Early Years Typical Progression Chart with additional guidance for practitioners

National Centre for Excellence in the Teaching of Mathematics

Pattern

Seeking and exploring patterns is at the heart of mathematics (Schoenfeld, 1992). Developing an awareness of pattern helps young children to notice and understand mathematical relationships. Clements and Sarama (2007) identify that patterns may provide the foundations of algebraic thinking, since they provide the opportunity for young children to observe and verbalise generalisations.

The focus in this section is on repeating patterns, progressing from children copying simple alternating AB patterns to identifying different structures in the 'unit of repeat', such as ABB or ABBC. Patterns can be made with objects like coloured cubes, small toys, buttons and keys, and with outdoor materials like pine cones, leaves or large blocks, as well as with movements and sounds, linking with music, dance, phonics and rhymes. Children can also spot and create patterns in a range of other contexts, such as printed patterns, timetables, numbers and stories.

	Activities and opportunities	Practitioner notes
Continuing an AB pattern		
Children need the opportunity to see a pattern, to talk about what they can see, and to continue a pattern. At first, they will do this one item at a time, e.g. red cube, blue cube, red cube…verbalising the pattern helps. Children may then be asked to say what they would add next to continue it.	• building towers or trains of different-coloured cubes (continuing patterns horizontally and vertically) • extending patterns using a wide range of identical objects in different colours, e.g. beads; small plastic toys such as bears, dinosaurs, vehicles. Try to avoid interlocking cubes or bead-threading so children can focus on the pattern rather than their coordination skills.	
Copying an AB pattern		
Copying a pattern can be difficult for children if they have to keep comparing item by item. AB patterns are easiest – when presented to children, these should contain several repeats, to ensure that the pattern unit is evident. Discuss the nature of the pattern: how has the pattern been made? Patterns can have a range of features such as varying objects, size or orientation.	• accessing a range of patterns to copy. For example, using the plastic bears: big, small, big, small, big… footwear: shoe, welly, shoe, welly..., actions and sounds: jump, twirl, jump, twirl, jump… or clap, stamp, clap, stamp… • collecting things in the outdoors environment: leaf, stick, leaf, stick…	

	Activities and opportunities	Practitioner notes
Make their own AB pattern		
As children progress from continuing to copying patterns, they can be challenged to change the sample pattern or to create their own. A range of objects can be provided for children to decide what the features of the pattern are going to be. Children may find it easier to make a pattern with the same colours as the original but with different objects. For example, copying a red–blue cube pattern with red and blue dinosaurs is easier than with yellow and green cubes. Patterns can involve different aspects and modes such as sounds, words or actions: some children will need suggestions, while others will think of their own. As children construct the patterns, ensure they have opportunities to: • repeat the unit at least three times (big bear, small bear; big bear, small bear; big bear, small bear). This is to ensure the child can sustain the pattern • make a specified pattern, e.g. 'Can you do a green, yellow pattern?' This is to ensure the child can apply their pattern understanding • choose their own rule, e.g. 'I am going to make a big, small pattern.' This is to ensure the child can identify pattern features/rules/criteria • choose their own actions or sounds, e.g. clap, stamp… This is to help children generalise the idea of pattern.	• challenging the child to change one element of the pattern they have created, e.g. 'Can you change the red bear to a blue bear? What is the pattern now?' • ensuring that there are numerous opportunities to create patterns – e.g. in the outdoors, using natural materials such as sticks, leaves, stones, pine cones; in craft activities, using stamping, sticking, printing; with musical instruments, using sounds such as drums, shakers, triangles, etc. • working collaboratively with a friend to take turns to create a pattern, e.g. one claps, one stamps, or one gets the red bear, one gets the yellow bear, etc. • challenging a friend to continue or copy their pattern.	

	Activities and opportunities	Practitioner notes
Spotting an error in an AB pattern		
When working with AB patterns, children also need the opportunities to spot and correct errors. It is easiest to spot an extra item, then a missing item, then items swapped around. When presented with an AB pattern, children can be encouraged to describe it to make sure it is right. Then, to detect an error, they can track the pattern from the start. To begin with, children may know there is something wrong, but might not be able to say what the error is. They then might take several attempts to correct it, before being able to repair the error in one move.	• presenting patterns with deliberate errors, including extra, missing and swapped items, e.g. red cube, blue cube, red cube, blue cube, red cube, red cube, blue cube – identifying there is an extra item and fixing it by removing the extra red cube, putting in an extra blue cube, or swapping the final cubes • asking the children to make a pattern with a deliberate mistake and challenging a friend to spot it.	
Identifying the unit of repeat		
The key aspect of understanding patterns is identifying the smallest part of the pattern, or the 'unit of repeat' You can draw children's attention to this when building patterns by picking up a unit at a time, e.g. a blue block and a red block together, and describing this as a 'red-blue pattern', rather than a red, blue, red, blue, red, blue pattern. Children can also be asked to show the pattern unit which repeats, e.g. show two blocks, a red and a blue	• highlight within a pattern what the unit of repeat is and ask the children to describe it. At this point for pattern novices (children who aren't as experienced as others), it would be good to do this with physical objects so that the unit of repeat can be moved to show how it repeats. Patterns that are printed, stamped or stuck down, and therefore cannot be corrected, are more appropriate for more confident pattern makers.	

	Activities and opportunities	Practitioner notes
Continuing an ABC pattern		
Once children are secure with alternating patterns, they can tackle more complex pattern structures: ABC has more items in the unit of repeat, but all different, e.g. red, blue, yellow; red, blue, yellow… ABB is more challenging because they have two items within the same unit of repeat, e.g. red, blue, blue; red, blue, blue… ABBC is more complex because it is longer, with three items, but also includes items which are the same, e.g. red, blue, blue, yellow; red, blue, blue, yellow… AABB may be simpler as there are just two items, both repeated, e.g. red, red, blue, blue; red, red, blue, blue… Children who have only experienced alternating ABC patterns may state that patterns such as ABBC are not patterns, as you cannot have two of the same colour next to each other. This highlights that children need lots of experience of a range of pattern types, so early misconceptions do not form about what makes a pattern. When working on continuing these patterns, children should be encouraged to focus on the unit of repeat, e.g. 'I see you are making a red, blue, green pattern'. Ensure that children repeat the pattern at least three times and are encouraged to describe and say how they would continue.	• building towers or trains of different-coloured cubes (continuing patterns horizontally and vertically) • extending patterns using a wide range of identical objects in different colours, e.g. beads; small plastic toys such as bears, dinosaurs and vehicles. Try to avoid using interlocking cubes or bead-threading, so children can focus on the pattern they are constructing rather than on their coordination skills.	

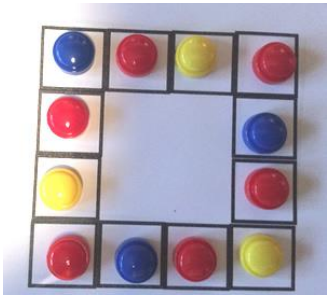
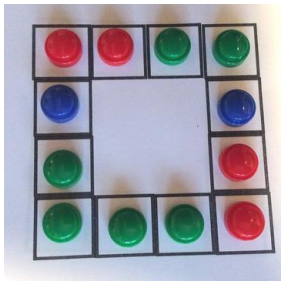
	Activities and opportunities	Practitioner notes
Continuing a pattern which ends mid-unit		
As children work on patterns involving more elements, they can be challenged to continue patterns which do not end after a whole unit of repeat. Provide experiences where the given pattern stops mid-unit.	• providing a range of patterns – physical and on cards – that children can continue • ensuring that the patterns offered have different structures and end after a complete or a partial unit.	

Make their own ABB, ABBC patterns		
As with the first stages of making an AB pattern, the same range of experiences needs to be provided when the unit of repeat extends. A range of objects can be provided for children to decide what the features of the pattern are going to be. Patterns may include varied items and modes, such as sounds and actions. Ensure that children have opportunities to: • repeat the unit at least three times (big bear, small bear, medium bear; big bear, small bear, medium bear; big bear, small bear, medium bear). This is to ensure the pattern can be sustained over a longer duration • make a specified pattern, e.g. 'Can you do a green, yellow, blue pattern?' This is to ensure the child can apply their pattern understanding • choose their own rule, e.g. 'I am going to make a big, small, small pattern.' This is to ensure the child can identify pattern features/rules/criteria • choose their own actions or sounds, e.g. clap, stamp, twirl… This is to support children in generalising pattern structures.	• utilising a range of items in the environment to create patterns such as interlocking cubes and toys, e.g. links, elephants, camels • exploring and creating patterns on peg boards, with fruit (e.g. fruit kebabs), musical instruments, movements and dance sequences.	

	Activities and opportunities	Practitioner notes
Spotting an error in an ABB pattern		
When working with ABB patterns, children also need the opportunities to spot and correct errors. It is easiest to spot an extra item, then a missing item, then items swapped around. When presented with an ABB pattern, children can be encouraged to describe it to make sure it is right. Then, to detect an error, they can track the pattern from the start. To begin with, children may know there is something wrong, but might not be able to say what the error is. They then might take several attempts to correct it, before being able to repair the error in one move.	• presenting patterns with deliberate errors • once children have fixed the pattern, encouraging them to check the 'fix' by tracking the pattern • asking the children to make a pattern with a deliberate mistake and challenging a friend to spot it.	
Symbolising the unit structure		
As children become more experienced with pattern-continuing, -extending and -creating, encourage them to record the patterns that they make. Initially this might be straightforward representations, but over time these recordings may become more iconic, e.g. a red dot representing the red dinosaur, a squiggle or the letter R for red dinosaur. As this progresses, encourage the children to symbolise their patterns in a range of ways, and to use these symbols to continue the pattern to demonstrate their understanding of the pattern. Children may, with adult direction, pick up on the coding of patterns as AB, ABB, ABBC, etc. One additional level of challenge is to create symbols for movement/sound patterns, as the children need to construct a symbol with less concrete/visual support.	• including the following phrasing in discussion and dialogue: 'This is a red blue pattern; this/that; I call it an A (one of these) then a B (one of those).' • constructing patterns with actions and developing symbols to show the pattern and to provide 'instructions' for someone else to follow the pattern • inviting friends to copy the pattern from the symbols.	

	Activities and opportunities	Practitioner notes
Generalising structures to another context or mode		
As children gain experience of symbolising patterns, they develop their experience of pattern structure. As they identify the unit of repeat and express it, they will be able to use this knowledge to create a pattern in a different medium, which follows the same structure. For example, a child might be working with a pattern like this:  You may ask them to describe the pattern, what comes next, what the rule is for their pattern, etc. If a child can do this confidently, they could be asked to recreate the same pattern rule with different objects. 'Can you use the nature basket to create a pattern with the same rule?' The child would need to recognise they need three different items, one of which is duplicated. They may say they will use a twig instead of the circle, a leaf instead of the square, a conker instead of the triangle, and create this instead: 	• providing a range of experiences where children can create a pattern using a coding structure • ensuring children can follow the patterns they have coded.	

	Activities and opportunities	Practitioner notes
Making a pattern which repeats around a circle		
As children become more experienced with the structures of patterns, they can investigate whether patterns can continue indefinitely in a circle. Linking elephants, camels or making a necklace can provoke discussion about this. You then might lead discussions about whether the pattern works and how you can tell. If it doesn't work, can children explain why, and correct it so it does? Circles allow children to adjust the circle size, so they can add or take out items. 	• making circular patterns such as necklaces, circles of linking elephants or camels • using pre-given circles to create a border, such as on or around a paper plate • exploring which patterns work, which don't, and why • offering a unit of the pattern and asking the child if they can include it in their pattern • making patterns around rectangular or other shaped frames.	

	Activities and opportunities	Practitioner notes
Making a pattern around a border with a fixed number of spaces		
This is where the children explore creating a pattern around a given space. In these sorts of activities, children have the additional challenge of recognising if their pattern can 'work' – fit into the given space. It is useful to include indoor and outdoor spaces, e.g. creating an outdoor reading area and defining it with a border of carpet tiles. Children can create a pattern on the carpet tiles with cubes to see if their pattern works, e.g. one coloured cube per tile. A pattern that works: A pattern that doesn't work:   When exploring if a pattern works or not, draw attention to the number of spaces and the size of the unit of repeat.	• creating borders around defined spaces in the learning environment, i.e. a garden for the teddy bears, an outdoor reading area, etc. • encouraging children to predict if the pattern could 'keep going', voting on this and discussing their thoughts and reasons with a partner.	

	Activities and opportunities	Practitioner notes
Pattern-spotting around us		
As children become pattern experts, look for opportunities to spot and study patterns in the environment. These patterns could be in construction, fabric, wrapping paper, wallpaper, etc. Look for opportunities to identify the unit of repeat and explain how it repeats. Consider other patterns, such as growing patterns, extending a cross shape, or spotting 'staircase' patterns of numbers going up in ones or twos. Children may make and spot spatial patterns, for example reflecting shapes or reversing an image. Stories and rhymes present a good opportunity to explore a growing pattern, e.g. 'There was an Old Lady who Swallowed a Fly', or 'A Squash and a Squeeze'. Explore representing these diagrammatically – to see a staircase pattern, for example.	• exploring patterns in stories, songs and rhymes • where possible, representing these diagrammatically to support pattern-spotting, and predicting what will happen next, and why • inviting children to spot patterns in the home environment, or bring in examples from home • looking at fabric patterns from different cultural traditions: discussing the patterns in terms of what stays the same and what is different • designing wrapping paper for a specific event that involves creating a pattern which the children can describe.	

Common errors in this area may include:	**What to look for** **Can a child:**
• not recognising a pattern such as ABBA (e.g. stating that patterns cannot have two of the same colour together) • when copying or extending a pattern, changing it before making three repeats • spotting that there is an error but not being able to describe it • identifying an error but not being able to correct it • correcting an error by making a 'local correction', which just moves the problem along (e.g. by adding an extra item when colours have been swapped) • describing the whole pattern instead of identifying the part which repeats, or the unit of repeat.	• continue, copy and create an AB pattern? • identify the pattern rule (unit of repeat) in an AB pattern? • continue, copy and create ABB, ABBC (etc.) patterns? • identify the pattern rule (unit of repeat) in ABB, ABBC (etc.) patterns? • spot an error and 'correct' a pattern? • explain whether a circular pattern is continuous or not?