

Patterns and algebra	Elaborations
Sort and classify familiar objects and explain the basis for these classifications. Copy, continue and create patterns with objects and drawings	<ul style="list-style-type: none"> <li>• observing natural patterns in the world around us</li> <li>• creating and describing patterns using materials, sounds, movements or drawings</li> </ul>

### Year 1

Patterns and algebra	Elaborations
Investigate and describe number patterns formed by skip counting and patterns with objects	<p>using place-value patterns beyond the teens to generalise the number sequence and predict the next number</p> <p>investigating patterns in the number system, such as the occurrence of a particular digit in the numbers to 100 (should be 120)*</p>

### Year 2

Patterns and algebra	Elaborations
Describe patterns with numbers and identify missing elements	<ul style="list-style-type: none"> <li>• describing a pattern created by skip counting and representing the pattern on a number line</li> <li>• investigating features of number patterns resulting from adding twos, fives or 10s</li> </ul>
Solve problems by using number sentences for addition or subtraction	<ul style="list-style-type: none"> <li>• representing a word problem as a number sentence.</li> <li>• writing a word problem to represent a number sentence</li> </ul>

## Australian Curriculum Mathematics

### Year 3

Patterns and algebra	Elaborations
Describe, continue, and create number patterns resulting from performing addition or subtraction	<ul style="list-style-type: none"> <li>• identifying and writing the rules for number patterns</li> <li>• describing a rule for a number pattern, then creating the pattern</li> </ul>

## The mathematics ideas in Patterning

- Sorting and Classifying
- Recognising a pattern
- Copy a pattern initially an AB pattern, then ABC pattern. Young children need to be able to recognise the pattern that they are copying
- Continue a pattern
- Create a pattern
- Communicate the pattern to some other or write or draw it
- Count how many in the pattern

Pattern Making can be made with many different materials. Start with unifix cubes because the focus on patterning is on one attribute: colour or coloured tiles or coloured cubes or coloured craft sticks. Other materials that have more than one attribute. They include pattern blocks (shape and colour), attribute blocks (shape, colour, thickness, size), three bear family ( size ,colour, mass) and connecting people (size , colour, gender )

Students also need to develop a link between word problems and number sentences that have a missing element.

They need to be able to see that addition is commutative and that one side of a number sentence balances with the other side. Number balances can be used to show aspects of addition.

Content descriptor Year 2 Number	Elaboration
Solve simple addition and subtraction problems using a range of efficient mental and written strategies	becoming fluent with a range of mental strategies for addition and subtraction problems, such as commutativity for addition, building to 10, doubles, 10 facts and adding 10  using materials such as 10 frames, 20 frames and empty number lines modelling and representing simple additive situations

Some of the above manipulatives can be used with balances to develop relationships between the attribute of mass. (see Three Bear Family . ) When students collect this type of data they need to record it in a table.

Young students need opportunity to work with repeating patterns and growing patterns. Growing patterns initially with only one idea growing AB, then ABB, ABBB, AB BBB.

Students need to record the data in a table so that they can predict what's coming up next and see the pattern to state what total number of counters are use to make the 10th position .

## USING A NUMBER BALANCE TO BALANCE AN EQUATION

Use the balance to show  $7+8 = 15$

<b>15</b>
Other Combinations

The thinking developed using the balance is  $a + b = 15$

What different combinations can you develop for  $a + b = 18$

<b>18</b>
Combinations

Create your own  $a + b = c$

Combinations

What other manipulative materials could you use to promote this thinking?

### Extending the thinking

$$7 + 8 = 6 + 9$$

$$a + b = c + d$$

	+		=		+	
	+		=		+	
	+		=		+	
	+		=		+	
	+		=		+	
	+		=		+	
	+		=		+	
	+		=		+	

How could you extend this idea to other aspects of algebra

Using the THREE BEAR mathematics manipulative to link Measurement to Algebra

In one pan of the balance put in 1 BIG BEAR now balance it with the correct number of SMALL BEARS Record this in the table

<b>BIG BEAR</b>	<b>SMALL BEAR</b>
1	
2	
3	
4	
5	
6	
7	
8	

Repeat this activity adding the MIDDLE BEAR

<b>MIDDLE BEAR</b>	<b>SMALL BEAR</b>
1	
2	
3	
4	
5	
6	
7	
8	

<b>BIG BEAR</b>	<b>MIDDLE BEAR</b>	<b>SMALL BEAR</b>
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1 big bear = 1 middle bear and 1 small bear  
or

1 big bear = 0 middle bears and 3 small bears

2 big bears = 1 middle bear and 4 small bears  
or

2 big bears = 2 middle bears and 2 small bears  
or

2 big bears = 0 middle bears and 6 small bears

ANSWER THESE NUMBER SENTENCES

2 big bear =  small bears  
or

2 big bears =  medium bears and  small bears

3 big bears =  small bears

3 big bears =  medium bears and  small bears  
or

3 big bears =  medium bears and  small bears  
or

3 big bears =  medium bears and  small bears  
or

3 big bears =  medium bears and  small bears

EXTENSION

What number sentences can you create using 4, 5 or 6 big bears?



1. Pattern 1 : Replicate with counters

Position	1	2	3	4	5	6
Number of counters	2	4	6	8	10	

What is happening in the pattern?

State the rule in your own terms?

Predict the 12 position?

2. Pattern 2 Use the table below to write the rule describing the relationship between the set of IN and OUT numbers.

IN	15	16	17	18	19
OUT	6	7	8	9	10

Rule:

3. Pattern 3

POSITION	1	2	3	4	5	6	7
PATTERN	19	17	15	13	11	9	7

What is happening in the pattern?

State the rule in your own terms?

Predict the 10 position?

4. Pattern 4

POSITION	1	2	3	4	5	6	7
PATTERN	104	100	96	92	88	84	80

What is happening in the pattern?

State the rule in your own terms.

Predict the 10<sup>th</sup> position.