



Early years curriculum materials

# **Developing early mathematical understandings**

- **How children build mathematical understandings**
- **Mathematical learning in the five learning contexts**



**Queensland  
Government**



**Queensland  
Studies Authority**  
*Partnership and Innovation*

## Introduction

During the Preparatory Year, children learn that mathematics helps people function in their environments through play, real-life situations, investigations, routines and transitions, and focused learning situations. They come to school with diverse experiences involving mathematics. Many children enjoy chanting number names, labelling shapes, identifying how big they think objects and people are, finding pathways to places they know and using their early mathematical understandings to think and reason. Children need enjoyable, interesting and challenging experiences that acknowledge and build on their prior understandings, capabilities and dispositions.

This section of the support materials describes how Preparatory Year children develop early mathematical understandings and how teachers can scaffold and monitor their learning. We give detailed examples of early mathematical learning through play, real-life situations, investigations, and routines and transitions. Children's prior experiences in each learning context contribute to the development of the planning examples and learning experiences. We then provide questions for use in focused learning and teaching situations — one of the contexts for learning — so that teachers can engage with children and scaffold the mathematics learning.

Children build early mathematical understandings in number, patterns and algebra, measurement, chance and data and space by investigating and communicating about:

- quantities and their representations, and attributes of objects and collections
- position, movement and direction
- order, sequence and pattern.

### **Investigating and communicating about quantities and their representations, and attributes of objects and collections**

Understandings, capabilities and dispositions in this area develop as children encounter early mathematical ideas in number, patterns, space and measurement.

When learning about quantities and their representations, and attributes of objects and collections they will have opportunities to:

- count to identify the quantity of a collection
- identify quantities in small collections of the same and different objects and in different arrangements in various representations
- represent the same quantities in different ways using a wide range of objects, drawings and symbols
- investigate attributes of collections, in particular, texture, colour, measurement and shape.

Learning about numbers involves counting, using numbers as labels, identifying quantities of collections, knowing the position of a number relative to other numbers and knowing various ways of representing them (Reuille-Irons, 2002).

Counting to find 'how many' items are in a collection and making collections when asked to match the number of items to given numbers is complex. Children learn to count by remembering the sequence of numbers. Counting with children helps them to learn the sequence of numbers. This is reinforced by reading stories and singing rhymes and songs together. Children will often chant a sequence of numbers not knowing that each number represents a quantity of objects. Some children can sequence many numbers while others may consistently or intermittently omit a number or numbers. They learn to apply the sequence, one number at a time, to items being counted and begin to develop understandings of the quantity of a particular number and of collections.

Children also need to recognise the use of numbers as labels, where the number may not represent a quantity in some situations. During dramatic play, children may, for example, draw or make a label "7" to put on a pretend bus with ten seats.

Knowing 'how many' items are in a collection relies not only on the ability to count but knowing that the last number counted is the quantity of the collection. Some children, including some indigenous children (Willis, 2002), are able to identify the quantity of small collections by seeing familiar arrangements of objects. Recognition of these familiar arrangements without counting seems to be culturally valued. Some children using visual arrangements to recognise the number in small collections may not be able to count in sequence. Children should be encouraged to use their visual strength as they learn to work with and understand numbers.

Children learn that the number of objects in collections will be the same regardless of the order in which the objects are counted, and regardless of any changes that may be made to the arrangement of those objects. Teachers should encourage children to investigate what happens when they start counting from a different starting point. Some children need to be encouraged to work out ways of counting one object using one number name to avoid counting the same object more than once. Children can also make collections of objects for particular purposes by matching the number of objects selected to small numbers.

Children can more easily make a judgment that one collection has 'more' or 'less' objects when the difference is extreme. Comparing collections that are closer in number are more difficult to judge. These activities require counting, representing 'how many' or remembering the number of each collection before any comparison can be made.

Children investigate ways of representing quantities of objects using a range of materials, or drawings and painting collections using different arrangements. They may include symbols (numerals) to represent the quantity of collections or may attempt to write some letters of the number words. They may prefer to copy numbers from wall displays or number cards. They learn that collections can be made using different or the same objects.

Numbers can be represented using different arrangements, for example:

- dominoes pattern
- Caldwell pattern (rows of three objects)
- pairs (rows of two objects)
- random scatter
- child-initiated arrangements and patterns
- objects forming shape outlines, sometimes circles.

Teachers can encourage children to "make pictures in their minds" of different arrangements of the same number to identify small collections without counting and to identify small collections in larger collections. Children better understand quantities when they have opportunities to represent collections in different arrangements and investigate how the number of any collection can be made up of smaller collections — for example, a collection of six objects can be made up of a collection of two objects and a collection of four objects. Children can represent the different combinations they make with drawings, paintings or collage and manipulative materials.

As children count and investigate numbers and quantities of collections, they learn the position of a number in relation to other numbers. Initially, they will identify the *next* number when counting because it naturally follows the counting sequence. They identify numbers that are '*near*' or *close* to each other. Later they will identify numbers that come *before* a given number.

Collecting data to answer questions of interest provides real-life opportunities for children to investigate and use number. Children can collect data from their peers to answer questions of interest to them — for example, "How many children have sandwiches for morning tea?" —and then choose ways to record the information, and discuss the results. They may ask the same question again on a different day, compare the information gathered and discuss any differences. They may hypothesise about what they think might happen another day.

Early understandings about measurement involve investigating a range of objects in different contexts to stimulate conversations about objects' characteristics and attributes. Children will readily identify colours and textures of objects, but may need help with attributes such as length, mass, area and volume.

Initially, children may identify a *characteristic* of an object, by naming a similar object that they are more familiar with — for example, when talking about square blocks during construction, they will talk about it as being "like my sandwich". In doing so, they recognise the shape and connect it with their prior experience but are not able to name the shape. Later as they are more familiar with shape names and have investigated, used and constructed shapes in their play and investigations, they will begin to identify specific characteristics of specific shapes and use shape names purposefully. Investigations involving other attributes of objects, for example length, mass or volume will broaden understandings about measurement.

Children can investigate and observe similarities and differences in attributes by direct comparison. When comparing length, objects are placed side by side to determine which one is longer or shorter, making sure that the two objects are aligned at one end. When comparing mass, objects are placed in each hand so the child can feel the difference in mass. Later, the teacher can use pan balances to demonstrate what children have felt when the mass of one object is more than another. It is easier for children to make comparisons when the differences in the attributes of the objects is extreme.

### **Investigating and communicating about position, movement and direction**

Understandings, capabilities and dispositions in this area develop as children encounter early mathematical ideas in space, position, direction and movement.

When learning about position, movement and direction, they will have opportunities to:

- understand and use the language of positions in space: in, under, on, between, beside, behind, in front of, above, below ...
- understand and use the language of movement: over, under, through, between, along, turn, forwards, backwards ...
- understand and use the language of direction: look sideways, forwards, backwards, inside, up ...
- sequence actions to move along different pathways
- visualise actions to plan movement from one location to another.

This learning focuses on the development of a purposeful language related to position, direction and movement. Children learn this language when teachers or peers provide and model the appropriate language relevant to their investigations in different contexts. Learning new vocabulary can be reinforced when teachers and children share a range of texts and work together in a range of contexts. Teachers and partners need to provide opportunities for children to share their mathematical thinking. Making mathematics explicit in texts and different situations helps children to make new connections, strengthen emerging understandings and revise and consolidate existing understandings. When children have developed a language that describes their position, movement and direction, they can be encouraged to use it in a range of contexts and with different partners in learning.

Children can use construction materials and blocks to design pathways. For example, they may plan pathways through the outdoor and indoor areas for themselves and peers to follow, or follow pathways teachers or peers suggest during transitions and routines. Describing preferred pathways through different settings encourages children to use positional and directional language. Children can be encouraged to "make pictures in their minds" of familiar pathways around the school to assist them when planning pathways.

Games and learning experiences involving non-locomotor movement, such as "Freeze", allow children to experiment with directional language ("look sideways", "look backwards"). Teachers can work together with the children initially and then slowly allow them increasing responsibility for their learning in a range of contexts. Children enjoy movement and positional activities during music, indoor and outdoor sessions, providing many opportunities to consolidate learning.

## Investigating and communicating about order, sequence and pattern

Understandings, capabilities and dispositions in this area develop as children engage in experiences involving early mathematical ideas in number, measurement (time) and patterns.

When learning about order, sequence and pattern they will have opportunities to:

- understand and use the language of order and sequence: after, next, between, before...
- understand and use the language related to patterns: sort, match, same, different, repeating...
- sort and classify objects and materials
- match the order of objects and numbers in sequence
- make patterns using objects and materials
- recognise significant components and predictable sequences that are a part of an event
- begin to understand notions of time in relation to significant events in their lives.

This learning focuses on the development of a purposeful language related to order and sequence. This language can be used during learning experiences involving sequences of events, patterns and number. Allowing children to talk about their thinking while engaged in learning allows teachers to check mathematical understandings and make decisions about the type and amount of scaffolding children may need. Teachers can continue to model mathematical ideas, support and guide new learning or allow children to investigate and consolidate new understandings in different contexts with appropriate support.

Children need to understand a range of instructions and processes such as *after*, *next* etc. for ordering, and *match*, *sort*, *classify*, *copy*, and *repeat* for patterning, so that they can respond appropriately to the instructions given. Initially, when children sort objects and materials they will match object with object: for example, grouping all the balls and placing them into the outdoor basket. As they begin to learn about attributes, they will sort the balls into big and little balls, heavy and light balls, soft balls and hard balls.

Sorting activities can provide opportunities for children to discuss ideas about chance. They can sort objects or pictures into categories that they think "might happen" and those they think "might not happen". For example, they can sort everyday items into the respective shops where they "might be purchased". Their reasons for sorting things in a particular way relate to their prior experiences, and they may find it difficult to accept alternative views because they have not had that same experience.

When making patterns, children use their knowledge of sorting and classifying, ordering and sequencing. They also need to develop an understanding of what a *pattern* is. Initially children will make what they may refer to as "pretty" patterns. These attempts are approximations of patterns, where the repetition is not consistent. Children need time to experiment with making patterns using two or more types of materials. Talking with peers and adults about the patterns they or others have made, and matching and copying patterns provide opportunities for children to investigate patterns. They develop understandings about the "repeating part of patterns" when these ideas are made explicit through games, music, chants, and actions. Children may create their own action patterns for games and music as well as patterns using objects and materials. When using objects and materials, children may create patterns that radiate from a central point, in a line or as a border round a page.

Ideas about chance are developed during discussions about sequences of events. Children will order a sequence of pictures depicting the significant components of an event based on their prior experiences or their interpretation of the images. Asking children to share their stories about the sequence provides valuable information about their thinking and reasoning. Children enjoy varying the sequence of the story and considering whether or not it might happen.

Early understandings of time develop when significant events and sequences of events are linked to the language of time. Initially the word *time* combines with other familiar language to designate particular *points in time*, the time of an event or transition time when activities change. All points in time need to be of significance and interest to children. The language terms commonly modelled and used by children include *lunch time*, *going home time*, *outdoor time*, *library day*, *school day*.

## Developing Early Mathematical Understandings

Children learn to chant the names of the days of the week by learning rhymes, songs and listening to relevant stories (felt board and texts). Prompts may assist children's recall of the sequence as they begin to remember the order of the words. When the names of the days of the week are linked to significant events in children's lives, they begin to use the language of time purposefully, for example "Tuesday is library day". They will begin to combine the days of the week with their understandings about *points in time*, for example "It's Tuesday. We go to library after lunch."

Talking with children about their mathematical ideas, their thinking and reasoning, and observing their interactions with objects, symbols and other people provides ways of monitoring learning and informing the decision-making process.

## References

Reuille-Irons, Rosemary, 2002, *I like working with numbers – Early years numeracy. Prime Number*, vol. 17, No.3, September, pp6-9, Mathematical Association of Victoria.

Reuille-Irons, Rosemary, 2002, *I like working with numbers – Early years numeracy. Prime Number*, vol. 17, No.2, June, 2002, pp21-24, Mathematical Association of Victoria.

Willis, Sue, 2002, Opening Address on *Numeracy*, developed for Brisbane Catholic Education Conference.

Grateful acknowledgment is made to Rosemary Reuille-Irons, (Lecturer, in Early Childhood Mathematics, School of Maths, Science & Technology Education, Queensland University of Technology), for providing expert feedback on request and for her overall support during the development of this document.

## Early mathematical understandings: Early numeracy

Children build early mathematical understandings about number, patterns & algebra, measurement, chance & data and space by:

- investigating and communicating about quantities and their representations, and attributes of objects and collections
- investigating and communicating about position, movement and direction
- investigating and communicating about order, sequence and pattern.

### Suggestions for planning

With children, teachers plan for learning across the five contexts by constructing experiences relevant to local settings, or drawing on the following examples, in which children:

- match and describe characteristics, attributes and representations for patterns, objects and collections
- sort and classify objects, and describe a characteristic of the collection, such as number, shape, colour, texture, size or function
- make patterns of repeated sequences, such as decorative patterns and sequences in movements, songs, games, manipulative play, routines and stories
- compare attributes and quantities in collections using comparative language
- order and describe sequences of actions, events, patterns, routines and transitions, and numbers in manipulative play, songs and games
- represent and describe early mathematical ideas using objects, pictures, drawings, text, child-created symbols and numbers
- explain mathematical thinking and reasoning for decision making and problem solving
- use information and communication technologies to explore quantities and their representations, position, movement, direction, order, sequence and pattern.

### Suggestions for interacting

Teachers create interactions relevant to local settings or draw on the following examples:

- discuss mathematical explorations, and thinking and reasoning, collaboratively
- model mathematical language and ways to represent mathematical ideas
- develop and extend the language of mathematics
- make explicit, strategies used for counting collections and identifying “How many?”
- give explicit prompts and support to assist the recall of beginning mathematical ideas
- draw attention to the mathematics in everyday situations
- acknowledge effort, interest, learning and experimentation with mathematical ideas
- ask children what support they need
- discuss approximations of early mathematical ideas and modify understandings as required
- encourage others to support mathematical thinking, reasoning and experimentation
- encourage children to reflect on their mathematical thinking and reasoning in different situations and contexts
- question thinking and reasoning by asking “why” and “how” questions
- encourage children to find ways of representing their mathematical ideas
- use teachable moments to draw children’s attention to mathematical aspects of their activities
- reflect on the situation or learning experience and decide how to extend and deepen the learning.

### Suggestions for monitoring and assessing

In relation to this learning statement, teachers may look for evidence that the child:

- counts small collections in different arrangements and from different starting points
- recognises familiar numbers
- identifies how many in a small collection
- recognises the required number of items needed to complete a planned task
- recognises parts of a whole
- identifies collections with exaggerated differences for “more” or “less”
- represents the quantities of small collections in different ways
- imitates exchange processes as part of play
- identifies and describes attributes of objects as long, short, empty, full, heavy, light
- uses comparative language when comparing two objects or pictures
- sorts collections by single attributes such as shape, colour or size of objects
- identifies and describes attributes of objects according to shape
- uses familiar positional language to communicate own position, the position of others and objects
- interprets familiar language of position to place or locate objects
- identifies the repeating element of a simple pattern and continues pattern
- identifies patterns in the environment
- follows a simple sequence of actions, or pattern, in order
- represents sequences of familiar events
- identifies points in time, with prompts
- in discussions, sometimes identifies that an event might or might not happen
- identifies ways of collecting data to confirm assumptions and answer own questions.



*Teachers monitor a child's learning in relation to the learning statements as they:*

- observe and analyse what the child is doing
- listen to and reflect on what the child says
- interact with the child
- record annotations
- communicate with partners including children, parents/carers and others.

*Teachers gather evidence about a child's learning through the five learning contexts: play, real-life situations, investigations, routines and transitions, and focused learning and teaching.*

### Suggestions for reflecting

Adults and children might reflect on the following questions relevant to this learning statement:

- How can we find out the most popular ... ?
- How can we share what we found out?
- How did you work out what came next in your pattern?



*Teachers also reflect on their practice, in terms of decision making and the five key components, in order to continually improve both their judgments about children's learning, and their planning for future learning experiences.*

Learning contexts	Planning examples and learning experiences
<p><b>Play</b></p> <p><b>Construct a farmyard</b></p> <p>The planned learning experiences may have developed from:</p> <ul style="list-style-type: none"> <li>• <b>child-initiated activity.</b> The child has spent the weekend with their family on a relative’s farm. On entering the classroom, the child announces that during play time a farmyard will be built using the blocks. Farm buildings will be constructed using boxes.</li> <li>• <b>teacher-initiated activity.</b> The class has recently visited a local farm. In preparation and as follow up, stories about farms and farm animals’ antics are read. The teacher suggests that some children may like to construct a farmyard using the blocks and the farm animals that have been placed on the shelf in the block area.</li> <li>• <b>teacher-child negotiated activity.</b> Children have been singing animal songs and have dramatised those songs during outdoor play. During those activities the teacher suggests that the children might like to construct a farmyard during indoor time. The children agree. The teacher asks if they have any ideas about what they might use to build the farmyard. Some choose the blocks but ask if they can use the toy farm animals that have been used during music time. The teacher agrees. Some choose to use collage materials to construct farm buildings and ask if they can cut up some boxes. The teacher discusses the size and shapes of the buildings needed. The children make different suggestions and together they decide which boxes to use. Other children want to use manipulative equipment as it has a range of shapes and animals that they can use. Some children want to display their farmyard on the shelf to show everyone what they have built, and talk about how the construction was made. The teacher asks them to help make a space in preparation for their construction.</li> </ul>	<p><b>Matching and describing characteristics, attributes and representations for patterns, objects, and collections</b></p> <ul style="list-style-type: none"> <li>• select blocks of different lengths to make farmyards of different shapes and sizes</li> <li>• match blocks of the same length and match one side with another</li> <li>• identify attributes of the blocks</li> <li>• use smaller blocks of different lengths and make a pattern (long block, short block, long block, short block) for the boundary of the farmyard</li> <li>• make another farmyard the same as the first farmyard</li> <li>• count the blocks used for one side of the farmyard and make another side to match that number</li> <li>• ask how to change the fence to have one block in the fence that can be a gate</li> <li>• place animals in one farmyard</li> <li>• count the number of animals in one farmyard and ask the child to put the same number of different animals into another farmyard or outside the farmyard</li> <li>• verbalise the matching process if needed</li> </ul> <p><b>Questions to focus learning</b></p> <ul style="list-style-type: none"> <li>• When I match things I .... What do you do when you are trying to match things? Sometimes when I am doing .... and I need to match very carefully then I ..... What do you do?</li> <li>• Will all the farm animals in this farmyard fit into the new farmyard that is a different shape?</li> <li>• Can you look at other parts of the object to help you match it?</li> </ul>



- How can we make the side of the farmyard longer/shorter?
- Can you think of the number of animals that might fit into the farmyard?
- How can you find out how many blocks were used?

**Sorting and classifying objects and describing a characteristic of the collection including number, shape, colour, texture, size and function**

- identify what is needed for the construction and collect equipment that is the same in preparation
- verbalise the sorting and classifying process if needed
- provide mathematical language to extend the child's everyday language
- stack blocks of the same shape and length on the shelf
- collect the same number of animals for different farmyards
- discuss what is needed as ground cover, e.g. grass
- sort collage materials to cover the ground — brown paper for soil, green for grass
- use combinations of boxes (collage) for sheds in the farmyard

**Questions to focus learning**

- What did you think of when you looked at all the objects? Tell me how you sorted the objects.
- How many groups of objects did you decide to have? Why?
- Can you sort these objects another way? Can you sort these objects differently? Do not sort by colour this time.
- All these objects are the same colour, I wonder if .... they all feel the same/they are all little/they are the same shape/they are used to do the same job. Let's find out. What will we start with, the shapes or what they are used for?
- Are there other ways of sorting these objects?

- How can you record the different ways you could sort the objects?
- I wonder if someone else would sort these objects the same way? How could we find that out?
- Does each group have the same number of objects?
- Why did you put these shapes into the same group? What part of the object were you looking at when you decided to put it into this group?

**Patterning repeated sequences such as sequences in movements, songs, games, dramatic and manipulative play and routines, stories and objects for decorations**

- chant the chorus of songs during the construction of the farmyard and when playing with the farm animals
- collaboratively plan a sequence of events using the farm animals, farm equipment and farmer
- act out sequences of events that occur on the farm using the animals, e.g. lining up the animals in a pattern around the dam for a drink, or as they move from one farmyard to another
- organise “the heaviest animal parade”
- make a pattern on the winning sashes to decorate the shortest, tallest, fastest and slowest animals on the farm
- make decorative patterns on a shed made for shade
- model mathematical language as appropriate

**Questions to focus learning**

- Can you think of some different patterns for a dance using only two or three movements, maybe jumping and nodding?
- Can someone think of a different way of moving using those two movements, jumping and nodding?
- Let’s record that way of moving. How can you do that?

- What other movements can we use to make different patterns?
- How can we decorate these winning banners? Can we make a pattern?

**Comparing attributes and quantities in collections using comparative language**

- count and compare the quantity of animals in one farmyard with another farmyard or the animals inside the farmyard with those outside the farmyard
- place one block on or next to another block and compare the length, describing it as longer or shorter
- discuss ways to find out how heavy the animals are
- feel the mass of small objects by placing them on hands (hefting)
- emphasise the use of comparative language if needed

**Questions to focus learning**

- How can we find out which group has more/less than this group?
- Are there other ways of finding out how heavy animals are?
- Is there an easy way of remembering the number of objects in each group?
- Is there an easy way of comparing each group of objects? i.e. familiar arrangements of groups of objects

**Ordering and describing sequences of actions, events, patterns, routines and transitions and numbers in manipulative play, songs and games**

- sequencing events that happen on the farm, e.g. the animals walk to the dam to have a drink then go to the feed trough
- dramatise the farmer's walk around the farm and describe, e.g. from the farm house to the dam for a drink, to the tree for shade, to the shed at night for safety
- discuss an order for the animals on parade
- dramatise the animal parade

- echo children's everyday language and model the use of mathematical language as appropriate

**Questions to focus learning**

- What is the easiest way to record the order of animals for the parade?
- Can they go a different way? Why? Will it work that way?
- How did you work out what the next event/number/action/ animal would be?
- Is there another way of working out what might come next/go before?
- Would someone else make the same sequence? Why? Why not?

**Representing and describing early mathematical ideas using objects, pictures, drawings, text, child-created symbols and numbers**

- representing mathematical ideas is a way of sharing thinking and reasoning
- it is important to represent mathematics knowledge so that others understand
- representing mathematical ideas allows for reflection when an idea does or does not work
- representing mathematical ideas helps to keep track of thinking and reasoning when solving problems

**Questions to focus learning**

- What is the easiest way of representing your ideas?
- Can you think of a different way of representing that idea?
- What is the quickest way of representing your ideas to help you remember what you are doing?

**Explaining mathematical thinking and reasoning for decision making and problem solving**

- prompt the recall of previously solved problems when faced with similar situations

	<ul style="list-style-type: none"> <li>• assist the recall of how previous problems were solved</li> <li>• assist with making plans to solve problems</li> <li>• discuss what might happen</li> <li>• assist with recalling sequences of events to work out the next step</li> <li>• collaboratively try out some new approaches and discuss what is happening</li> </ul> <p><b>Questions to focus learning</b></p> <ul style="list-style-type: none"> <li>• What did you do when you got stuck on a problem?</li> <li>• Is this the only way of working it out?</li> <li>• Can you think of other ways of solving the problem?</li> <li>• If you solve the problem a different way, will it always work out this way? Why? Why not?</li> </ul>
<p><b>Real-life situations</b></p> <p><b>Hosing the garden</b></p> <p>As the water sprays on the plants, creatures (insects and animals) begin to move. Children can see grasshoppers, butterflies, dragonflies and a friendly blue tongue reversing back into a log home.</p> <p>(<b>Note:</b> when garden is watered each day, what is being observed can vary. Avoid distressing the creatures that share this environment. Follow up simulated activities during indoor and outdoor times to allow time for experimentation and investigation.)</p> <p>The planned learning experiences may have developed from:</p> <ul style="list-style-type: none"> <li>• <b>child-initiated activity.</b> The child notices the movement of the insects and animals as the water sprays onto the plants and shouts, “Come and watch the things jump! Quick!”</li> <li>• <b>teacher-initiated activity.</b> The class decide to organise a garden bed. They discuss what they might grow and how to arrange the plants in the garden bed. The teacher suggests that they read together sections of gardening</li> </ul>	<p><b>Matching and describing characteristics, attributes and representations for patterns, objects and collections</b></p> <ul style="list-style-type: none"> <li>• identify the characteristics and attributes of the creatures as they move, and collaborate and share observations</li> <li>• copy the creatures’ movements after they observe them, emphasising the use of the word after</li> <li>• re-enact movements during music or transition activities, prompting recall with verbal prompts or actions</li> <li>• combine movements to create patterns of movements</li> <li>• represent and match the shapes of the creatures using templates for tracing or copying from identified shape cards</li> <li>• discuss and label obvious characteristics and attributes, reinforcing children’s everyday language or introducing mathematical language</li> <li>• identify other characteristics and attributes by examining representations of the creatures in books, magazines or borrowed museum collection displays</li> </ul>

books and magazines to find what plants are recommended for planting and what creatures they might find in the garden.

- Alternatively, the children observe that the insects move as the plants are sprayed with water. The teacher notices that the children do not refer to the creatures by name and comments about the event are more about the excitement of the movement. The teacher inspects the plants with the children and suggests that they find out more about these creatures, learn their names, and investigate their movements and the shapes of their bodies.
- **teacher-child negotiated activity.** A child has planted a vegetable garden at home and would like to set up a similar one in the outdoor area at school. The child suggests that the plants that are currently bearing at home are the plants that should be planted. The teacher agrees to construct and plant a garden but negotiates with the child about the type of vegetables to be planted. They discuss what they might do with the crop. The teacher suggests making something for all the children to share. The child suggests making sandwiches. Together they decide to plant tomatoes, lettuce, radishes and onions. They agree to make sandwiches whenever the food is ready to pick. All children are encouraged to care for the garden, make the sandwiches and taste the food.

- count only one type of creature as the water is sprayed across the plants
- record the arrangement of the creatures on the move and count them
- represent the collection of garden creatures, matching the position of the creature on the plant (on or under the leaf, between plants) and record the number that moved
- match the locations of the creatures using play dough and position toy creatures to represent the locations, prompting the use of or providing positional language if needed
- make another collection of the same number of creatures that moved

**Questions to focus learning**

- I was looking for.... when it jumped. How could you tell what your creature was?
- Are there other ways of watching the creatures move?
- Can you think of how many creatures might jump when the hose sprays? How can we check?

**Sorting and classifying objects and describing a characteristic of the collection including number, shape, colour, texture, size and function**

- draw/ paint what you saw, and show what the creature/s did
- sort plastic creatures into groups, name the category and discuss why that category was chosen
- sort creatures by their position in the garden, providing positional language if needed
- sort creatures by their location in the garden

**Questions to focus learning**

- How did you sort the creatures?
- Can you sort the same creatures another way?

- Which creatures like to hide in different positions in the garden?
- Which creatures like to move ....(e.g. from the lettuce to the tomatoes)?
- Which creatures like to move ...(e.g. from one lettuce plant to another)?

**Patterning repeated sequences such as sequences in movements, songs, games, dramatic and manipulative play, routines, stories and objects for decorations**

- use the movements of the creatures to make patterned sequences during music
- innovate on the “Cat and mouse circle game” and play “Chase/catch the ....” Children are asked to adopt the movement of the creature they are pretending to be, moving in and out of the circle. The child who is chasing goes over the arms of the circle (arms drop down to allow safe passage) while the creature being chased goes under upheld arms. Vary the creature each time to change the movements
- share stories involving creatures living in gardens
- make up and dramatise stories based on the antics of creatures when their garden is hosed
- use the movements of the creatures and dramatise how they move around the garden
- record different pathways used by the creatures
- show how the creatures hide in the garden using drawings, paintings, collage or creative body movements

**Questions to focus learning**

- How could you move like a .....?
- How can you hide a big/little creature in the garden?
- Are there other ways of hiding creatures in a garden?
- What is the best way of hiding in the garden?

- How can you use the movements of the creatures to make a pattern?
- Where would a creature go to first to get out of the spray of the hose? Where would they go next?

**Comparing attributes and quantities in collections using comparative language**

- compare the number of creatures observed on different days and decide if there were more, less or the same. Help children with the language of the days of the week and more/less/same if needed
- compare the number of legs, wings and body parts of one creature with another. Reinforce children's everyday language and introduce mathematical language as appropriate
- use a magnifying glass to compare different features of the creatures
- identify characteristics and attributes of creatures. Play "Spot till you drop!" Take turns and continue to identify characteristics and attributes until one person cannot spot something different. Encourage children to use positional language to help the partner see what has been identified. Mark the attribute or characteristic with a spot or dot. Point to the position of the characteristic if necessary
- compare the number of plants in two rows placed side by side and planted using the same interval. Reinforce the language of more/same. Discuss how to make the rows contain the same number
- compare the number of plants in different plant groups
- identify and compare the attributes of:
  - different leaves, vegetables, fruit, (shapes, wide/narrow, thick/thin, long/short)
  - pathways through the garden, (wide/narrow, long/short, lines)
  - mulch coverage (thick/thin, small/large sections)
- discuss how to make the hose spray longer or shorter, wider or narrower — provide actions if necessary to help children understand



- compare the length of the hose spray as the tap turns on and off. Mark the length with a streamer from a child's foot to where the water hits the ground. Put the streamers together to compare the length. Use comparative language as a prompt
- compare the attributes and quantity of cut food. Identify shapes of cut portions and use everyday language to label portion sizes
- identify and compare the shapes made when a sandwich is cut differently

**Questions to focus learning**

- What parts of the creature/food are you comparing?
- How do you know that the creature has more/the same number of legs?
- What did you do to find out whether this creature is bigger than that one?
- How many stops did this creature make through the garden?
- Can the creature make different pathways through the garden?
- Did it take more/the same/fewer stops/jumps than ....?
- What happened to the shape of the food when it was cut?
- Can we cut a sandwich in a different way and still make four/two ... shapes?

**Ordering and describing sequences of actions, events, patterns, routines and transitions and numbers in manipulative play, songs and games**

- make a story map showing creatures moving through the garden from the same start and finish
- order movement sequences for songs and games. Use number in the sequence, e.g. one jump, two leg shakes
- use repeating movements or sequenced movements during routines and transitions to imitate the creatures, using appropriate language to describe the movement
- discuss and decide how the plants will be positioned in the garden bed — identify the quantity, the shapes and position relative to other plants

- make imitation garden beds using play dough and junk materials, checking the number of plants is the same as their garden
- make models of garden beds using collage materials
- discuss a sequence for planting throughout a week, list plants to be planted on shared week calendar
- discuss and record the sequence of harvesting, preparing and tasting the food
- describe what a sandwich looks like using positional language, e.g. bread goes on the bottom and the top and filling between the bread, or fillings on top of bread
- discuss the sequence of preparing sandwiches. Model and prompt the use the language of order and positional language
- discuss different sequences for making a sandwich and decide whether or not it will still be a sandwich when finished
- keep a diary of what was seen from day to day, during the week, e.g. "Monday, four small grasshoppers; Tuesday, two small grasshoppers and one big grasshopper ..."

**Questions to focus learning**

- Which creatures follow the same pathway through the garden?
- Which creatures landed on/near/crawled under the same plant first/last?
- Can you still make a sandwich if you put things on in a different order?
- Can you find someone who made the sandwich in the same order as you?

**Representing and describing early mathematical ideas using objects, pictures, drawings, text, child-created symbols and numbers**

- make representations to recount events, just after they have happened and make a "book" in sequence
- record children's language during activities and insert mathematical

language in talking bubble inserts

- keep a record of the time it takes, (in whole days) for short durations, e.g. seeds to sprout, buds to flower
- design garden beds of different shapes. Copy shapes from shape cards or trace templates as required
- make "creature spotter" badges using photographs or drawings featuring obvious characteristics and attributes. Children look for and spot what is on their badges
- identify shapes and use many plants to create the shape outline, e.g. a circle of lettuce plants
- make a list of creatures found in the garden using pictures, drawings, collage or manipulative equipment
- make a chart of the creatures and their movements using pictures, drawings, collage

**Questions to focus learning**

- Is there a special mathematics word for ... ?
- How did you make the garden bed like a square/triangle ... ?
- How did you place the ... (e.g. lettuce) plants to make a triangle?
- Record how many ... (e.g. lettuces) are needed for this triangle.

**Explaining mathematical thinking and reasoning for decision making and problem solving**

- discuss the situation and identify a problem to be solved
- discuss plans of how to get started — decide on creature spotters to watch different parts of the garden
- discuss plans of possible next steps
- discuss what a garden could look like
- encourage recall and experimentation of previously used plans and decide if

some of the ideas or plans can be used in this situation

- discuss alternative approaches
- discuss possible outcomes

***Questions to focus learning***

- Do you think we have a problem?
- You wanted it to look like .... Does this look like ... ?
- Is there another way to do this?

### Investigations

#### What shapes do leaves look like?

Children and adults often pose open-ended questions, which encourage investigation of:

- new knowledge, thinking and reasoning
- pre-existing thinking and reasoning in different contexts
- consolidation of existing thinking and reasoning.

Investigations require individuals to seek and find different approaches and solutions to problems, which are meaningful to them and to others.

Investigations require differing amounts of time and intensity, depending on the question and the thinking and reasoning abilities of the child. Guiding children towards their own conclusions is as important as asking the question, developing plans, and finding and experimenting with different approaches.

Children might also like to investigate questions such as:

- “How can I make a bridge to cross the ‘river’ in the sand?”
- “Does everyone have the same bedtime?”

The planned learning experiences may have developed from:

- **child-initiated activity.** A child brings in a bag of leaves that were raked up at the weekend. The child tips the leaves into a pile on the table and starts to tell friends how they were gathered. The child says, “These leaves look like little circles.”
- **teacher-initiated activity.** A small group of children are ‘re-reading’ a story with large illustrations of leaves on a vine. The teacher approaches the group and asks the children to have a look closely at the leaves, and poses the question, “What shapes do leaves look like?” They discuss the illustrations in the book and notice that some of the leaves are different shapes. “What about the leaves in our garden — do those leaves have the same shape?”
- **teacher-child negotiated activity.** The children have made a pretend cubby

### Matching and describing characteristics, attributes and representations for patterns, objects, and collections

- observe leaves in stories and magazines and discuss and identify shapes
- examine leaves with a magnifying glass and discuss and identify shapes
- trace round leaves and cut out paper shapes. Match leaves that are the same, or are a familiar shape
- place a leaf on top of a tracing of a leaf and trace the second leaf. Discuss the match
- fold leaves lengthwise and discuss the match. Use the language of the same and not the same.
- match leaves with card replicas of leaf shapes. Reinforce the use of appropriate language
- match shapes with shape cards
- count the veins on a leaf. Discuss how many veins on a leaf. Find another leaf with the same number
- find leaves with veins that have a given number of veins, e.g. “Find a leaf with four veins”
- represent a leaf with the same number of veins using collage or drawings and paintings
- place two leaves back to back and match the length
- play “Draw my leaf!” — one child describes the leaf and another tries to represent it from the description

#### Questions to focus learning

- How did you match these leaves?
- Can you think of other ways to check if they are the same shape?
- Which leaves look like circles or other shapes?

in the outdoor area. They have made a pathway to the entry. They approach the teacher and ask if they can pick leaves from the bushes and trees and make a patterned edge for the pathway. They discuss how the pattern will be made using leaves. One child suggests making a brown leaf, green leaf pattern. The teacher asks, "What shapes do leaves look like?", drawing their attention to a different attribute of the leaf.

- Which leaves have the same number of veins?
- How can we record what we have found out about leaves?
- What were you thinking when you were playing, "Draw my leaf!"

**Sorting and classifying objects and describing a characteristic of the collection including number, shape, colour, texture, size and function**

- sort leaves from the garden and identify what criterion was used for the sort. Suggest and discuss different ideas for sorting
- use the same leaves and sort using a different attribute
- do leaf rubbings to observe and discuss characteristics
- make charts of groups of leaves that are the same
- count the number in each group

**Questions to focus learning**

- How did you decide to sort these leaves?
- Can you sort these leaves using different ideas?
- Which group has more/less/the same number of leaves?
- How can we make these groups of leaves the same number?

**Patterning repeated sequences in movements, songs, games, dramatic and manipulative play, routines, stories and objects for decorations**

- create leaf shapes using your body
- make leaf shapes using a small group of children
- review photographs of leaf shapes children have made
- display representations of different leaves. Play "Which leaf am I?" — someone describes one of the leaves and children guess/point to which leaf they think it is. Help them to repeat the description if needed

- make patterns of leaves and place along the sides of the pathway. Reinforce the language of patterns
- make a leaf mat for the cubby entrance. Cover a surface with leaves
- make a leaf print patterned place mat. Count the different leaves used in the pattern. Help children to find the repeating part
- make representations of leaves for patterns
- make leaf print patterns
- share text information and stories about gardens and identify the leaf shapes

***Questions to focus learning***

- How can you make patterns using these leaf shapes?
- How can we make different patterns using the same leaves?

**Comparing attributes and quantities in collections using comparative language**

- compare different attributes of the leaves. Help children to identify the shapes
- make groups of different and the same quantities of leaves
- count the number of leaves used to line one side of the pathway and compare the number used to line the other side of the pathway
- place two leaves back to back and compare the length
- measure the length of one leaf with a streamer and use the streamer to match the length with other leaves

***Questions to focus learning***

- What shapes do the leaves look like?
- Are all the leaves that you see this shape? Why? Why not?
- Do we have enough leaves to put on the side of the pathway?

- What else can we compare?
  - How do you know the groups have the same/different number of leaves?
  - How can we make each group have the same number of leaves?
- Ordering and describing sequences of actions, events, patterns, routines and transitions and numbers in manipulative play, songs and games**
- discuss the order of the pattern for the side of the pathway. Model the appropriate use of mathematics language
  - talk about which shape could be used first in the sequence
  - talk about which leaf could come next along the pathway
  - repeat different body shape actions or finger shape actions, depicting leaf shapes and other shapes and use for a movement sequence during music
  - represent activities about shapes of leaves in the order in which they occurred
  - note the sequence of the growth of plants and how the leaves have changed
- Questions to focus learning**
- Can we make different patterns using the same shapes?
  - Look at the pictures of the growing leaves. Can you guess what might happen next? Can you guess what happened before this picture?
- Representing and describing early mathematical ideas using objects, pictures, drawings, text, child-created symbols and numbers**
- use different ways to represent the various attributes of leaves, in particular the shapes
  - make stories about what children have done to help leaves grow and develop
  - discuss different attributes of the leaves
  - record different numbers of characteristics identified on leaves – number of



veins, points, spots

***Questions to focus learning***

- What is the best way of recording your ideas to remember them easily?

**Explaining mathematical thinking and reasoning for decision making and problem solving**

- plan ways to organise how to find out about the shapes of the leaves
- share the "Sequence of activities book" to assist recall of activities about leaves
- discuss what has been discovered about the shapes of leaves
- consider a response for the original question and give reasons why that conclusion was reached

***Questions to focus learning***

- Is this the only way of working out this problem?
- Can you think of other ways of deciding what shapes leaves look like?

### **Routines and transitions**

#### **When can I go ... ( home, swimming, to the library ...)?**

There are many opportunities during routines and transitions to introduce or consolidate early mathematical learning.

The planned learning experiences may have developed from:

- **child-initiated activity.** The child suggests particular rhymes, songs, games or actions that can be used as they move from one area of the room to another or as they move from one activity to the next.
- **teacher-initiated activity.** The teacher reflects on current and prior mathematical learning and prompts children to recall or practise particular mathematical ideas of interest to them.
- **teacher-child negotiated activity.** The teacher prompts children to recall early mathematical learning and the children suggest using some of these ideas during routines and transitions. The teacher agrees.

### **Matching and describing characteristics, attributes and representations for patterns, objects, and collections**

- at tidy-up time, discuss which activities take about the same time to clean up
- practise location and position language when tidying. Consider novel ways of putting equipment away, for example, locating objects that go on the same shelf, chanting rhymes to remind them of the task (e.g. “Cars in the box, blocks on the shelf”), asking a friend to help carry heavy things
- limit and vary the number of objects that can be put away at any one time – two objects, one in each hand
- match the time of significant events represented on replica clocks with picture clues with actual time on the wall clock

#### **Questions to focus learning**

- How can we tidy up faster?
- Is there a different way of tidying all the small things?
- Is there another way of tidying the big things?
- How do we know when it is time to go home?

#### **Sorting and classifying objects and describing a characteristic of the collection including number, shape, colour, texture, size and function**

- discuss how to organise indoor and outdoor equipment for easy access. Use positional language where appropriate
- sort and group equipment that is the same shape, colour, texture, size or function. Reinforce the use of everyday language or introduce appropriate mathematical language
- organise collage materials according to different attributes
- organise equipment by its function for ready access

***Questions to focus learning***

- How can we arrange the equipment in different ways so we can all use it?

**Patterning repeated sequences (movements and expressions in songs, games, dramatic and manipulative play and routines, ideas in stories and objects for decorations)**

- do simple repetitive actions to move from one location to another
- play “Spot the .....

***Questions to focus learning***

- What other ways can we move to the ..... or tidy up?

**Comparing attributes and quantities in collections using comparative language**

- discuss how more children helping gets the tidying done quickly
- compare what happens when walking fast and slow during transitions and routines

***Questions to focus learning***

- How can we get to the ... quickly?

**Ordering and describing sequences of actions, events, patterns, routines and transitions and numbers in manipulative play, songs and games**

- describe and make picture sequences of actions for morning tea/lunch/toilet times
- make pictorial sequences of events for the daily program, and later the weekly program
- make lists to organise who will have the next turn at ....
- use a shared week calendar to connect the days of the week with particular events of interest

- mark the days with weather pictures and count rainy, cloudy and sunny days at the end of the week/month

**Questions to focus learning**

- What has happened with the weather this week?

**Representing and describing early mathematical ideas using objects, pictures, drawings, text, child-created symbols and numbers**

- represent the time of the next event on the teaching clock placed under the wall clock
- represent events of relevance to the children on clock replicas placed beside or under the wall clock
- list events of relevance on daily charts
  - Monday — library, swimming
  - Tuesday — Year 7 buddies visit; special music with ...
- play transition games using:
  - space
    - “Make a shape on the floor, using this rope. Ask a friend to help.” Name the shape.
    - “Make a shape with your body before you go to morning tea” Name the shape.
    - “Ask two friends to help you make a shape with your bodies. Tell everyone the name of the shape. Then go to lunch.”
    - “Tell me how to get to the library.”
  - measurement
    - “Show us a long way to the bathroom and we will follow.”
    - “What is the shortest way to the book area in our classroom.”
    - “I will count to three/five... (always count at one second intervals when using counting for activities related to time). Can you walk to the bathroom by the time I get to three/five....? You cannot get there until I say three.”
- patterns

- “Walk to the school bags doing these actions: clap, turn around, clap turn around”
- “Lets make a pattern using the children in a line: boy, girl, boy, girl”
- chance
  - Play “Can it happen?” Children answer with “can happen, might happen, can’t happen.” They can give one reason why they think the way they do. Another child can answer the same question differently and provide a different reason. Continue until children run out of ideas or ask a new question. For example, “Will an elephant fly into this room?” or “Will the principal visit our class before lunch?”
- data
  - “Find some friends who have a drink for lunch.”
- number
  - “If you are five stand up.”
  - “Do three actions then go to the bathroom.”

**Questions to focus learning**

- How can we keep track of all the things we can do at school?

**Explaining mathematical thinking and reasoning for decision making and problem solving**

- use different ways to get from one location to another
- make mind pictures of walking along different pathways after walking that pathway
- use mind pictures of walking along a particular pathway to plan a walk to a location

**Questions to focus learning**

- Did everyone think of the same pathway to ...? Why not?