

Kindergarten research insights

Professional reading resource



Patterning

Early childhood mathematics

Understandings of pattern and structure develop from a very young age. Experiences such as sorting and classifying are often the beginnings of pattern investigation ([Miller, 2019](#)). Activities that involve kinaesthetic movement, concrete manipulatives, space, pictorial representations and numbers are also powerful ways of exploring patterns ([Warren, Miller & Cooper, 2012](#)), and even very young babies recognise patterns in familiar songs or regular movements ([Montague-Smith & Price, 2012](#)).

An understanding of patterning underpins the development of many mathematical concepts.

For example, pattern and structure form the basis of algebraic thinking, and the use of repeated units to measure or represent data ([MacDonald, 2018](#); Miller, 2019). Research suggests that, from a conceptual point of view, it is important for children to be able to identify repeating units — that is, the *structure* of a pattern (Miller, 2019). Understandings of structure help children to develop *relational* understandings of mathematical concepts and transfer knowledge across concepts ([Warren & Miller, 2013](#)), and patterning skills in early mathematics have been shown to positively impact children's later mathematical achievement ([Papic, 2007](#)).

Pattern and structure

From a mathematical perspective, a **pattern** can be defined as any predictable regularity, usually involving spatial, numerical or logical relationships ([Mulligan & Mitchelmore, 2009](#)). Patterns are based on **structure**, which can be defined as the relationship between elements (Warren & Miller, 2013). Children develop awareness of pattern and structure through *recognising* patterns, *copying* patterns, *continuing* patterns, and *creating* patterns:

- **Recognising patterns** involves awareness of different forms of patterns and identifying the items which make up the pattern structure.
- **Copying patterns** requires children to **decompose** the pattern (break it up into its individual parts) and match those parts one-for-one.
- **Continuing patterns** is about knowing what comes next. To do this, children need to be able to recognise the structure of the pattern.
- **Creating patterns** enables children to explore the many different attributes and structures of patterns. The creation of patterns reinforces the elements of structure and repetition for children (MacDonald, 2018).



Based on the work of Dr Amy MacDonald. Dr MacDonald is Associate Professor of Early Childhood Mathematics Education at Charles Sturt University. She is a member of the Executive of the Mathematics Education Research Group of Australasia, and a recipient of an Australian Research Council research fellowship. Amy is a senior researcher whose interests focus on noticing and celebrating the mathematical capacities of young children and supporting early childhood educators in their mathematics education practice.

Types of patterns

There are lots of different ways that children can recognise, copy, continue, and create patterns. However, patterns tend to take one of the following forms:

- **Repeating patterns** have a structure that is made up of repeating sequences of items. These repeating sequences may have different layouts, e.g. linear, circular, repeating rows or columns, or diagonal.

Linear repeating pattern



Circular repeating pattern



There are opportunities to explore repeating patterns through mealtime routines and creating mandalas

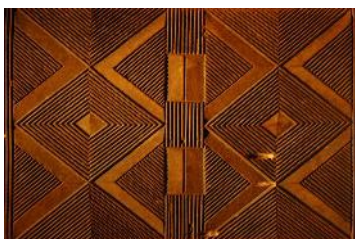
- **Growing patterns** have a similar relationship between one element and the next, but the shape or number increases or decreases in size.



Growing patterns may be explored through block play. Here the pattern grows by one, this could be adapted to include increases of twos or threes each step.

- **Symmetrical patterns** are formed using reflective or rotational correspondence, i.e. items that “mirror” one another.

Reflective symmetry



Rotational symmetry



There are opportunities to explore symmetry in architecture, design and nature

- **Arrays** are arrangements of rows and columns with equal numbers in each row and equal numbers in each column. Arrays may be structured using elements of the other three pattern forms (MacDonald, 2018; Montague-Smith & Price, 2012).



QKLG: Confidence and interest in exploring patterns and relationships

Building children’s confidence and interest in exploring patterns and relationships is a significant learning area in the QKLG. Within this learning area, children build their skills in recognising repetition, and copying or continuing repetitions to create patterns.

Educators can help build children’s confidence and interest in exploring patterns and relationships when they support children to make connections to patterns in everyday environments. For example:

- Play a variety of music and ask children to identify different pitches or the sounds of different instruments. Encourage them to notice how these repeat throughout the music. Ask them to consider how patterns are used to create different rhythms or melodies.
- Use songs or story books to identify repeating elements, such as a repetitive chorus or series of phrases in a story. Encourage children to use these repetitions to predict what comes next in the song or story.
- Notice the incidental opportunities to explore patterns. For example, sharing a plate of fruit is a great stimulus for shared conversations about repeating patterns (“Let’s eat the fruit in a pattern: apple, banana, kiwifruit; apple, banana, kiwifruit...”). Try to keep these conversations as natural and playful as possible. The idea here is not to turn fruit time into direct instruction, but rather to capitalise on everyday opportunities to notice and talk about patterns.
- Look for ways to consolidate the ideas about patterning you explore throughout the day. For example, you might use similar provocations when sharing fruit and when packing away toys. Transitions throughout the day present great opportunities for noticing repetitions and patterns.
- There are many opportunities to notice repeating, growing and symmetrical patterns in nature. Have a look around your service’s yard or a local park — what do you notice about the leaves, flowers, bark?
- Built and designed environments offer similar possibilities for exploring pattern and structure. What types of patterns can you see in architecture, building materials, and textiles? How are repeating, growing, and symmetrical patterns and arrays represented in mechanical and engineered forms?

Reflection: What opportunities do I provide for children to develop awareness of pattern and structure in different contexts (e.g. routines, transitions, music, stories)? Do I plan opportunities for children to explore different pattern types? How can I assess and document children’s understandings of patterning?

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