

# Mathematical thinking

## Early childhood learning trajectory



### What is mathematical thinking?

Mathematical thinking is embedded in children's everyday lives. Research shows mathematical thinking and learning starts in infancy and develops into adulthood. It includes learning about mathematical concepts and applying them in everyday situations. Mathematical thinking involves 4 subdomains, including skills and ways of thinking listed below.

- **Patterns and predictions**: noticing patterns (repetition of 2 or more items) and predicting what comes next, which is the foundation of mathematical and logical thinking.
- **Shapes and spatial thinking**: describing physical objects, including what type of object they are (and why), their position relative to each other and their direction of movement.
- **Measurement and data**: understanding units of measurement (for example, length, weight and area) and using broader mathematical knowledge to answer simple questions through a process of collecting, interpreting, representing and communicating information.
- **Quantity and counting**: naming numbers in sequence and connecting them to quantities, and using actions, objects or numbers to represent quantities symbolically.

### Early Years Learning Framework

AERO's early childhood learning trajectories align with the Principles, Practices and Outcomes of the **Early Years Learning Framework V2.0**. The learning trajectories **user guide** provides further information and demonstrates how the Learning Outcomes can be mapped to domains.

### National Quality Standard

**Quality Area 1 - Educational program and practice**

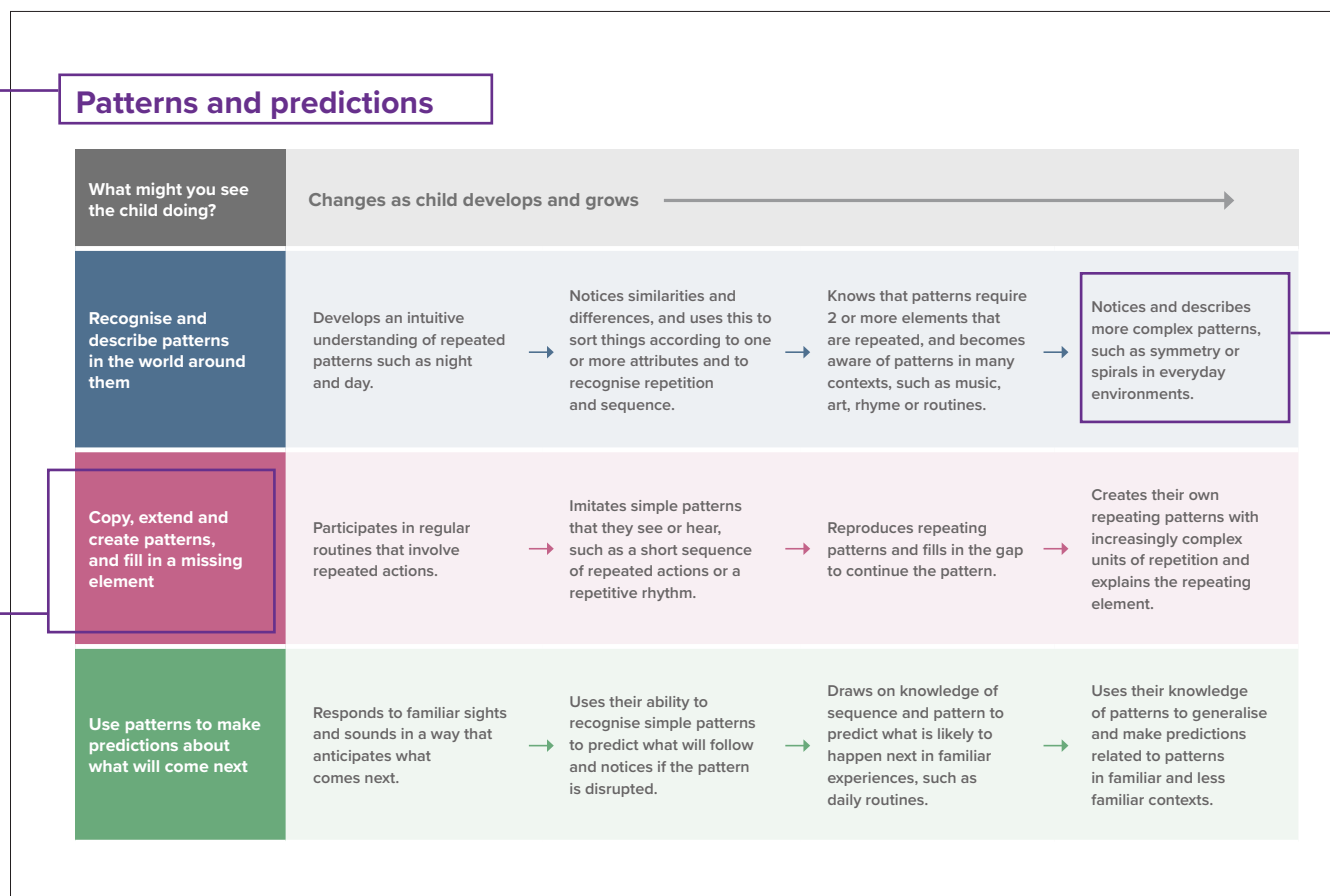
## How to use the early childhood learning trajectories

These learning trajectories will help you observe children’s progress in mathematical thinking. They will give you language and ideas for documenting children’s learning and development, and for your conversations with families and colleagues about children’s progress. The trajectory is not a checklist. You are encouraged to use your professional knowledge and judgement in determining how each child may demonstrate progress along each trajectory, and how best to support their learning.

The domain for this set of learning trajectories is mathematical thinking.

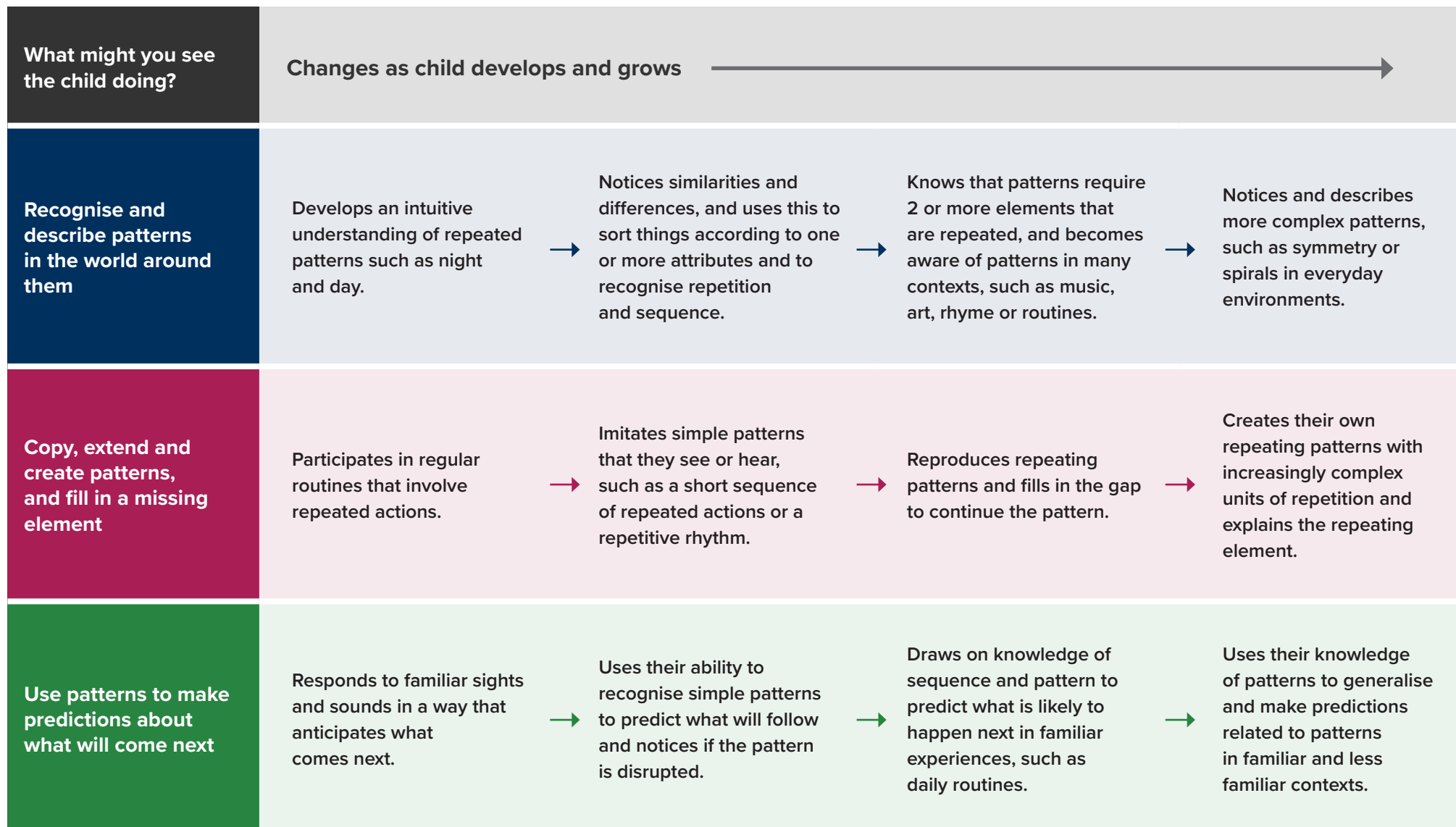
Within this domain, there are **4 subdomains**: patterns and predictions, shapes and spatial thinking, measurement and data, and quantity and counting. Each subdomain is presented in a separate table.

Within each subdomain, there are **3 strands**, describing the capabilities that change over time as children learn and develop.

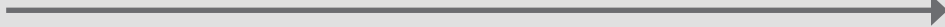


Within each strand, there are **indicators** that describe what you might observe as children progress along the trajectory. These indicators build on one another over time.

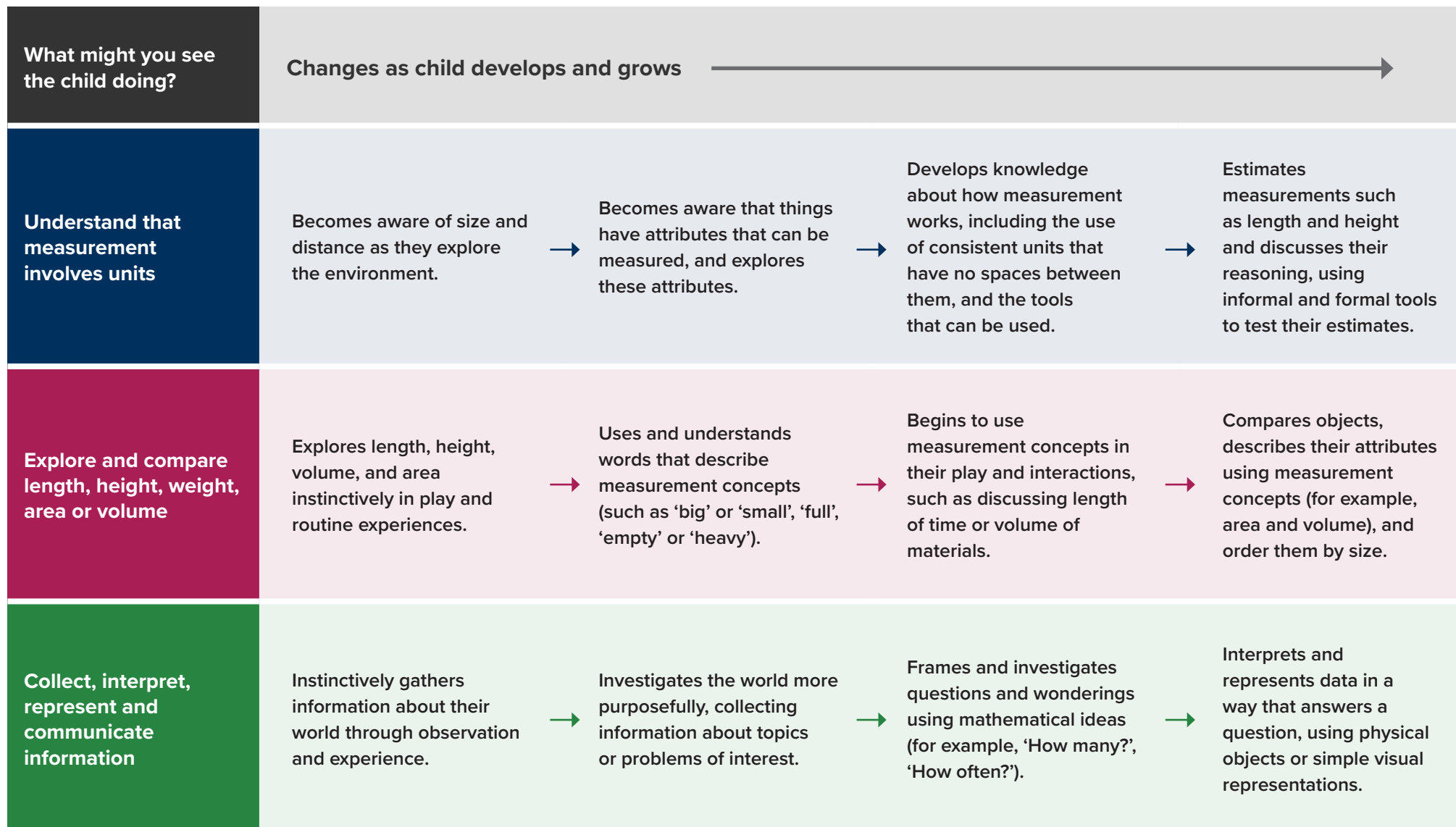
## Patterns and predictions



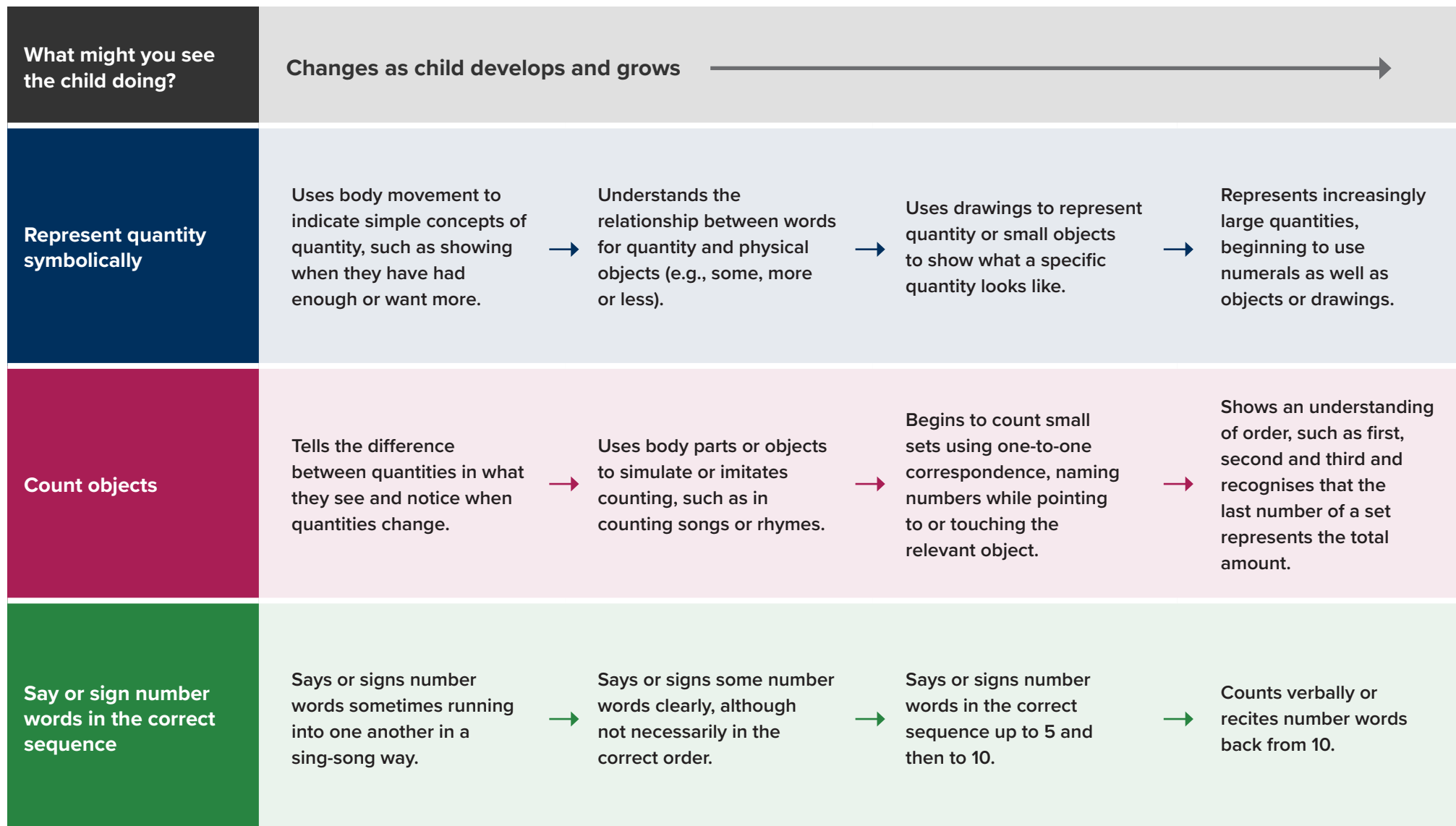
## Shapes and spatial thinking

<p><b>What might you see the child doing?</b></p>	<p><b>Changes as child develops and grows</b> </p>			
<p><b>Recognise and describe shapes and spaces in the world around them</b></p>	<p>Uses their body to explore the shapes and spaces.</p>	<p>→ Begins to match shapes (for example, same), and uses simple words and gestures to describe location and direction (for example, 'there', 'up').</p>	<p>→ Uses more precise language to describe shapes (for example, pointy, round), location (for example, 'near') or direction (for example, 'forwards').</p>	<p>→ Describes more complex attributes of shapes (for example, sides, corners) and explains relative positions (for example, on top, in front).</p>
<p><b>Manipulate shapes and objects to create new forms or positions</b></p>	<p>Changes the position of their body or an object, or looks at objects from different perspectives.</p>	<p>→ Manipulates shapes and objects experimentally to change their form or position.</p>	<p>→ Manipulates shapes and objects purposefully and accurately.</p>	<p>→ Flips, slides, and rotates shapes and objects in accordance with a mental image.</p>
<p><b>Describe and represent the relations between shapes or positions</b></p>	<p>Moves their eyes or body in the direction of a desired object and recognises items are still there even if not visible.</p>	<p>→ Sorts or stacks objects by shape, and organises groups of objects into desired positions.</p>	<p>→ Uses words to describe the location of things in relation to each other (for example, beside, next to, between) and classifies shapes according to their similarities and differences.</p>	<p>→ Connects representations of places and shapes with physical realities (for example, uses a simple map or identifies a three-dimensional object using a 2-dimensional image).</p>

## Measurement and data



## Quantity and counting



# Creating opportunities to support children's mathematical thinking

## Patterns and predictions

- Help children to notice patterns in their everyday experiences, including following predictable routines for pre-verbal children.
- Talk about the unit of the pattern that repeats, such as designs on fabric, table settings (such as spoon, fork, cup) or events in the day.
- Help children to become pattern finders by encouraging them to learn about and find 'units of repeat' such as ABCABC or blue-red-blue-red.
- Encourage children to create patterns and play with variations, including drawing, painting, play dough actions and songs.

## Shapes and spatial thinking

- Provide a range of shapes and objects in the physical environment, including large obstacles to navigate and smaller objects to move around.
- Find opportunities to support spatial thinking in interactions with children, describing the position of an object and using shape language.
- Notice and discuss children's purposeful manipulation of shapes and spaces, including in block play, jigsaws, dancing or tidying up.

## Measurement and data

- Encourage children to investigate measurement concepts through play such as exploring size, length, height, and weight.
- Demonstrate effective measurement strategies (for example, lining blocks up to measure the length of the table and showing consistency with start and end points, consistency with units of measure (the blocks), and knowing there are no spaces in between each unit).
- Encourage children to estimate the length and height of an object or area and then use informal and formal tools to check and reflect on their initial ideas.

## Quantity and counting

- Show children that counting tells us how many. Draw attention to numerals in the environment (for example, in books, on the clock or on posters).
- Use every opportunity to count verbally (such as in songs and rhymes or in routines) and support children in learning the number words.
- While you count, point to the objects you are counting and move them to one side to show which ones still need to be counted.
- When children tell you 'how many' without counting, ask how they know, count together to check, and emphasise the total number.

## About this resource

Our early childhood learning trajectories are designed for teachers and educators working in early childhood education and care (ECEC) services with children in the years before school. They can support ongoing professional learning, for individuals, and entire ECEC services and teams.

The early childhood learning trajectories describe how children learn and develop in these key domains:

- [Executive functions](#)
- [Social and emotional learning](#)
- [Mathematical thinking](#)
- [Language and communication](#)
- [Physical development.](#)

While each learning trajectory describes children's progress in a single domain, they are designed to be used in interconnected ways. A single experience may support progress in multiple domains at the same time. Progress in one domain may depend on progress in another.

## Further reading

For more information on our learning trajectories research

- [Early childhood learning trajectory user guide](#)
- [Early childhood learning trajectories: The evidence base](#)

## More information

The AERO website features further guidance, including practice guides, case studies for early childhood practice. Visit the [Practice Hub](#) at [edresearch.edu.au](http://edresearch.edu.au) for more information.