

GRADE

R

NumberSense

PROMPTS, STRATEGIES & SOLUTIONS

English

Teacher's Guide

**MAKING SENSE OF
NUMBERSENSE**

Term 1

**OCT
2025**



ABOUT THIS TEACHER GUIDE

The NumberSense Mathematics Programme aims to make the teaching and learning of mathematics an integrated, sense-making, problem-solving activity. By providing useful prompts, strategies and solutions, teachers are empowered to make sense of the NumberSense Workbooks and resources within their context. The aim of this guide is to support teachers in provoking reflective discussions where reasoning is applied so that connections between activities and solution strategies can be developed.

Please note that this is a sample, draft version, which includes the start of a comprehensive Grade R Teacher Guide.

The following is included:

1. Using NumberSense in Grade R

This section includes:

a) Curriculum mapping: a year plan showing NumberSense resources and content coverage over the course of the year as well as how this corresponds to the CAPS curriculum.

b) NumberSense approach to Grade R: Grade R-focussed teaching and learning strategies and structures.

2. Workbook support

This section includes:

a) Number concept activities for Term 1 and 2. Only Term 1 is included at present.

Sample "What do you notice?" posters and picture cards are included in the middle of this guide for you to remove and use.

b) Written prompts and teaching strategies for teachers on key pages of Workbook 00 and 0 (Term 3 and 4). (Note: this section is under development and not included at present).

c) Additional information regarding the conceptual development of the Pattern, Space & Shape, Measurement and Data Handling content areas as well as activity suggestions.

3. Planning resources

a) Photocopiable planning tools (a one-page planning prompt with simple planning prompts).

b) Reflection question bank.

Using NumberSense in Grade R			
Year overview			
Term 1 Counting and Number concept activities and "What do you notice?" posters	Term 2 Activities and "What do you notice?" posters	Workbook 00 Notes	Workbook 0 Notes
Patterns Notes and Activities			
Space & Shape Notes and Activities			
Measurement Notes and Activities			
Data Handling Notes and Activities			
Planning prompts and question bank			

USING NUMBERSense IN GRADE R

The NumberSense Grade R workbooks are designed to inspire activities that are play-based and centred around concrete activities. There are only two workbooks as the intention is that teachers only start to use the workbooks in the second or third term of the year. Prior to that, the teacher can use the workbooks as a guide to creating meaningful mathematics activities, problems and situations. The workbooks therefore serve primarily as an activity guide and do not replace concrete work that should be done with counters, beads and other manipulatives.

Curriculum mapping

		YEAR →			
		Term 1	Term 2	Term 3	Term 4
CAPS CONTENT AREAS	Number, Operations & Relationships Teacher Guide <ul style="list-style-type: none"> Teacher guided activities No NumberSense workbooks Only written component – practicing number formation 			Workbook 00 Number, Operations & Relationships <ul style="list-style-type: none"> Teacher guided activities that support concepts introduced in workbooks NumberSense Workbooks 00 and 0 	Workbook 0
	Pattern Teacher Guide <ul style="list-style-type: none"> Hands-on activities (Grade R Activity Kit, and general Grade R manipulatives) 			Teacher Guide Pattern Teacher Guide <ul style="list-style-type: none"> In Workbooks 00 and 0 	<ul style="list-style-type: none"> Continue hands-on activities
	Space and shape Teacher Guide <ul style="list-style-type: none"> Hands-on activities (Grade R Activity Kit resources, and general Grade R manipulatives) and activities suggested in the TG. Grade R Activity Kit According to each individual’s developmental trajectory 				
	Measurement Teacher Guide <ul style="list-style-type: none"> Activities suggested in TG Grade R Activity Kit 				
	Data handling Teacher Guide <ul style="list-style-type: none"> Activities suggested in TG Grade R Activity Kit 				

This diagram illustrates the NumberSense Mathematics Programme resources that will be available for the different areas of the CAPS Mathematics Content Areas and how these resources correspond to the different terms. Grade R is unique in that NumberSense does not promote the use of workbooks in the first one to two terms of the year. Grade R focuses more on hands-on concrete activities than the later grades. Many sections of the curriculum are best explored only at a concrete level.

NumberSense Mathematics Programme resources

Workbook 00 and 0

If and when children do begin working in the workbooks, it is imperative that the teacher mediates the activities. The activity in the workbook should only be done once a similar concrete activity has been done on the mat or in small groups. The workbooks thereby provide support and consolidation of play-based, concrete activities.

Children should not be expected to work independently in the workbooks; rather, the teacher should facilitate all the learning activities. The children should be encouraged to make sense of the situations and not simply be told how to fill in the page. This is achieved through reflective questioning. Children should be asked to explain their answers, describe any patterns they have observed, and ask questions of their own.

The pages should be done in sequence as each page builds on the previous pages in a spiralled manner, introducing and reintroducing mathematical concepts, continually building on prior instruction.

Teachers should become comfortable knowing that some children may not 'get it' the first or even the second time. However, they can be confident that through further play with concrete apparatus and continued reflective questioning, the children will begin to develop confidence and a robust sense of number.

Due to the mediated nature of the Grade R workbook activities, it is not expected that the Grade R children work independently. The activities in Workbooks 00 and 0 may appear more complex in nature than those in the first half of Workbook 1. This is because in Workbook 1 the expectation is that the children complete the page independently.

The skills and knowledge underpinning the activities in each Grade R workbook are: rote counting, rational counting, reading and writing numbers, comparing quantities and solving problems in context. It is recommended that teachers pace the workbooks according to the developmental level of the children in the class, repeating activities as needed but also continuing with new activities. Teachers can do this with the confidence that the same mathematical concepts will be covered again and again.

Teacher Guide (under development)

The completed Teacher Guide will provide practical activity ideas and guidance to support the activities in Workbook 00 and 0 as outlined above. It will also contain activity ideas for Number, Operations and Relationships for Term 1 and 2, as well as activities ideas for the whole year for Pattern, Space and Shape, Measurement and Data Handling.

Grade R Activity Kit (under development)

The completed Grade R Activity Kit will contain Grade R appropriate activity cards to be used with materials such as Mosaic Puzzles, Attribute Blocks, Tangram Puzzles and connecting cubes.

Additional materials

It is expected that Grade R teachers will already have a collection of manipulatives and learning materials in their classrooms and there is no need for NumberSense to duplicate these materials.

These materials should include, but are not limited to:

- Counting manipulatives
- Blocks and construction toys
- Jigsaw puzzles
- Ice-cream sticks and/or match sticks
- Pegs and peg boards
- Beads
- Playdough
- 3D recyclable objects
- Sand and water play equipment
- Calendar resources
- Art resources (2D and 3D)

The use of these additional materials explains why the NumberSense Grade R Activity Kit does not overlap completely with the NumberSense Teacher Guide in the year overview diagram.

It is anticipated that Grade R children will require many more opportunities to practise number formation and writing than are presented in Workbook 00 and 0. Therefore, teachers will need to continue to use additional materials such as number tracing templates. (This is illustrated by the gap in overlap in Number, Operations and Relationships for Term 1 and 2).

The NumberSense Approach to Grade R

Conceptual understanding

Grade R teachers may notice as much as a four-year variation in the development of different skills amongst various children in their class. The aim is to accommodate for multiple levels of functioning, stimulating the children at the level they are at and gradually moving them through the levels to be age-appropriate by the end of Grade R. To do this, we have to be clear about what we want to achieve, where we are in the journey, where we are going (plan forwards) and where we have come from (plan backwards). Learning trajectories can help us to understand the specific developmental building blocks in different skill areas. Some learning trajectories will be included in the next sections about the mathematics content areas.

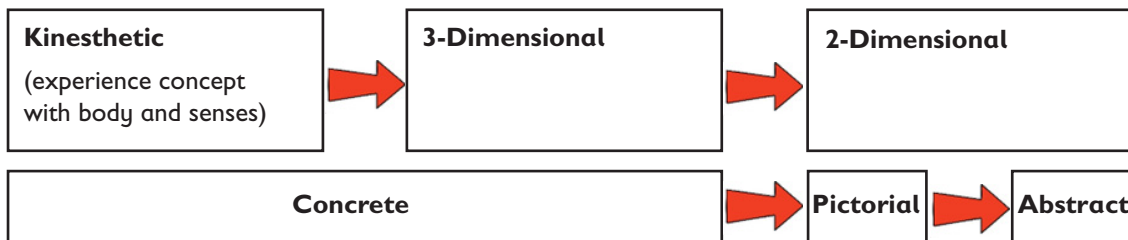
In Grade R, there should be a focus on the development of pre-mathematics skills such as:

- matching
- sorting
- comparing
- classifying
- ordering
- problem solving
- providing good reason
- communication
- making connections
- representation

These skills are heavily reliant on the individual child's development of underlying skills in:

- visual perception
- auditory perception
- language
- fine motor
- gross motor
- sensory processing

A solid early mathematical foundation is built by developing key concepts first through exposure to kinesthetic and concrete activities before moving onto pictures and eventually more abstract representations.



In Grade R, the NumberSense Mathematics Programme encourages teachers to make extensive use of hands-on, play-like activities to introduce mathematical concepts before introducing workbook activities.

Play, language and the role of the teacher

CAPS recommends that the approach to learning mathematics in Grade R should be based on the principles of integration and play-based learning. All classroom activities can be envisioned on a continuum according to where the locus of control lies between the child/children and adult or teacher.



A variety of activities at different points on this continuum are used to develop the Grade R child’s mathematical ability. Many concepts, particularly those in Pattern, Space and Shape, Measurement and Data Handling are more suited to being explored through play-based activities than formal adult-directed activities. This does not mean that mathematical concepts develop simply by allowing children lots of “free play”. The role of the Grade R teacher is to purposefully and proactively plan and mediate play-based learning experiences that will help the children develop age-appropriate mathematical concepts.

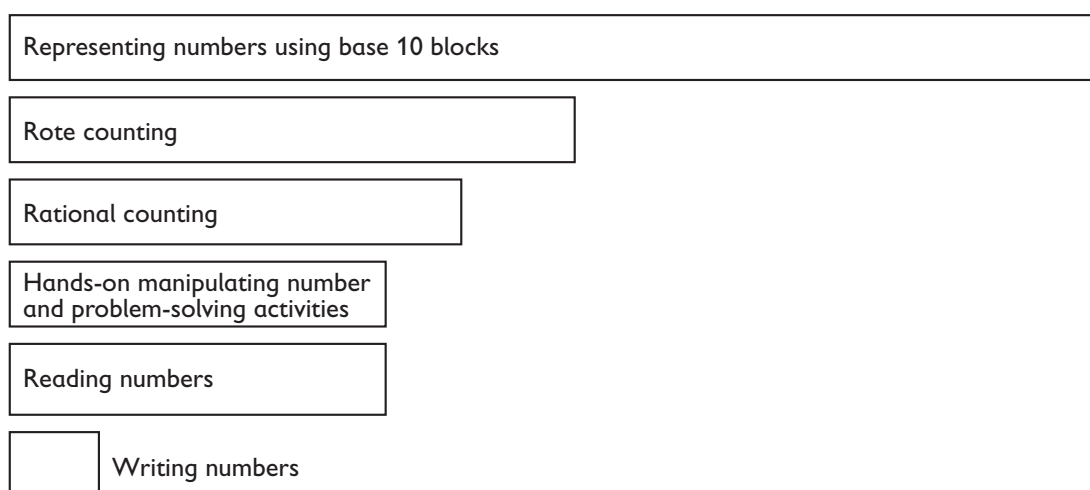
The role of the teacher

- Careful planning of activities according to learning trajectories, which may include less (closer to free play) or more structure, such as giving a challenge or task card.
- Asking questions to direct the children’s attention to specific mathematical concepts or to provoke certain types of thinking.
- Introducing the children to the correct terminology and expanding their expressive language.
- Engaging children in discussion that encourages problem solving and the explanation of their thinking.
- Allowing opportunities for reflection and mediating these thoughts to advance their thinking.

Refer to the Question Bank page 49 for ideas of questions to stimulate children’s thinking.

Number range

Young children benefit from exposure to visual representations of very large numbers to help develop their sense of number. Grade R teachers do not need to feel constrained to working within a number range that their children can write. Young children can represent and work with numbers at a higher range than they can write. Due to their developing visual-motor integration skills, a unique feature of Grade R children is that their ability to form number symbols on a page lags significantly behind their conceptualisation of numbers as represented by concrete objects and even by their ability to read number symbols.



A visual representation of how different number ranges can be used in different mathematical tasks.

Note that context-free problem solving does not appear on this diagram as this level of abstract mathematical thinking is not expected at a Grade R level.

Suggested pacing and focus areas for Numbers, Operations and Relationships in Grade R (Work in progress. First draft).

	Term 1 (suggested)	Term 2 (suggested)	Term 3 (Workbook 00)	Term 4 (Workbook 0)	CAPS (for the year)
Rote counting	Rote counting at least to 10	Rote counting at least to 20.	Rote counting to at least 30.	Rote counting to at least 50.	Rote count to 10 (forwards and backwards).
Object counting	Counts objects (in structured arrangements) to at least 5. Cardinality. Correct one-to-one correspondence.	Counts objects to at least 10. Starts to keep track of objects that have and haven't been counted.	Counting objects to 20. Keeps track of objects that have and haven't been counted.	Counting objects to 50. May start using grouping/skip counting strategies. Keeps track of objects that have and haven't been counted.	Count objects to 10.
Picture counting	Counting clear orderly pictures to at least 5. Cardinality. Correct one-to-one correspondence.	Counting pictures to at least 10. More visually complex pictures. Introduce counting different things on same picture.	Counting pictures to 20. Counting different things on the same picture. Optional counting in 2s/doubling. More complex pictures/figure-ground challenges. Strategies for keeping track of what has been counted.	Counting pictures to 50. Counting different things on the same picture. Optional counting in: • 10s and adding 1s • 2s/doubling • 5s Strategies for keeping track of what has been counted.	Not specified, assume 10.
Number symbol reading	Reading number symbols 1-5.	Reading number symbols 1-10.	Reading number symbols 1-20 (number range works up gradually). Count and circle number (up to p. 13).	Reading number symbols 1-50. (number range works up gradually).	1-10.
Number symbol writing	Fine motor, visual perceptual, visual motor integration and pencil control activities.	Start introducing number formation 1-5 with emphasis on correct formation.	Continue explicitly teaching number formation. Write numbers 1-20 (with copying support, number range works up gradually) Count and write numbers (from p.14). Trace numbers (up to p.28).	Continue explicitly teaching number formation. Count and write numbers. Write numbers 1-50 (with copying support).	Not required.

	Term 1 (suggested)	Term 2 (suggested)	Term 3 (Workbook 00)	Term 4 (Workbook 0)	CAPS (for the year)
Number ordering	Ordering quantities (dots) up to 5.	Ordering quantities (dots) to 6 and beyond. Ordering number symbols to at least 5.	Number ordering to 20. Fill in missing numbers to 20. (<i>Number range works up gradually</i>).	Write missing numbers to 50.	Not specified, assume 10.
Number name reading	None.	Start introducing number name reading (1-5).	Number name reading: • 1-5 (p.1-16) • 1-10 (p. 21 onwards)	Number name reading 1-10.	1-10 reading (no writing required).
Subitising	Perceptually subitise 1-5 (in different arrangements).	Perceptually subitise 1-5 (in different arrangements).	Conceptually subitise to at least 5.	Conceptually subitise to 7 (or more).	Not specified.
1 more/ 1 less	Introduce 1 more with objects and pictures.	Introduce 1 less with objects and pictures.	Draw 1 more picture (and write number from p.22). 1 less introduced on p.33.	Draw 1 more/less picture and write the number.	Which number comes before/ after/between.
Comparing collections	Compare by matching (less advanced) or counting up to 5 (more advanced) of similar sized objects. Identify more/less if differences between sets are clear.	Compare by matching (less advanced) or counting up to 10 (more advanced). Identify more/less.	Compare by counting up to 10. Identify more/less and can figure out how many more or less.	Compare sets accurately by counting (even when larger collection's objects are smaller) up to 10 and can figure out how many more or less.	Compare collections of objects.
Comparing numbers	Comparing numbers (1-5) by using concrete modelling. Exposure to ordinal numbers.	Comparing numbers (1-5) by using concrete modelling. Exposure to ordinal numbers.	Comparing numbers (1-10). Ordinal numbers.	Comparing numbers (1-10). Ordinal numbers.	Ordinal numbers (up to 6 th).
Producing numbers (pictures/ objects)	Counts out up to 5 objects when asked.	Counts out required number of objects (5-10).	Counts out required number of objects to 10. Draw pictures of quantities (up to 10).	Counts out required number of objects to at least 10.	

	Term 1 (suggested)	Term 2 (suggested)	Term 3 (Workbook 00)	Term 4 (Workbook 0)	CAPS (for the year)
Tables	No tables.	Start introducing tables.	Simple tables.	Simple tables.	
Problem-solving (addition and subtraction)	Add (join/combine) and subtract with totals up to 5 by “counting all” with objects in context.	Add (join/combine) and subtract with totals to at least 5 by “counting all” with objects in context. Starts to make one number into another number (“make it N”).	Add (join/combine) and subtract with totals up to 10 with pictures in context. Make one number into another number (“make it N”). Combining to 10 with pictures. Adding 1 more with pictures.	Combining to 10 with pictures in context. Make one number into another number (“make it N”). Finding missing addend. Adding 1 more or making 1 less with pictures.	Solve word problems in context and explain own solution to problems involving addition and subtraction with answers up to 10.
Problem-solving (multiplication/repeated addition and division/sharing)	Informal grouping and sharing.	Sharing problems using concrete modelling with up to 10 objects and up to 3 people. Counting legs/eyes/arms using concrete modelling and pictures.	Sharing problems using concrete modelling with up to 10 objects and up to 3 people. Sharing up to 10 objects between 2 bowls using pictures (starts on p.27). Grouping legs (hidden bodies).	Sharing problems using concrete modelling with up to 20 objects and up to 5 people. Sharing up to 10 objects between 2 bowls using pictures (starts on p.27). Doubling and halving using concrete modelling. Doubling and halving using pictures. Hidden parts leading to repeated addition (only once). Hidden parts leading to sharing – grouping legs.	Solve and explain solutions to word problems in context that involve equal sharing, grouping with whole numbers up to 10 and answers that may include remainders. (No multiplication or repeated addition).

NumberSense Resources for Pattern, Space and Shape, Measurement, and Data Handling in Grade R (First draft).

NumberSense Concepts and Resources		CAPS (for the year)
Patterns	<p>Grade R activity kit: Fix, duplicate, extend, describe colour and shape patterns: AB, AAB, ABC, AABC. (20 cards of different difficulty levels). To be included in the “What do you notice?” poster book.</p> <p>Concrete activities to be included in the Teacher Guide. To be included in the “What do you notice?” poster book.</p>	Copy and extend simple patterns using physical objects and drawings (e.g. using colours and shapes).
Space and shape – position and orientation	<p>Concrete activities to be included in the Teacher Guide. To be included in the “What do you notice?” poster book.</p>	Language of position: describe the position of one object in relation to another e.g. on top of, in front of, behind, left, right, up, down, next to. Position and directions: follow directions to move around the classroom.
Space and shape – 3D objects	<p>Concrete activities to be included in the Teacher Guide. To be included in the “What do you notice?” poster book.</p>	Recognise and name 3-D objects in the classroom <ul style="list-style-type: none"> • ball shapes, • box shapes. Describe, sort and compare 3-D objects in terms of: <ul style="list-style-type: none"> • size • colour, • objects that roll, • objects that slide.
Space and shape – 2D shapes	<p>Grade R activity kit: 40 cards of different difficulty levels. Included in the “What do you notice?” poster book.</p> <p>Workbook activities: Geometric pattern tracing Extending and copying geometric patterns Drawing shapes for 1 more/less tables Geometric pattern tracing Extending and copying geometric patterns Copying geometric patterns Make your own geometric pattern Drawing shapes for 1 more/less tables</p>	Recognise, identifies and names two-dimensional shapes in the classroom and in pictures.

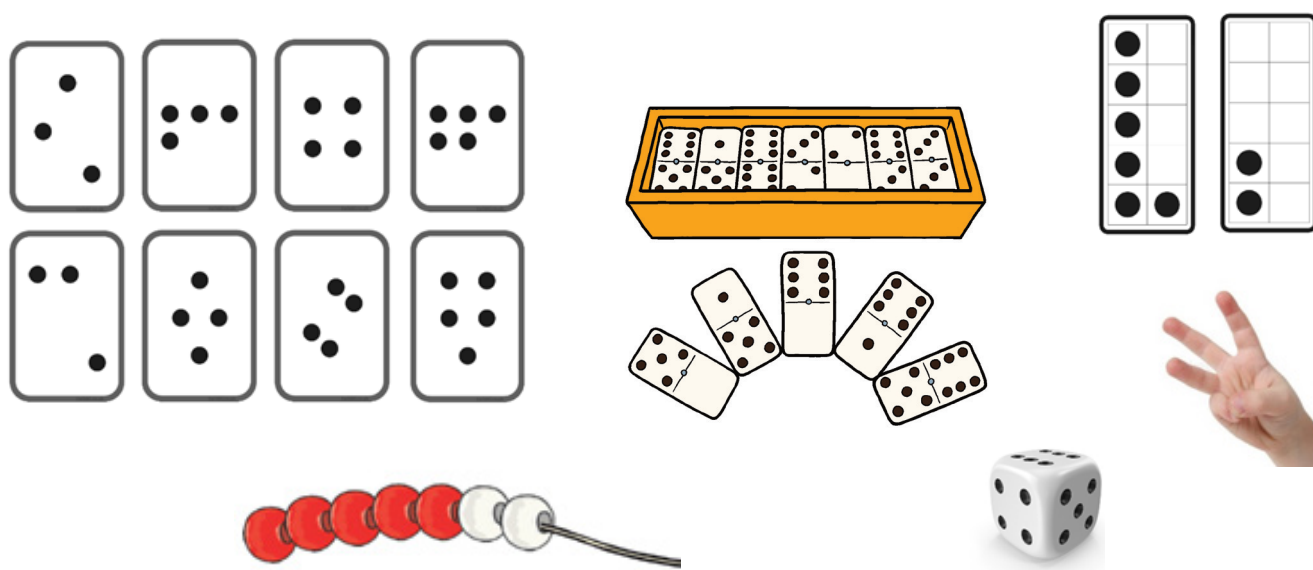
NumberSense Concepts and Resources		CAPS (for the year)
Space and shape - Symmetry	Body-based activities to be included in Teacher Guide . To be included in the “ What do you notice? ” poster book.	Recognise symmetry in own body
Measurement - Time	Concrete activities to be included in the Teacher Guide . To be included in the “ What do you notice? ” poster book.	Talk about the passing of time <ul style="list-style-type: none"> • Talk about things that happen during the day and things that happen during the night • Learners sequence events that happen to them during the day • Order regular events from their own lives Telling of time – not required
Measurement - Length	Concrete activities to be included in the Teacher Guide . To be included in the “ What do you notice? ” poster book.	Informal measuring Compare and order the length, height or width of two or more objects by placing them next to each other. Use language to talk about the comparison e.g. longer, shorter, taller, wider
Measurement - Mass	Concrete activities to be included in the Teacher Guide . To be included in the “ What do you notice? ” poster book.	Informal measuring Compare and order the mass of two or more objects by feeling them or using a balancing scale. Use language to talk about comparison e.g. light, heavy, lighter, heavier.
Measurement – Capacity/ Volume	Concrete activities to be included in the Teacher Guide . To be included in the “ What do you notice? ” poster book.	Informal measuring Compare and order the amount of liquid (volume) in two containers placed next to each other. Learners check by pouring into a third container if necessary. Compare and order the amount of liquid that two containers can hold if filled (capacity). Use language to talk about comparison e.g. more than, less than, full, empty.
Data handling	Concrete activities to be included in the Teacher Guide . To be included in the “ What do you notice? ” poster book.	Collect and organise objects: collect and sort everyday physical objects. Represent sorted collection of objects: draw a picture of collected objects. Discuss and report on sorted collection of objects Answer questions about: <ul style="list-style-type: none"> • How the collection was sorted • The drawing of the collection.

Counting and Number Concept

Subitising

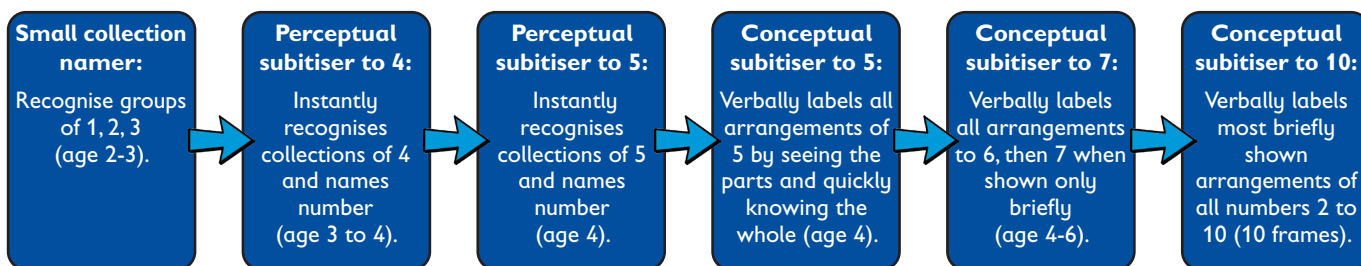
Subitising is the ability to instantly perceive and name the number of a group of pictures or objects without counting. Subitising introduces basic number concepts such as quantity, cardinality, “more” and “less,” parts and wholes and their relationships, and beginning arithmetic.

Subitising can take different forms, such as: dots (dice, dominoes), fingers, 10 frames and bead strings. People can also subitise auditory patterns as well as spatial patterns. Some formats are particularly helpful for numbers above 5, such as 10 frames and bead strings.



Teachers can inadvertently discourage the development of subitising by forcing children to count individual objects. For example, if playing a dice game and a child rolls a 3 and says “3” don’t force them to count each dot aloud. If you want to hear them count objects rather add one object and at time and ask them to count as you add.

This learning trajectory for subitising is helpful for understanding the stages of subitising development and illustrating how children move from **perceptual** to **conceptual** subitising as their understanding of numbers deepens and they begin to see groups of objects as composed of smaller parts rather than just as whole visual patterns.



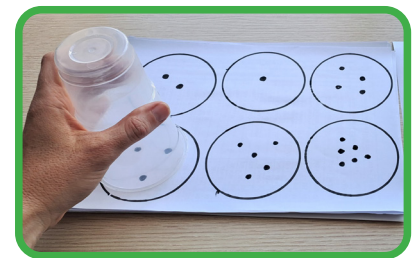
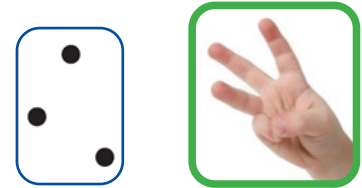
Extract from a **Learning Trajectory for Subitising**. Adapted from Clements & Sarama, 2021.

Subitising activity ideas

The following activities represent basic types of activity, that can be modified to fit into specific themes, or altered to provide further variety. Most of these activities don't require number symbol recognition.

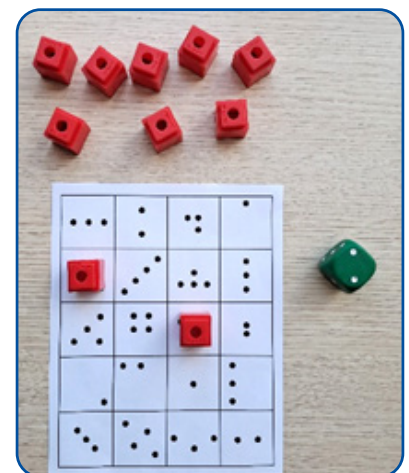
Flash and show

- You will need:
 - a set of A4 subitising cards
 - materials for the children to use to respond.
- This game can be played as a whole class or as a teacher-guided, small-group activity.
- The teacher warns the class that they need to pay attention because she is only going to show a picture for 1 second and they must try to take a photograph of it in their minds.
- After flashing the image, the children respond to indicate what they have seen. Some ideas for different responses:
 - show with fingers
 - cover the picture with a cup
 - lay out the correct number of blocks
 - make balls with playdough
- This activity also helps improve visual memory.



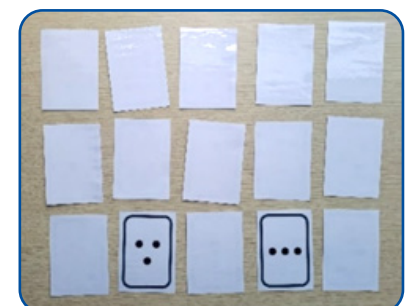
Roll and cover

- You will need:
 - 1 game card per player
 - Counters for each player
 - 1 die per player/pair/group (depends how much sharing you want to facilitate) (note: you may need to adapt your die to match the numbers used)
- Children roll the die and cover the corresponding picture with a counter.
- They can play until all the blocks are covered or until they get four in a row or all their counters are used.



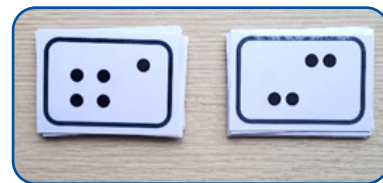
Memory game

- You will need:
 - a set (or two) of subitising cards which target the numbers you wish to practise per pair/group of children
- Children play in pairs or small groups
- They lay out all the cards face down in a grid array.
- They take turns to turn over two cards keeping them in the same place. If the cards have the same number of dots they get to keep them. If not, they must turn them face down again.
- Play until all the cards have been claimed. The winner is the person who made the most matches.



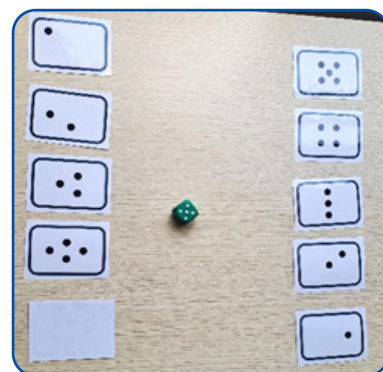
Snap

- You will need:
 - a set (or two) of subitising cards which target the numbers you wish to practise per pair of children.
- Children play in pairs.
- They divide the pack in two and try to coordinate turning the top card over at the same time.
- Children say 'snap' if the number of dots on the top cards of both piles is the same.



Roll and turn

- You will need:
 - four - six subitising cards per player
 - Counters for each player
 - 1 die per group (note: you may need to adapt your die to match the numbers used)
- This game can be played in pairs or small groups.
- Players take turns to roll the die and then turn over the matching card. If there is no matching card they do nothing until their next turn. The winner is the child who turns over all their cards first.



Throw the beanbag

- You will need:
 - bean bags
 - masking tape or chalk
- The teacher calls out a number and the children try to throw the beanbag onto the square with the correct number of dots.
- Or, children throw a die to determine which square they should throw to.



Play dominoes

- Teach children how to play dominoes.
- The traditional rules are:
 - Play with two - four children.
 - Shuffle the dominoes face down.
 - Each player picks up 7 for their hand.
 - Take turns adding tiles by matching a tile in your hand to an end of the line.
 - If you can't play, pick up one from the pile.
 - The winner is the first person to play all of the dominoes in their hand.



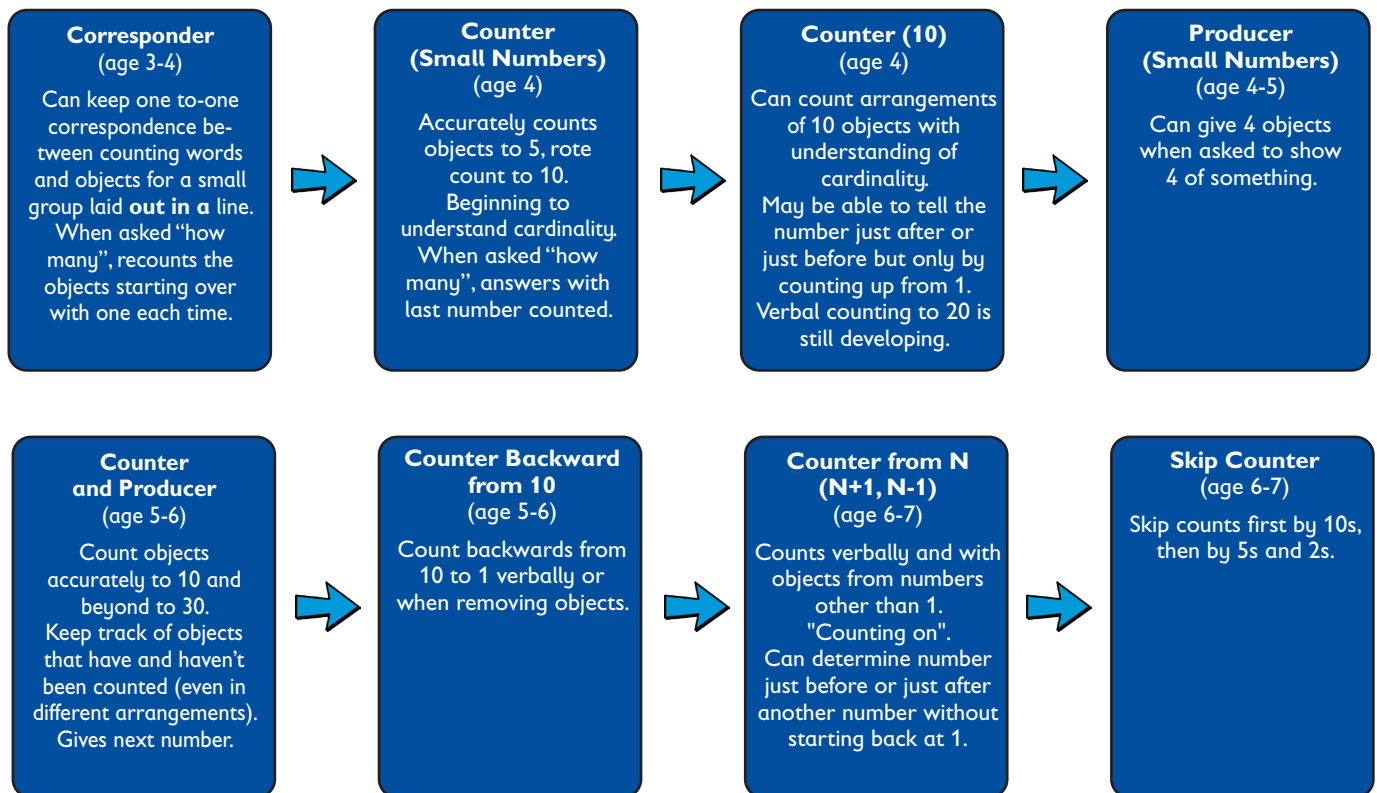
Play board games

- Teach children how to play basic board games using a die and counters.
- Giant game boards can be created outside using chalk. Instead of using counters, the children physically move themselves around the squares. Different movements such as jumping or hopping can also be incorporated.



Counting

This diagram illustrates the typical development of early counting skills and the approximate age they are usually observed with appropriate stimulation.



Extract from a **Learning Trajectory for Counting**. Adapted from Clements & Sarama, 2021.

Counting includes several different sub-skills. A few that are particularly relevant to Grade Rs are described below.

One-to-one correspondance

One-to-one correspondance refers to the ability to say number words in correspondance with objects and is often demonstrated by touching or pointing to objects while counting them. Children develop this ability in stages, first for small numbers up to 5, then to 10 and finally to 20 and beyond. They can usually count 5 objects with correct one-to-one correspondance around the age of 3 to 4. If children have difficulty with one-to-one correspondance (for counting four or five), they will need a lot more practice counting concrete objects. Concrete objects are more helpful than pictures because they can be physically manipulated and encourage exaggerated movements while counting aloud slowly might help.

Cardinality

The purpose of counting is to answer the question 'How many?'. While this might seem obvious to us, young children are often asked to count something without being given a reason (even if the reason is simply to know how many). After counting children are required to make a mental shift from focusing on individual objects in an order to seeing the 'how-many-ness' of the whole group. Cardinality is the understanding that the number of the last object counted represents the total number of objects in the group.

To check if a child has developed the concept of cardinality, ask them 'how many?' after they have

counted a group of objects. If they start counting again from one, cardinality is not yet developed.

Cardinality normally develops around age 4, so it is recommended that Grade R teachers check this concept in the beginning of the year and promote its development in any children who have not yet grasped the concept.

If a child shows understanding of cardinality for five objects, check if they also understand it for nine objects. If they do, no further practice is required.

The development of cardinality can be encouraged by:

- always posing a question that prompts a counting response (e.g. 'How many ducks are in the river?') instead of simply asking a child to count the ducks.
- Instead of touch counting objects in a line, reveal one object at a time as the child counts so that the child hears 'two' when seeing two objects.
- once counting is complete, gesture around the whole group and repeat the 'how many?' question.

Counting strategies

Children need to learn to count objects (and pictures) in different arrangements and to keep track of which objects they have and haven't counted in order to count accurately.

It is easier for children to count objects or pictures that they can move.

Strategies for movable objects/pictures:

- line up objects
- move objects as they count

Strategies for non-movable pictures:

- choose a clear starting point and direction
- use a pencil to cross them out/colour them in

Counting pictures

Counting pictures requires a higher level of abstraction and attention than counting real objects. Counting pictures is often more difficult than counting physical objects because:

- pictures lack physical interaction. Children show more difficulty keeping track of what's been counted.
- pictures are symbolic representations and not real objects. Representational thinking is required which adds to the cognitive load.
- pictures may lack visual organisation making it harder for children to distinguish and keep track of individual items.
- pictures require mastery of one-to-one correspondence and stable order which children might not be developmentally ready for.

Producing numbers

An instruction like 'Give me 5 apples' requires children to produce a collection of a given number, by counting out a group. Producing a set number of items is typically more difficult than counting a collection of items because children have to keep the target number in mind at all times and stop themselves when they reach it. You might see children continuing to count past the target number before they have mastered this skill.

Counting on

'Counting on' is the ability to start with a known quantity and continue counting without having to start from 1. It reflects a shift in thinking from counting each item from one to thinking of numbers as part of a sequence. It allows children to become more efficient in their counting and acts as a bridge between basic counting and more advanced addition methods.

Skip counting

In Workbooks 00 and 0, pictures to be counted are often presented in groups (e.g. legs on people, fingers on hands, rows of 10 objects) to encourage the concept of grouping while counting. Skip counting often develops around the age of 6 to 7 years, so some children might be ready for skip counting towards the end of the year. They can use this technique in the workbooks however, it is optional. Children who are not yet ready for skip counting can simply count in 1s (with a good strategy for keeping track).

Number symbol recognition (reading)

Children develop the ability to recognise number symbols gradually, through rich experiences that link symbols, spoken words and quantities. They need frequent practice seeing and using numbers in everyday context in order to develop automatic recognition of number symbols.

Counting activity ideas

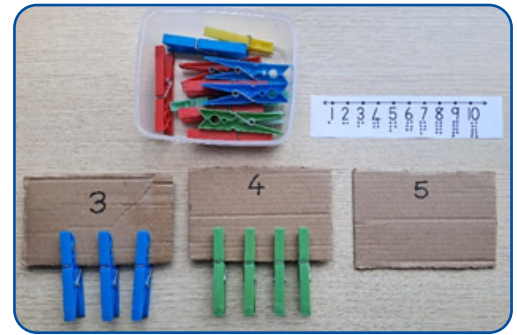
Counting and number recognition frequently occur together in the same activities. Activities that promote counting with less emphasis on number symbol recognition will be described first. The following activities represent basic types of activities, that can be modified to fit into specific themes or altered to provide variety.

<p>Simon Says (or Teacher says) Play the classic game but with every command involving a number e.g. "tap your head three times". Or, give commands that include a number of fingers on body part e.g. "put 4 fingers on your knee".</p>	<p>Counting songs and rhymes</p> <ul style="list-style-type: none"> • Use classic songs like <ul style="list-style-type: none"> - "Five Little Ducks" - "Ten in the Bed" - "One, Two, Three, Four, Five, Once I Caught a Fish Alive." • Act out the songs with toys or fingers so children connect the rhythm of number words to quantity changes.
<p>Counting pictures in stories During story time, pause and request that a child count specific items that are shown in the pictures.</p>	<p>Nature collections When outdoors, ask children to collect stones or sticks and then count them.</p>
<p>Counting everyday objects Encourage children to count meaningful real-world objects, e.g.</p> <ul style="list-style-type: none"> • 'How many children are at school today?' • 'How many windows are in our classroom?' • 'How many children are sitting at this table?' • 'How many pieces are there in the puzzle?' 	<p>Counting movements</p> <ul style="list-style-type: none"> • Combine counting with actions: <ul style="list-style-type: none"> - 'Let's jump five times!' - 'Clap three times!' - 'Take two giant steps.' • This builds coordination and connects counting to real experiences.

Counting and number symbol recognition activities

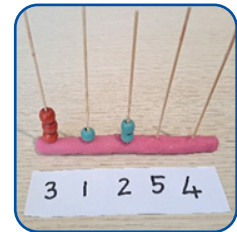
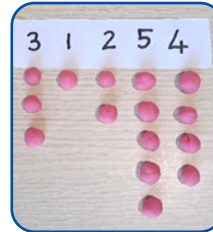
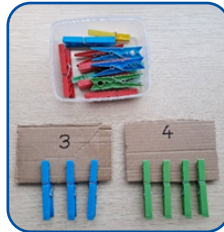
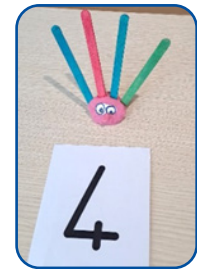
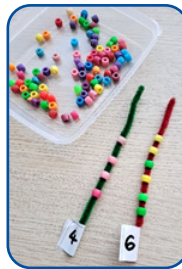
Tips for differentiating number symbol activities:

- for support, provide a number line or a number line with dots for even more support
- place numbers in order for more support, or out of order for more of a challenge.
- use lower or higher numbers according to your children's abilities.



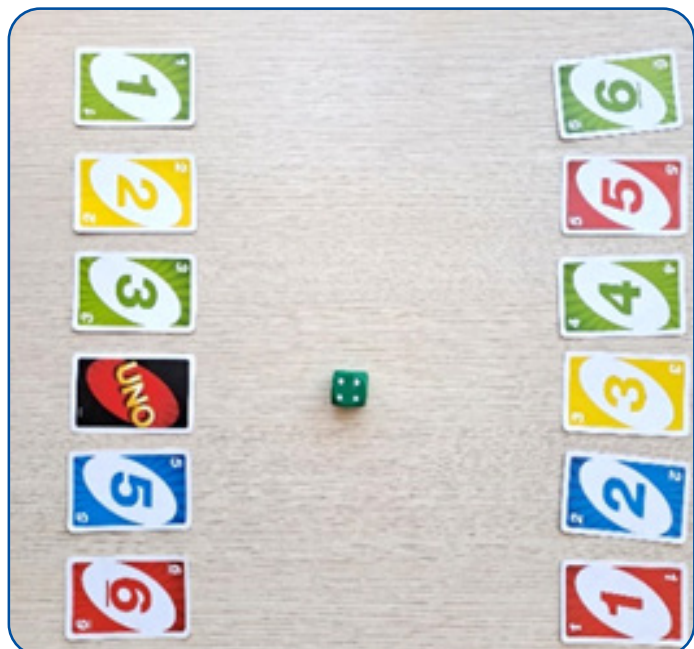
Building numbers with a fine-motor element

- Children read the number symbol and place the correct number of objects
- There are many different variations on this type of activity. Some ideas:
 - rolling playdough balls
 - beads on sticks in playdough
 - threading beads onto pipe cleaners
 - placing sticks into playdough
 - pegs on cardboard
 - building block towers
- Adaptations:
 - use theme-related materials
 - extension: higher number range
 - scaffolding: provide learners with a number line, or present number prompts in order.



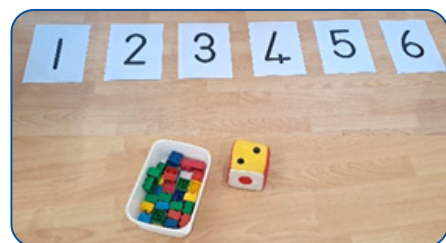
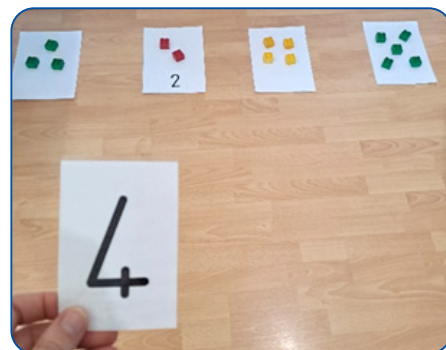
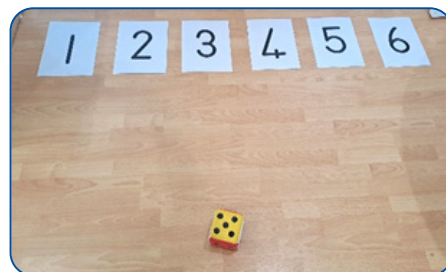
Roll and turn

- You will need:
 - 6 Uno/number cards per player
 - 1 die per group (note: you may need to adapt your die to match the numbers used).
- This game can be played in pairs or small groups.
- Each player must have the same number of cards and lay them out in a line.
- Players take turns to roll the die and then turn over the matching card. If there is no matching card they do nothing until their next turn. The winner is the child who turns over all their cards first.



Relay-type games

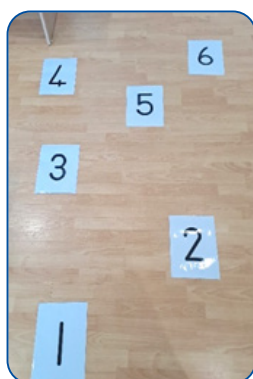
- These games can be played with the whole class or a small group.
- They will probably require teacher facilitation.
- Set up large number cards on the far side of the room.
- Children line up on the other side and can be divided into multiple lines.
- **Step 1:** Child/children at the front of the line are presented with a number. Some ideas:
 - child rolls a large die
 - teacher shows/gives a number card
 - teacher calls a number
- **Step 2:** Child/children move to the numbers on the other end of the classroom. Some ideas:
 - walk
 - run
 - hop, skip or do an animal walk
- **Step 3:** Child/children:
 - touch the corresponding number
 - place a number card on the corresponding number
 - place the correct number of objects on the corresponding number
- **Step 4:** Child/children rejoin the back of the line and it's the next child/children's turn.



Number order jumping

- You will need:
 - large number cards
- Attach number cards to the floor.


Children take turns to jump from one number to the next in the correct order.



Fill in the missing numbers

- You will need:
 - number manipulatives
 - number cards with missing numbers



 This activity is a good example of how to allow young children the opportunity to work with number symbols but not have to write them.

Producing numbers

Roll, run and count on

- Lay out numbers and blocks on one side of the classroom.
- The children wait at the other side.
- A child rolls the die, remembers the number rolled and runs to the other side of the room.
- He/she must count out the correct number of blocks and place them on the correct number symbol card.



Fetch the correct number

- Create a situation where a specific number of objects is needed, e.g. fill the egg box or each child in the group needs a glue stick. Child must work out how many will be needed.
- The child must remember the number needed and go to the relevant place and fetch the correct number of objects.
- The child returns and gives out the objects and sees if he/she is correct.



Shopping game

- Set up an imaginary play shop with multiple items of stock.
- Children pretend to come shopping and request a certain number of items, e.g. '5 apples, please'.
- The "shopkeeper" must then count out the correct amount.
- Alternatively, there could be no shopkeeper, and children are given a "shopping list" and must bring back the correct number.



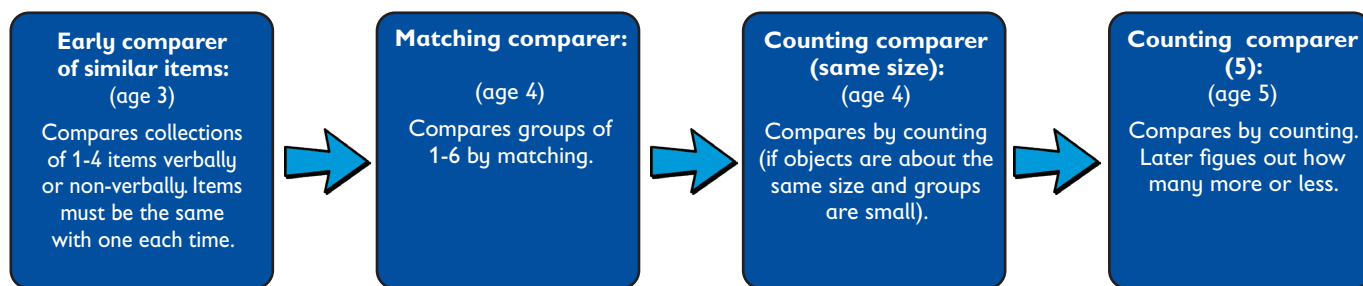
Make N

- This game can be played with the whole class or a small group.
- Give each child some small objects, e.g. buttons, counters, animals.
- The teacher, or selected child, chooses a number and all the children count out that number of small objects.

Comparing number

Comparing collections of objects

This diagram illustrates typical development for comparing collections of objects. The age norms are dependent on appropriate stimulation.



Extract from a **Learning Trajectory for Comparing Number**. Adapted from Clements & Sarama, 2021.

Reference:

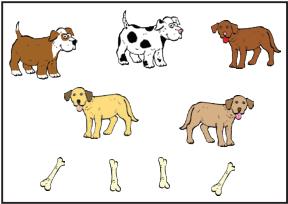

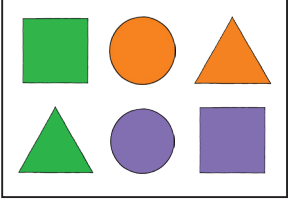
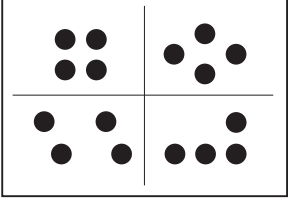

Clements, D. H., & Sarama, J. (2021). *Learning and teaching early math: The learning trajectories approach* (3rd ed.). Routledge. <https://www.routledge.com/Learning-and-Teaching-Early-Math-The-Learning-Trajectories-Approach/Clements-Sarama/p/book/9780367521974>

Introducing the "What do you notice?" posters

The "What do you notice?" posters are designed to help develop key concepts over the course of the Grade R year. They systemically cover important pre-mathematics and early mathematics concepts according to developmental trajectories. Each poster is designed to target specific skills and gives guidance on supporting learners who are 'behind', while extending others.

The posters can be used as whole-class activities or as small group teacher-led activities. Alternatively, they could be presented first to the whole class and then later in a differentiated way for each 'ability' group. Each poster consists of an image which provokes children to think carefully about what they are seeing. Prompt questions are provided to help the teacher guide the children's thinking. Children are encouraged to use reasoning and should be guided in developing their ability to communicate their thinking. Engaging with the posters will help prepare Grade R learners for the concepts they will encounter in Workbook 00 and 0 and in the early Grade 1 workbooks.

Eventually, each poster will also include activity suggestions for concrete activities that are inspired by the poster to explore different concepts further or to support or extend children. The following pages contain a sample of five posters with prompt questions and information about concepts targeted.

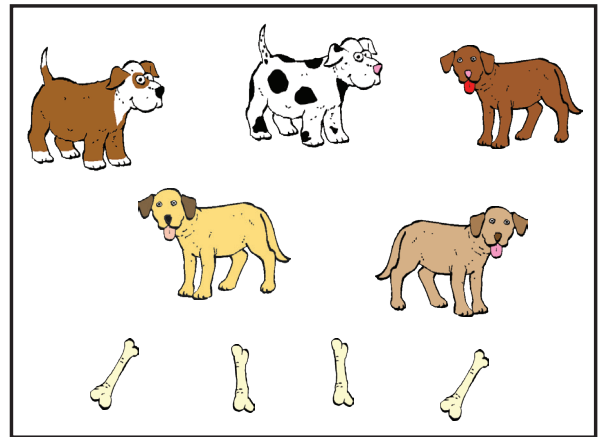
Poster		Concepts
Poster 1: Dogs and bones		One-to-one correspondence Counting pictures Cardinality Comparing collections
Poster 2: Two girls running		Reasoning Same and different
Poster 3: Sorting		Counting pictures Naming colours Naming shapes Sorting by colour or shape Shifting attributes
Poster 4: Subitising 4 dots		Perceptual subitising of 4 Introducing conceptual subitising
Poster 5: Sara and Fundi's balloons		Counting pictures Comparing collections Adding/combining/joining two pictures Make it N

Poster 1: Dogs and bones

What do you notice/see?

? Prompt questions

- How many dogs are there?
- How did you count them?
- How can we be sure we aren't making mistakes when we count them?
- How many bones are there?
- Are there enough bones for each dog?
- How do you know?
- Are there more dogs or more bones?



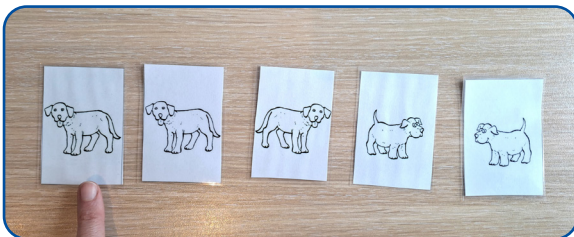
Key concepts

One-to-one correspondence

Check that children count with correct one-to-one correspondence. This is usually apparent around age 3-4 (for small numbers).



Children might need to count pictures/objects that can be manipulated.



? How many dogs are there?

? How many bones are there?

These questions prompt the children to count the dogs and bones.

The child counts five dogs and four bones. Children may touch the pictures as they count. Some children may be able to subitise these amounts and therefore there is no need to count. Do not force them to count if they have subitised correctly. You could prompt by asking:

? How did you know? and they might respond

💡 I just knew. or 💡 I can see.

← If children have difficulty with one-to-one correspondence (for counting four or five), they will need a lot more practice counting concrete objects. (See page 14 and 16 for more information).

Counting strategy

Children need a plan for keeping track of which items have been counted and which have not. It is easier for children to count objects or pictures that they can move.

Strategies for moveable objects/pictures:

- Line up objects.
- Move objects as they count.

Strategies for non-moveable pictures:

- Choose a clear starting point and direction.
- Use a pencil to cross them out/colour them in.

? How did you count them?

? How can we be sure we aren't making mistakes when we count?

💡 I can just see. (subitising)

💡 I can touch them as I count.

💡 I can move them as I count.

(if given manipulatives)

Counting pictures

Counting pictures requires a higher level of abstraction and attention than counting real objects because:

- Pictures can't be moved so it is more difficult to keep track of what's been counted.
- Pictures are symbolic representations which requires representational thinking and adds to the cognitive load.
- Pictures may lack visual organisation making it harder for children to distinguish and keep track of individual items.



How many dogs are there?



How many bones are there?



These questions prompt the children to count the dogs and bones.

Children may want to touch the pictures as they count them.



Children who are still developing mastery of one-to-one correspondence and stable order might not be developmentally ready for counting pictures. Give them lots more opportunities to count objects.

Cardinality (How many?)

Cardinality is the concept of understanding that the last number word said when counting represents how many items have been counted.

There is a stage of development where a child is able to count five objects but when asked "How many are there?" will not be able to answer without recounting.

Cardinality normally develops around age 4, so it is recommended that Grade R teachers check this concept in the beginning of the year and promote its development in any children who have not yet grasped the concept.

If a child shows understanding of cardinality for five objects, check if they also understand it for nine objects. If they do, no further practice is required.



How many dogs are there?



How many bones are there?



If a child counts without answering the question, repeat the question.



Five dogs, four bones.



If a child cannot answer the 'how many?' question, encourage the development of cardinality by:

- always posing a question that prompts a counting response.
- revealing one object at a time as the child counts so that the child hears 'two' when seeing two objects. This can be done in place of touch counting objects in a line.
- gesturing around the whole group and repeating the 'how many' question once the child has completed counting.



Notes

Comparing collections

There are different developmental stages to comparing collections:

- Initially children can only compare collections of the same object (approximately age 3).
- Then, they compare collections by matching (as in the picture) at approximately age 4.
- Then, they learn to compare using counting (also about age 4) but this is limited to items of similar size and small groups of up to 5.
- Next, they develop the ability to compare collections up to 5 even if the larger collection's objects are smaller.
- And then, this ability is extended to collections up to 10.

Encourage children to 'act out' the problem using manipulatives (as in the picture).

? Are there more dogs or bones?



There are more dogs than bones.



Five is more than four.



Are there enough bones for each dog to have one?



No



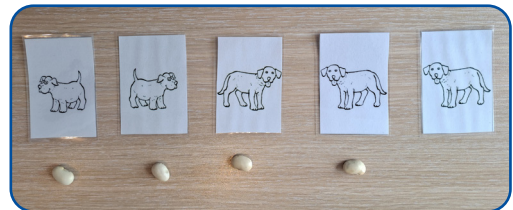
How do you know?



If I put one bone next to each dog (or draw a line from each bone to each dog), I can see there are not enough bones and one dog does not get a bone.



Five is bigger than four; the numbers are not the same.



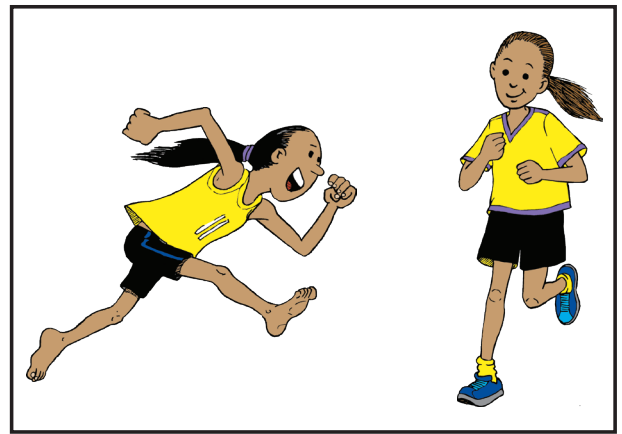
Notes

Poster 2: Two girls running

What do you notice/see?

? Prompt questions

- How many children do you see?
 - What is the same about both of them?
 - What is different between them?
- (It might help to give them names).



Key concepts

Similarities

? What is the same about both of them?



Encourage children to speak in full sentences.

Some possible formats are:

“They are both _____.”

“They both have _____.”

There are many things that children could say.



Here are a few ideas:

- They are both girls.
- They are both running.
- They are both wearing yellow tops and black shorts.
- They both have long hair tied in a ponytail.
- They both have two eyes/legs/feet/knees/etc.
- They both have one head/mouth/nose.
- They are both smiling.

Differences

? What is different between them?



It is helpful to give the girls names.

Ask the children to name each girl and write their name below each one on the poster.





Encourage children to speak in full sentences.

A possible format is:

“Their _____ is/are different.

‘A’ is _____ and ‘B’ is _____.”

There are many things that children could say. Here are a few ideas:

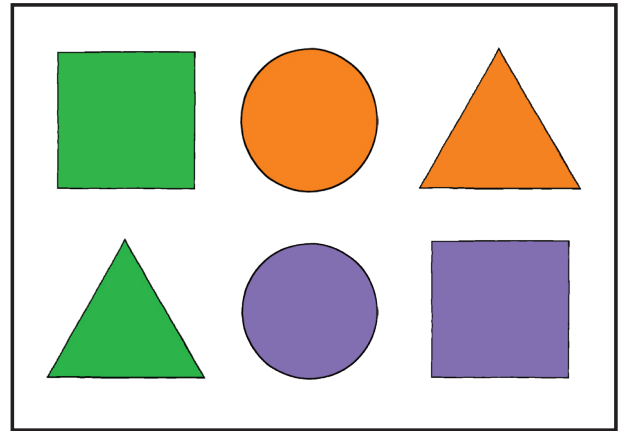
A 	B 
<p> ‘A’s hair is black. ‘A’s hair is longer than ‘B’s hair. ‘A’ is shown from the side. ‘A’ is running faster (because her legs are open wider, her head is down, her body is tilted forward and her arms are further out from her body). ‘A’ is barefoot. ‘A’ is wearing a vest with a number on it. ‘A’s mouth is open.</p>	<p> ‘B’s hair is brown. ‘B’s hair is shorter than ‘A’s hair. ‘B’ is shown from the front. ‘B’ is running slower (because her legs are closer together, her arms are closer to her body and her body is upright). ‘B’ is wearing shoes and socks. ‘B’ is wearing a T-shirt with purple edging. ‘B’s mouth is closed.</p>

Poster 3: Sorting

What do you notice/see?

? Prompt questions

- What do you see?
- How many shapes do you see?
- What shapes do you see?
- If we wanted to sort these items into groups, how could we do it?
- Is there another way?



Key concepts

Counting pictures

? How many shapes do you see?



6.

See Poster X and Y for more information about counting.

Naming colours

? What colours do you see?



Green, orange, purple



This question will give you an idea of the children's knowledge of colour names.

← If any children appear not to know the colours' names, you might want to create opportunities for more exposure in the classroom and possibly at home.

Naming shapes

? How many shapes do you see?



square, circle, triangle.



This question will give you an idea of the children's knowledge of shape names.

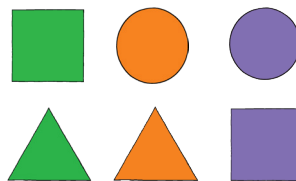
Naming shapes can be practised throughout the year whenever encountering shapes.

Naming colours

? If we wanted to sort these items into groups, how could we do it?



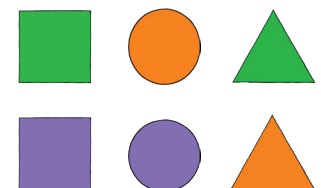
Children should be able to sort by one attribute. Ideally, use concrete manipulatives.



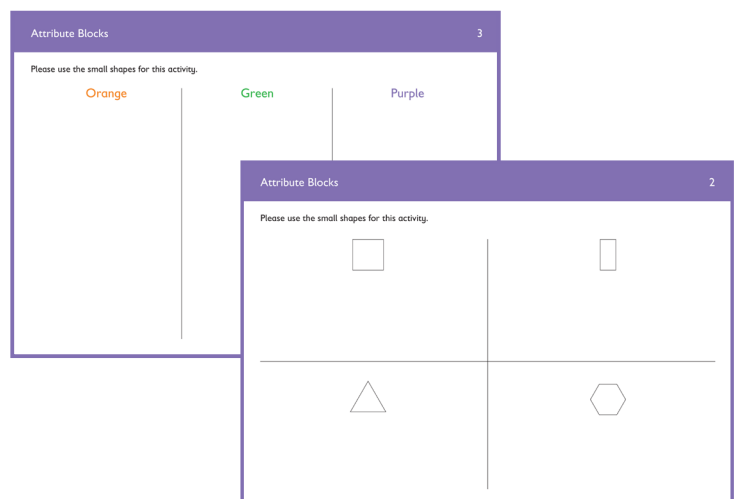
I can sort them like this.



I can sort them like this.



If children need more practice with sorting, the sorting mats from the new Grade R activity cards can be used.

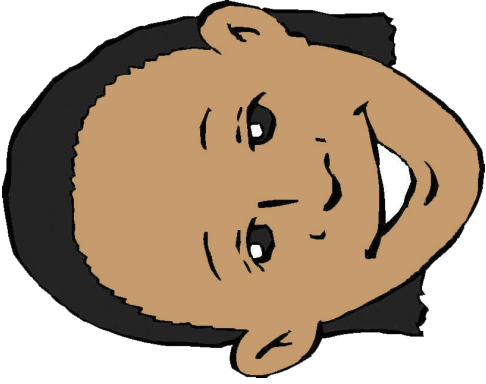




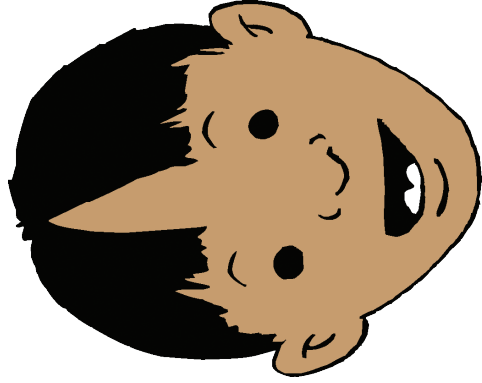
NumberSense
Mathematics Programme



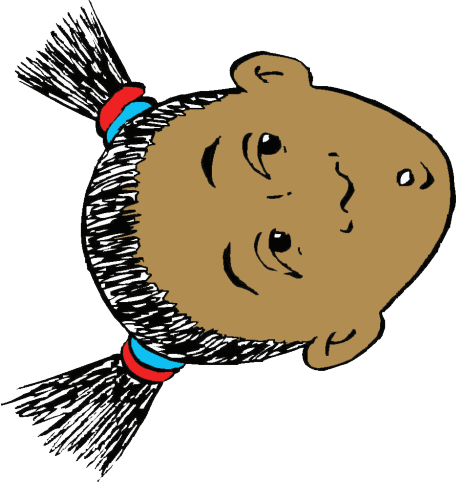
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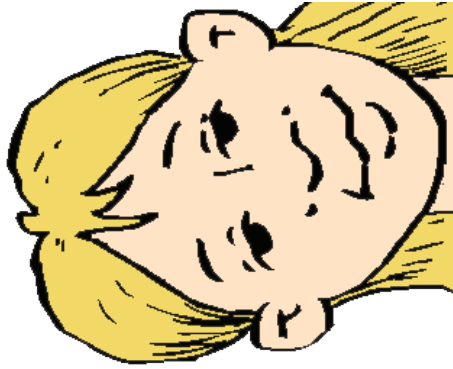
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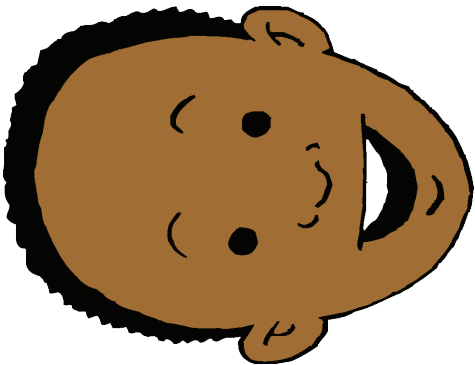
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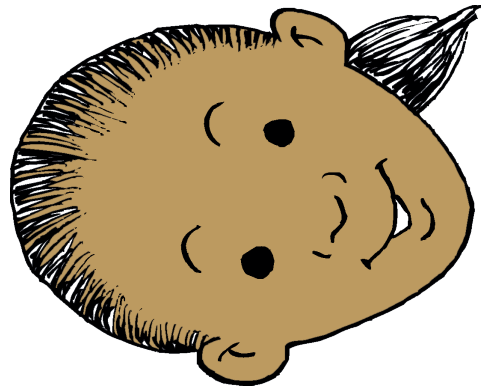
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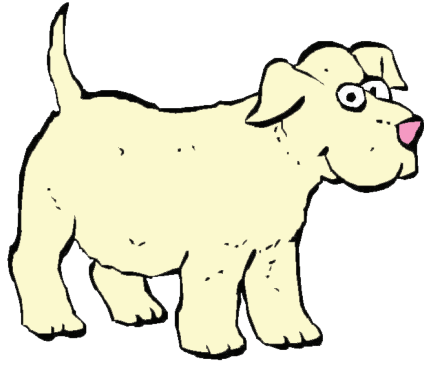
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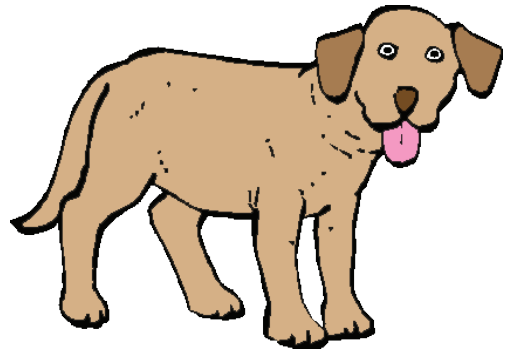
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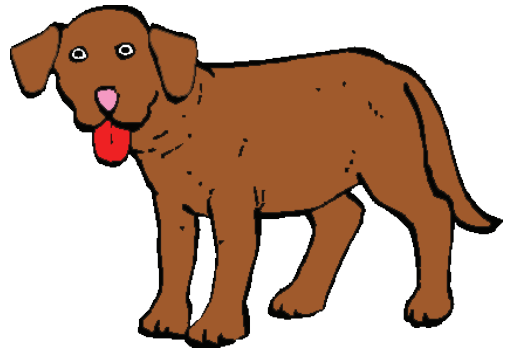
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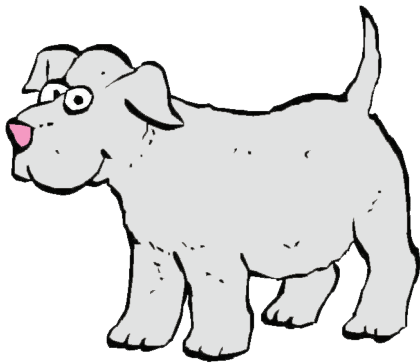
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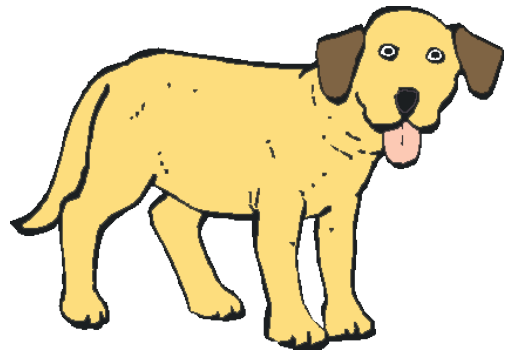
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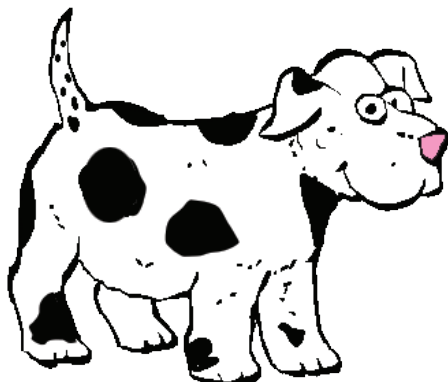
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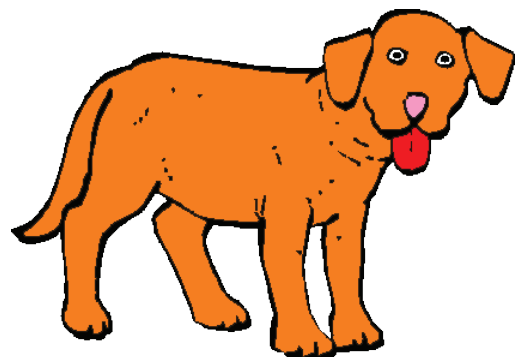
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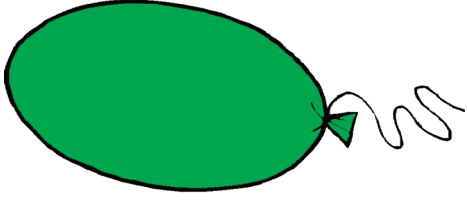
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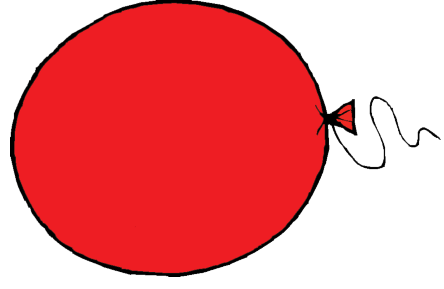
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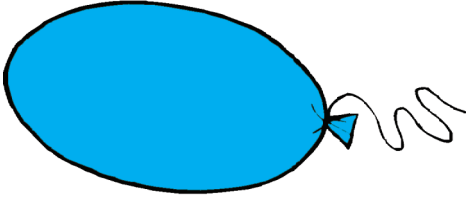
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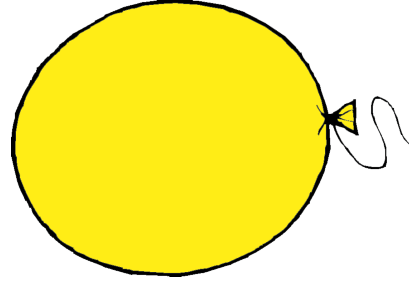
NumberSense
Mathematics Programme



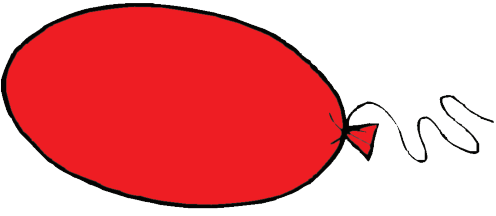
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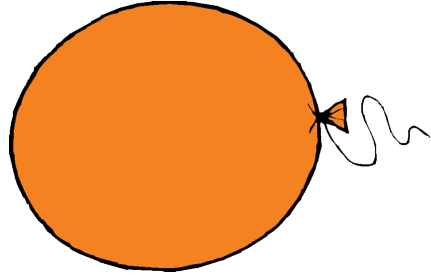
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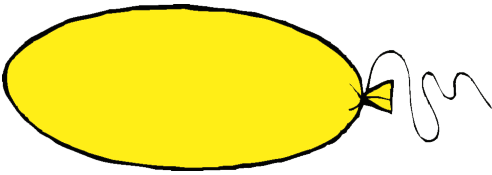
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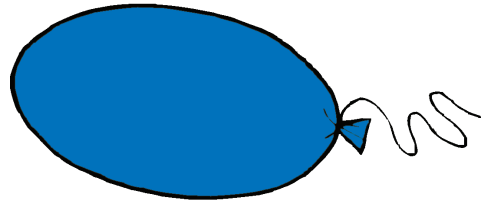
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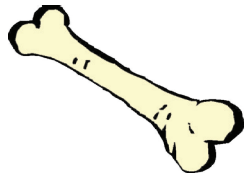
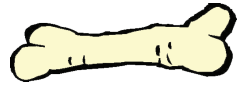
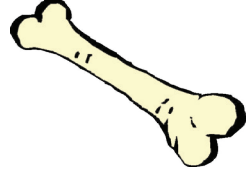
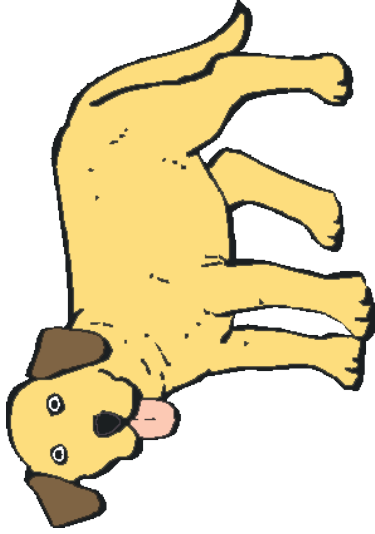
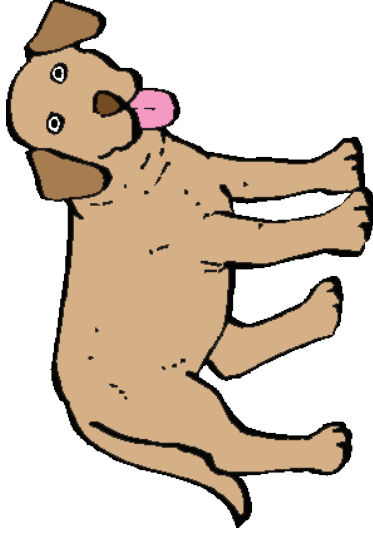
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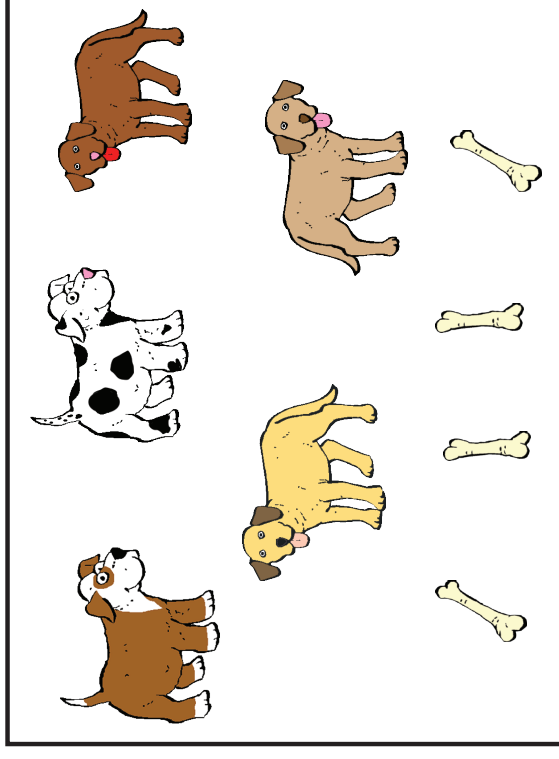
Poster 1: Dogs and bones

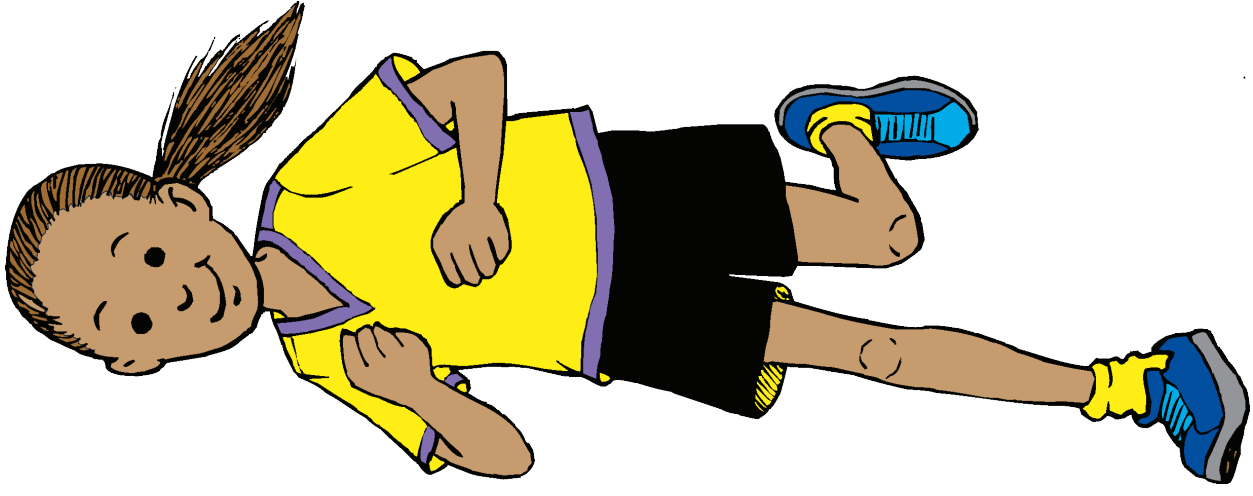
What do you notice/see?



Prompt questions

- How many dogs are there?
- How did you count them?
- How can we be sure we aren't making mistakes when we count them?
- How many bones are there?
- Are there enough bones for each dog?
- How do you know?
- Are there more dogs or more bones?





Poster 2: Two girls running

What do you notice/see?

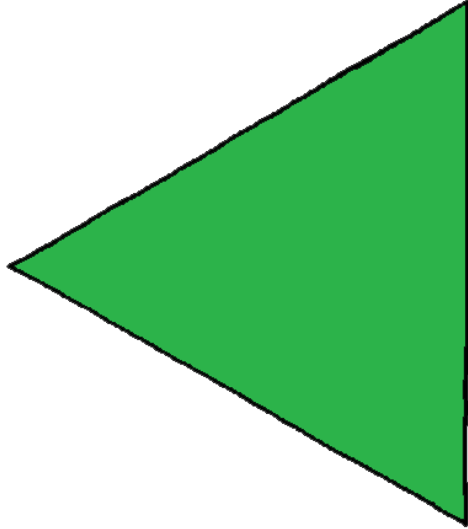
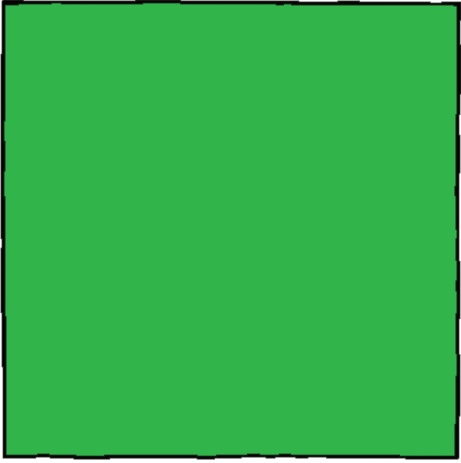
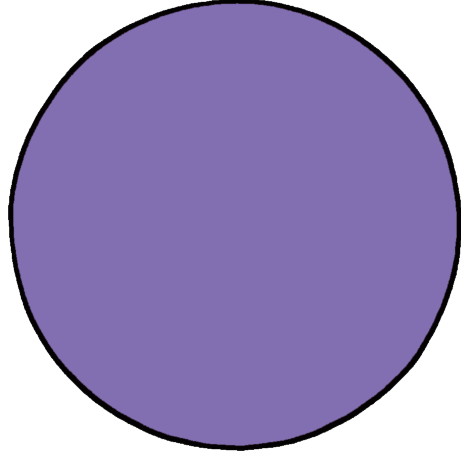
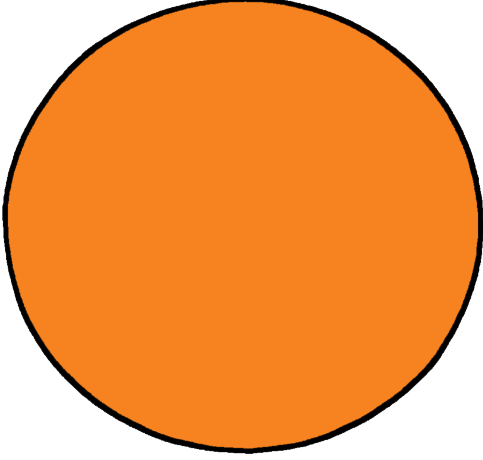
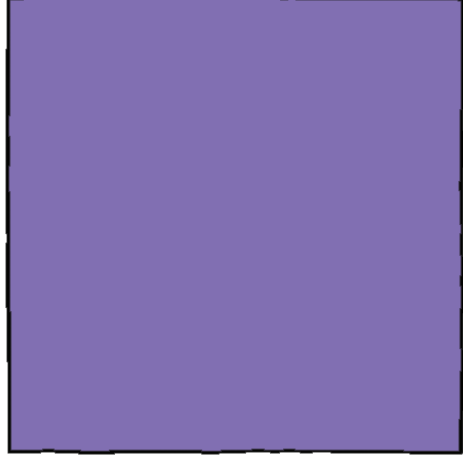
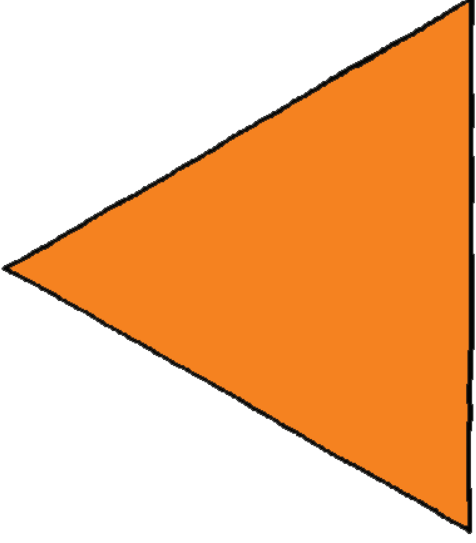


Prompt questions

- How many children do you see?
- What is the same about both of them?
- What is different between them?

(It might help to give them names).





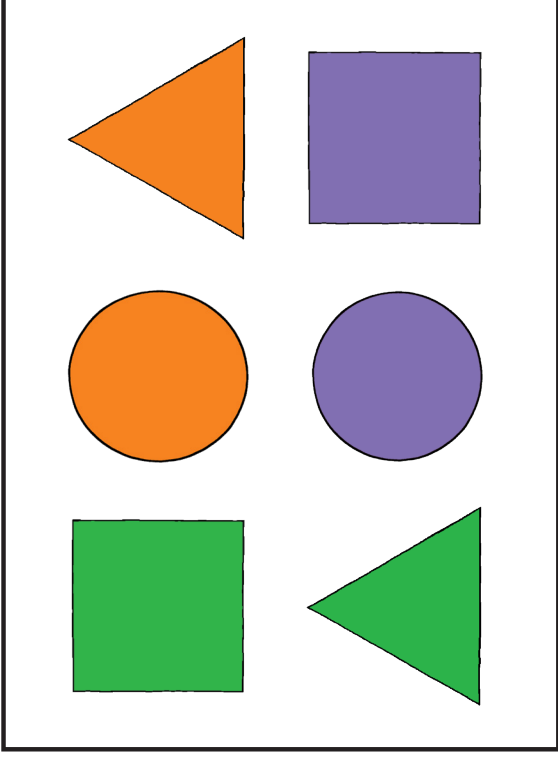
Poster 3: Sorting

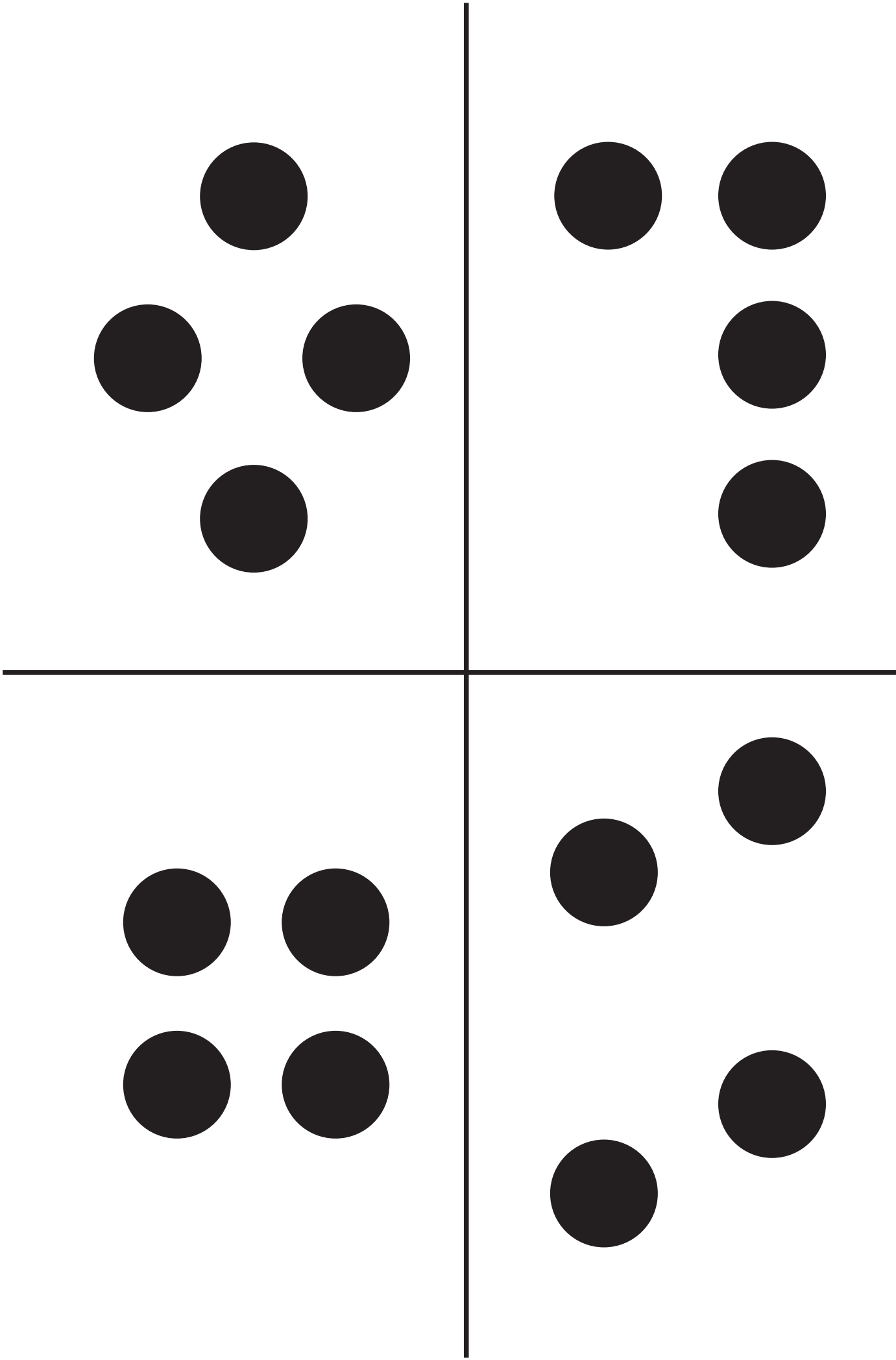
What do you notice/see?



Prompt questions

- What do you see?
- How many shapes do you see?
- What shapes do you see? What colours do you see?
- If we wanted to sort these items into groups, how could we do it?
- Is there another way?





Poster 4: Subitising four dots

What do you notice/see?

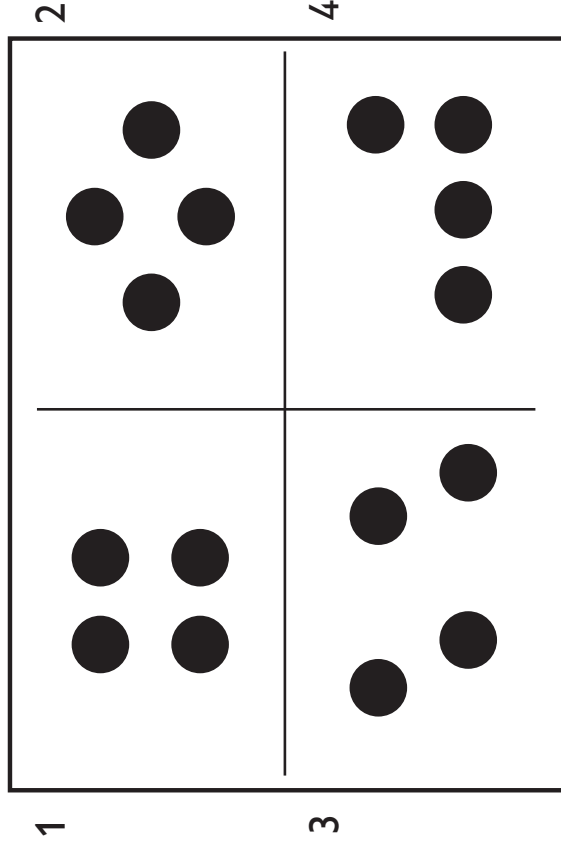


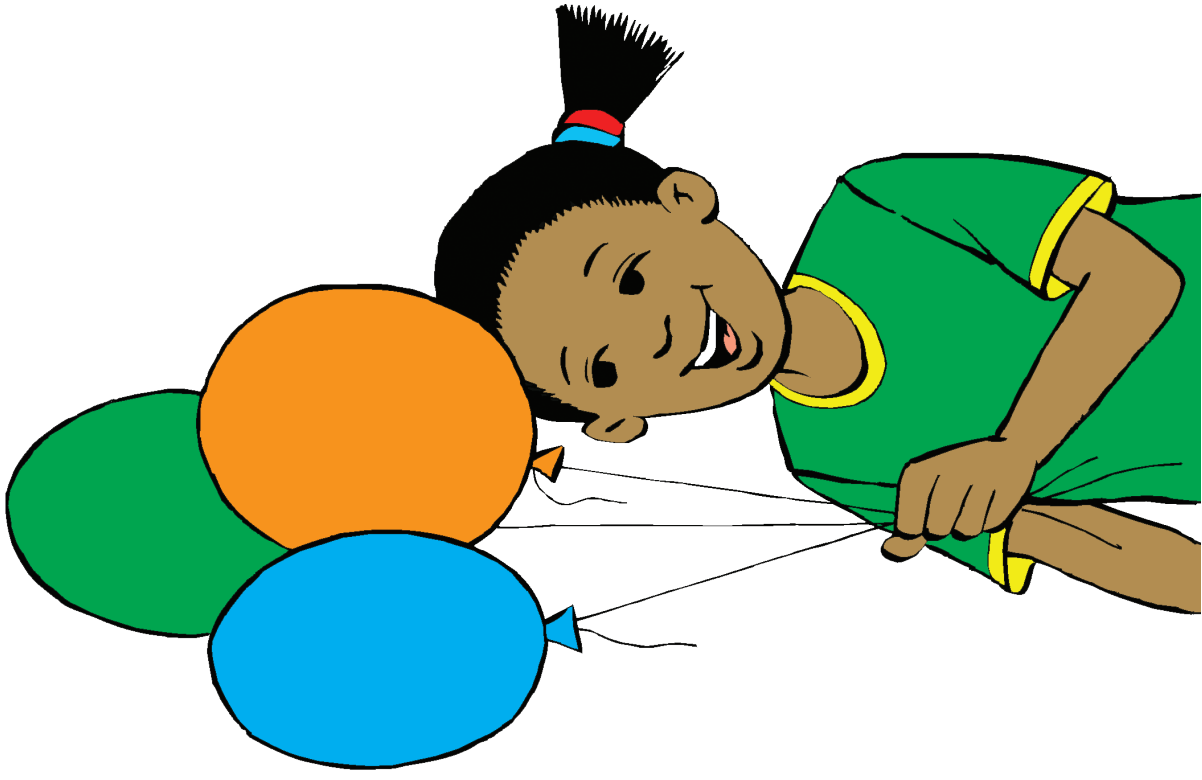
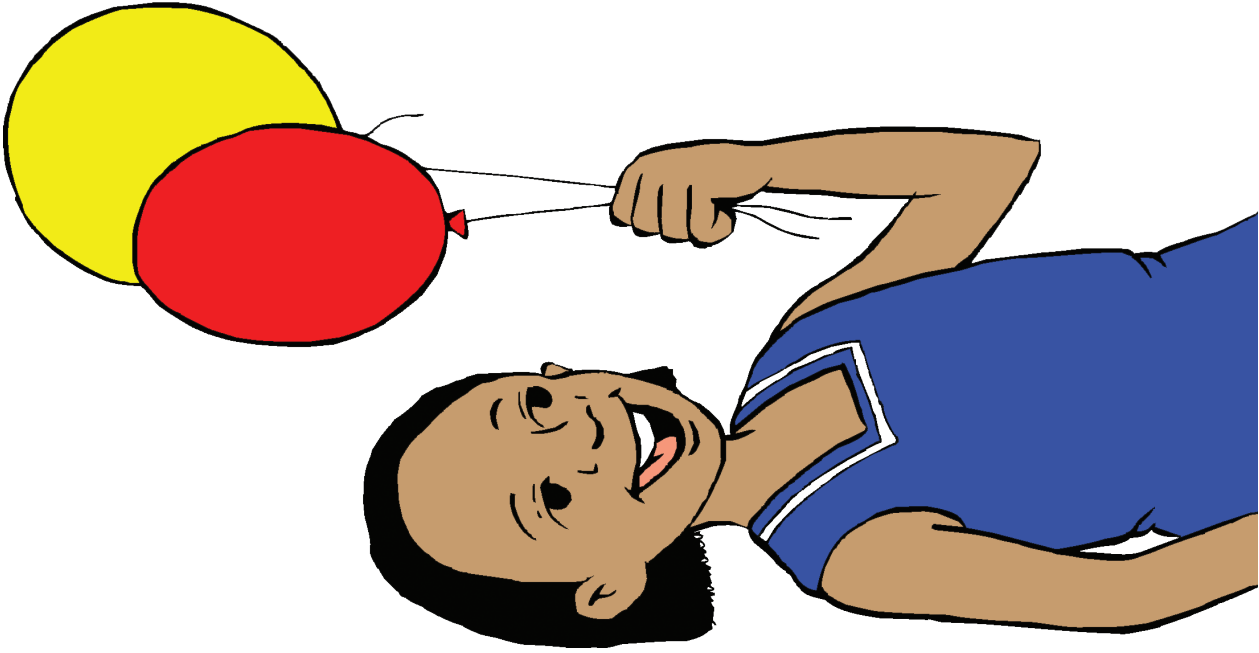
Prompt questions

Present each image one at a time (in the order shown by the numbers)

and ask all these questions for each:

- How many dots do you see?
- How do you know?
- Is there a different way to see them?





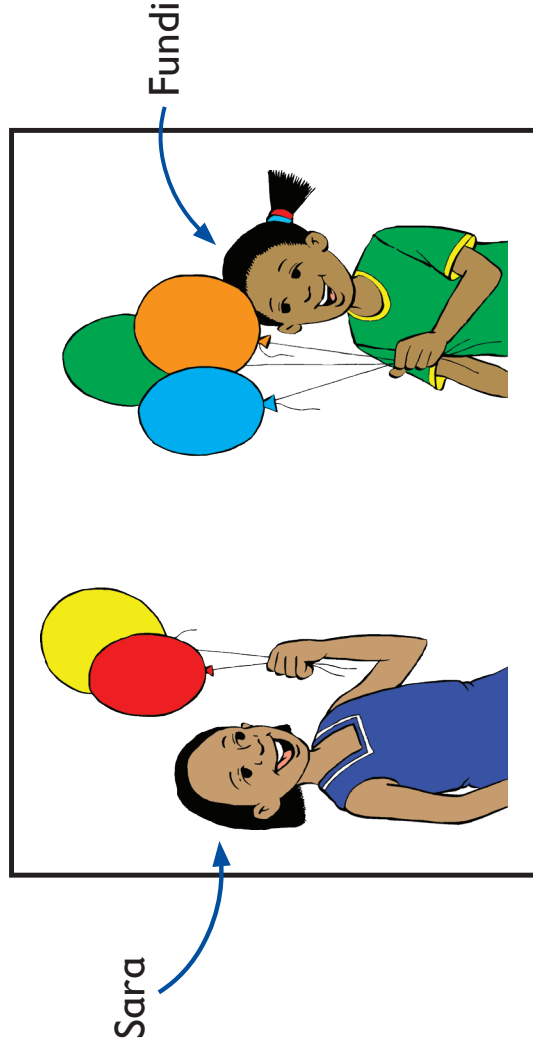
Poster 5: Sara and Fundi's balloons

What do you notice/see?



Prompt questions

- How many children do you see?
- How many balloons do they each have?
- How do you know?
- Who has the most?
- Who has the least?
- How do you know?
- How many balloons do they have altogether?
- How do you know?
- What can we do so that they both have the same number of balloons?
- Is there another way we can do it?



Shifting attributes



Is there another way we could sort them?

Yes. I can do this (move the shapes to show the other option).

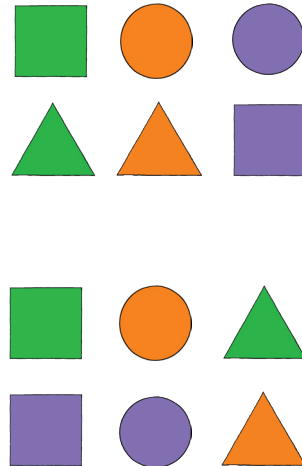


Children may be able to recognise that the same set of items can be sorted in more than one way. This ability usually develops around 4 years of age and requires children to:

- stop paying attention to the first attribute they chose to sort by
- demonstrate cognitive flexibility.



Watching other children performing this helps children to grasp the concept for themselves.



Notes

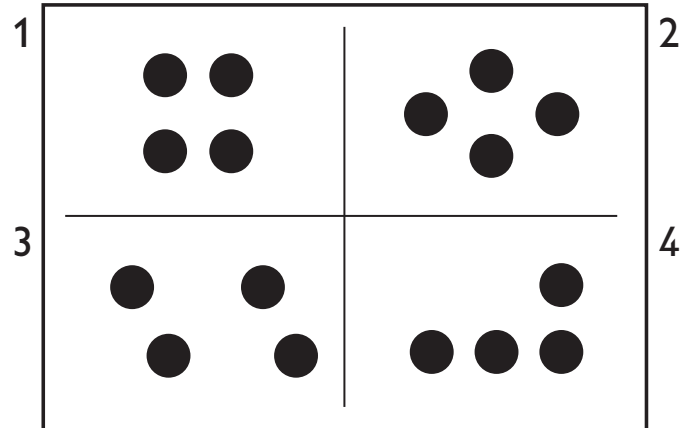
Poster 4: Subitising four dots

What do you notice/see?

? Prompt questions

Present each image one at a time (in the order shown by the numbers) and ask all these questions for each:

- How many dots do you see?
- How do you know?
- Is there a different way to see them?



Key concepts

Perceptual subitising

Subitising is the ability to instantly perceive and name the number of a group of pictures or objects without counting.

You may want to introduce this activity like this:

? I'm going to show you some dots for only one second. I want you to try take a photograph in your mind and then tell me how many dots there are without counting.

? How many dots do you see?

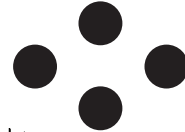
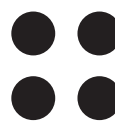
Children should be able to subitise four dots (usually develops at age 3 to 4), but some may need to count.

Do not force them to count if they have subitised correctly.

Four

? How do you know?

I just knew. or I can see.



It looks like four on a dice.

It looks like the other one but turned to the side.



The next stage of perceptual subitising is to subitize five dots in different arrangements.

← If this is too difficult for some children, they need to practice subitising one, two and three. (See page 12-13 for activities).

Conceptual subitising

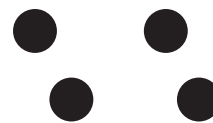
Conceptual subitising is the ability to identify a whole quantity as a result of composing smaller quantities (known through perceptual subitising) that make up a whole.

? How do you know how many dots there are?

? Is there a different way to see them?

Some children might not be able to answer questions that show understanding of conceptual subitising. They will benefit from listening to the other children's explanations. The next stage in conceptual subitising is subitising to five and then six and seven.

These are some responses you might get:



I saw two and two. I know that two and two makes four.



I saw three and one. I know that three and one makes four.

Poster 5: Sara and Fundi's balloons

What do you notice/see?

? Prompt questions

- How many children do you see?
- How many balloons do they each have?
- How do you know?
- Who has the most?
- Who has the least?
- How do you know?
- How many balloons do they have altogether?
- How do you know?
- What can we do so that they both have the same number of balloons?
- Is there another way we can do it?

Sara



Fundi

Key concepts

Counting pictures and counting strategy

? How many children do you see?

? How many balloons do they each have?



Some children might subitise these quantities, but some may need to count.

Do not force them to count if they have subitised correctly.



Two children.



Sara has two balloons.

Fundi has three balloons.

? How do you know?

If they subitised they might respond



I just knew.

or



I can see.

If they counted, they might demonstrate touch counting the pictures.



← If children have difficulty counting the pictures, try concrete modelling and see if they can count objects instead.

← If children have difficulty with one-to-one correspondence (for counting four or five) they will need a lot more practice counting concrete objects (See page 14 and 16 for more information).

← If children can count but have difficulty answering the question 'how many', they have not yet grasped cardinality (See page 14-15 for more information).

Comparing collections

? Who has the most?

Who has the least?

How do you know?



Fundi has the most balloons/more balloons.

Sara has the least/less balloons.



Three is bigger/more than two.



Children might be able to compare the two collections perceptually. Or they might use a matching or counting strategy.



← If children are having difficulty with comparing the pictures, try using concrete objects and lining them up so the difference can be seen more clearly.

Adding/combining/joining two collections

? How many balloons do they have altogether?

? How do you know?



Around the age of 4 to 5 children learn to add/combine/join two collections (of small numbers) by using concrete modelling and counting all the objects. You might want to set up the scenario with concrete objects.



There are 5 balloons altogether.



I put the counters in a line and counted them all.



Some children might demonstrate a 'counting on' strategy and count all the balloons in the picture, moving from Sara's two, directly to Fundi's three without pausing.



I just counted the balloons like this.

(touch counting).



Some children might use subitising. I can see 5 balloons.



← If a child has not grasped the concept of solving combine problems by using concrete modelling and counting all objects, they will have difficulty with the next concept: 'Make it N'. Keep practicing combine problems with concrete objects and in context.

Making it N

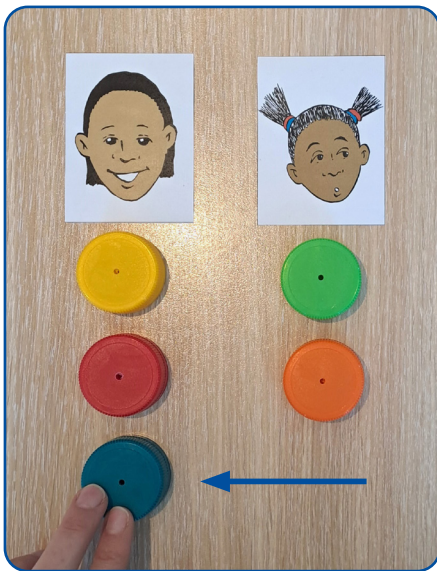


Once children grasp solving combine problems by direct modelling and counting all objects (as shown in the previous concept), the next stage of adding and subtracting is to make one number into another number.

? What can we do so that they both have the same number of balloons?



If Fundi gives one balloon to Sara, then Fundi will have two and Sara will have three and they still won't have the same.



If we give Sara one more balloon (without taking any from Fundi) then they will both have three.



Is there another way we can do it?



If we take one away from Fundi then they will both have two.



Notes



Notes

PATTERN

Overview

Studying patterns is at the heart of doing mathematics; in fact, mathematics can be described as the study of patterns.

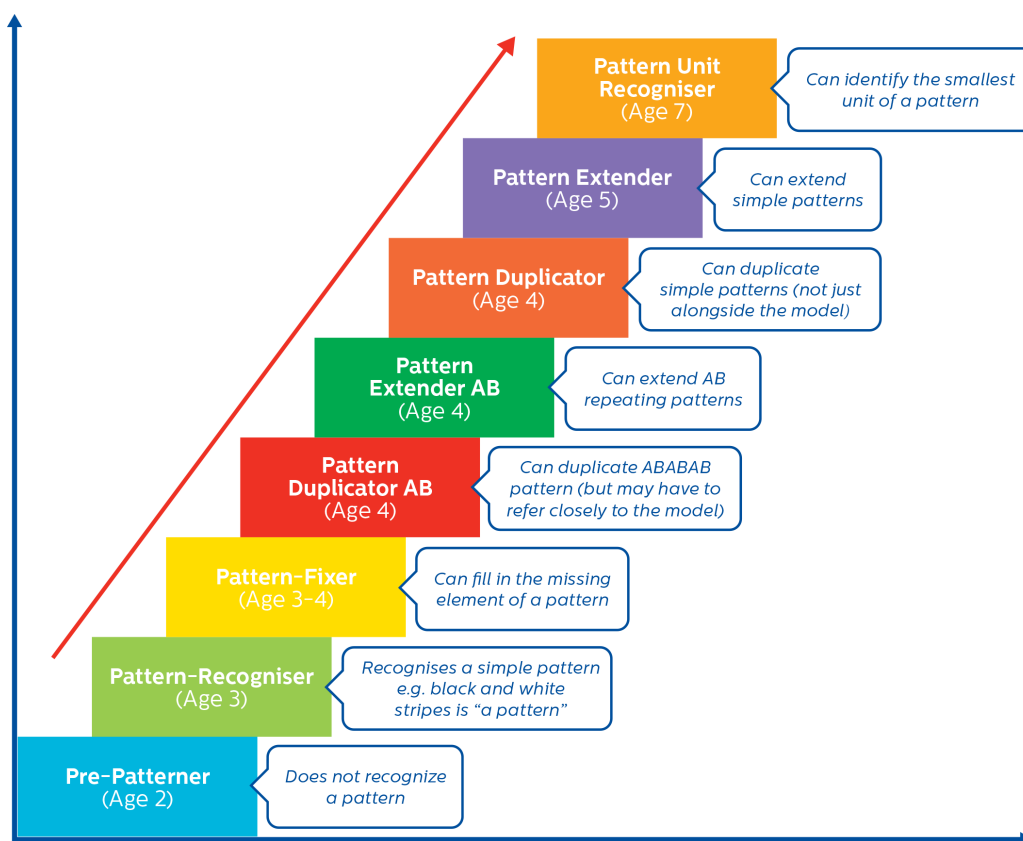
Patterns are relationships with some form of regularity or rule.

There is evidence that children's ability to recognise, describe and extend patterns is predictive of their future success in mathematics. If mathematics is indeed the study of patterns, then this should not be a surprise. However, the ability of children to recognise, describe and extend patterns can vary a great deal. For this reason, the study of patterns and patterning is a critical component of mathematics in the early years.

The challenge of school mathematics is not so much to 'teach patterns and patterning' as a topic, but rather, to make children aware of the regularity that is so much a part of their lives, to reflect on it and to develop the vocabulary with which to describe it.

Conceptual development

In the early primary years, we expect children to develop the ability to copy, describe and extend patterns in shapes, colours, numbers and other mathematical objects.



Developmental levels for patterning (adapted from Clements, Sarama & DiBiase, 2004)

The diagram depicts the developmental trajectory for the development of pattern that may be observed in Grade R children. The role of the teacher is to identify at which level a child might be at and to facilitate their progression through the levels to catch up with their chronological age.

Pattern activities in Grade R

- There are several pattern activities in Workbook 00 and a few in Workbook 0.

The aim of these pattern activities is to:

- facilitate a motor experience of pattern and to improve pencil control.
- create an awareness of pattern at a 2D pictorial level.
- allow opportunities to practise copying patterns, extending AB and AAB repeating patterns and create their own patterns.

Workbook 00 p. 1

Trace the waves

Workbook 00 p. 16

What comes next?

Workbook 0 p. 16

Trace the mouse's path.

Workbook 0 p. 39

Make them look the same.

Make your own.

- It is expected that most patterning activities will be hands-on using manipulatives such as beads, blocks, pom-poms and coloured sticks.
- Art activities also present opportunities for copying, extending and creating patterns.
- Grade R teachers can help children develop language and reasoning skills by encouraging them to describe the patterns they are making.

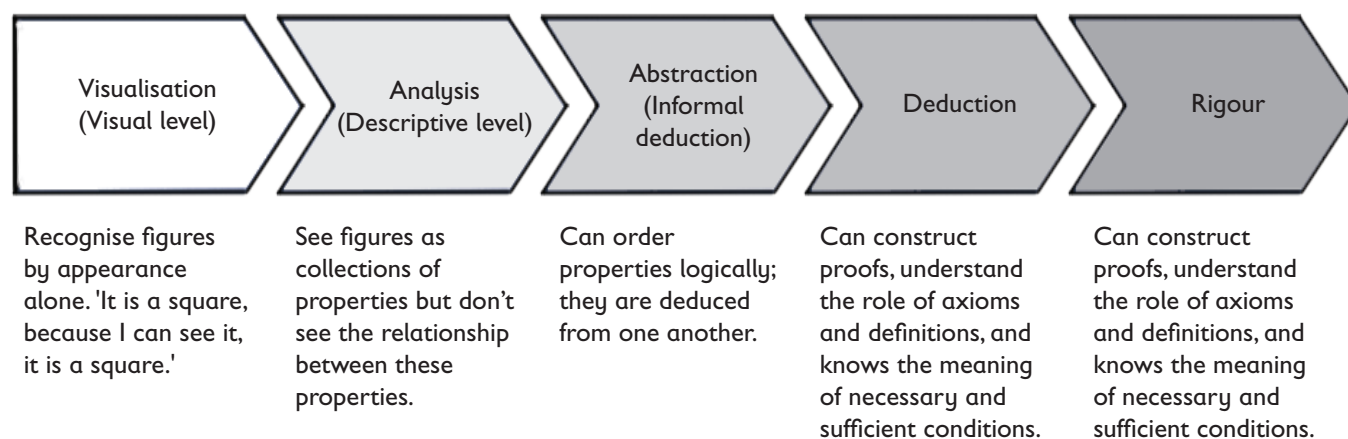
SPACE AND SHAPE

'Geometry begins with play.' - van Hiele, 1999

Conceptual development

The activities discussed below are informed by the research of Pierre van Hiele. According to van Hiele, there are five levels of geometric thought that are sequential and hierarchical. These include visualisation, description, abstraction, deduction and rigour (although it is unlikely that children in the early grades will move beyond the descriptive level). For children to function at any given level, they must have developed confidence at the preceding level. Progression from one level to another is largely based on instruction and experience rather than age or physical development.

Van Hiele's levels of geometric thought

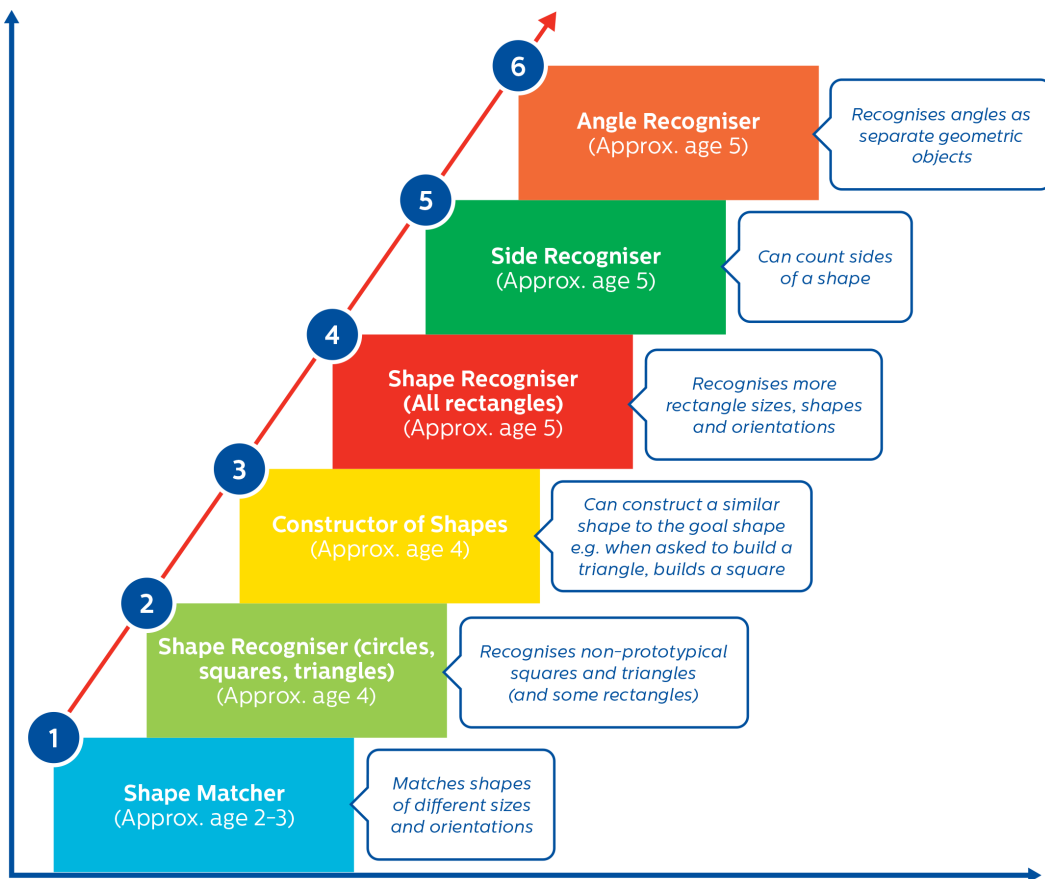


For a child at the visual level of geometric thinking, figures and shapes are identified in terms of what they 'look like'. If asked why a square is a square, a child will say that it is a square because it looks like one. However, if the square is tilted so that its sides appear to be at a 45° angle, then the child may not recognise the shape as a square, instead, they may call it a diamond.

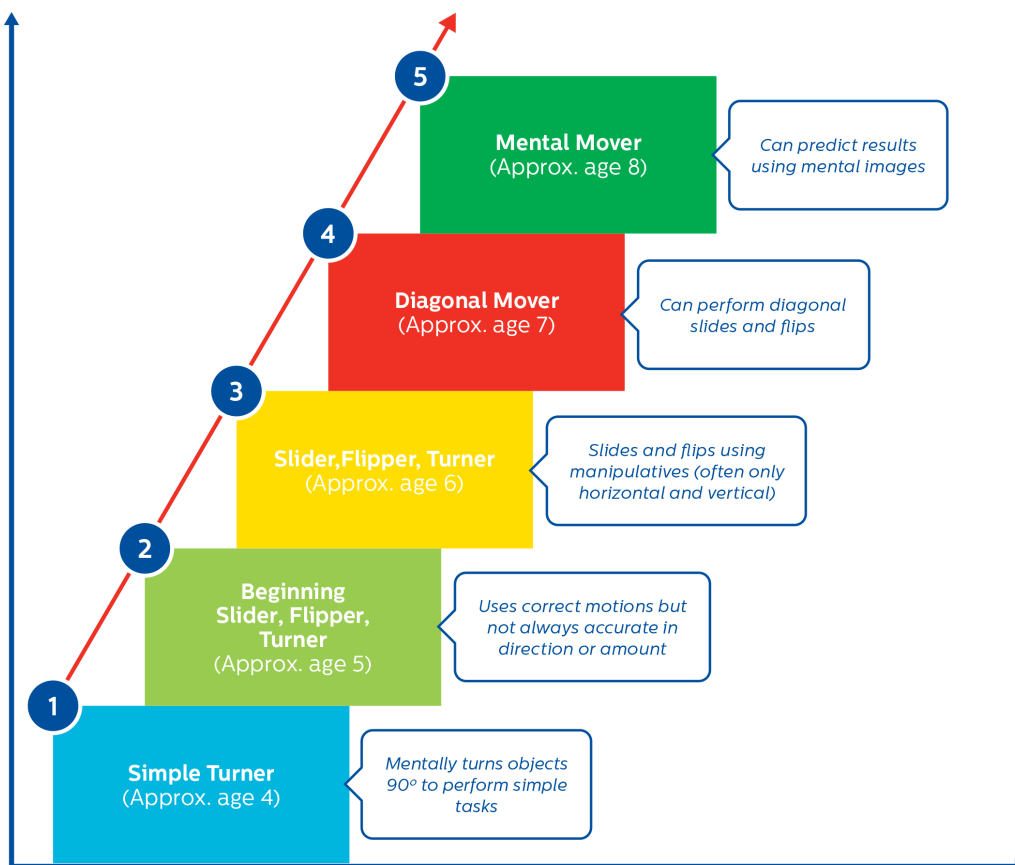
Teachers in the early grades typically work with children who are at the visual level of geometric thinking. The teacher's role is to create learning situations that develop the children's confidence in moving from the visual to the descriptive level of geometric thinking. Such learning situations can even lead to the informal deductive level.

The development of space and shape in Grade R

Consider the following extracts from learning trajectories for different aspects of Space and Shape that relate to levels of development that might be observed in the Grade R classroom. The aim is to accommodate for multiple levels of functioning, stimulating the children at the level they are at and gradually moving them through the levels in order to be age-appropriate by the end of Grade R.



Developmental levels for recognising shapes (adapted from Clements, Sarama & DiBiase, 2004)



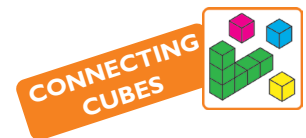
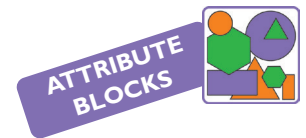
Developmental levels for spatial sense and motions (adapted from Clements, Sarama & DiBiase, 2004)

Space and Shape activities

Developing geometric thinking in the early grades is reliant on play with resources. Many Grade R classrooms use activity stations and it is envisioned that a Space and Shape station could be one of the daily stations. The NumberSense Activity Cards and resources have been developed to support the progression previously described.

The table below indicates a suggestion of the range of Activity Cards per resource that may be suitable for Grade R.

Grade	Mosaic puzzle	Tangram puzzle	Connecting cubes	Attribute blocks
Grade R	Guided play + Cards 1-4	Guided play + Cards 1-4	Guided play + Cards 1-2	Guided play + Cards 1-14



The NumberSense Grade R Activity Kit is under development and will contain a full set of Grade R-appropriate activity cards that utilise the existing manipulatives.

The role of the teacher in these activities might include:

- careful planning of tasks according to learning trajectories which may include less (closer to free-play) or more structure, such as a challenge or task cards.
- asking questions to direct the children's attention to the geometric qualities of a shape or to provoke certain types of thinking.
- introducing the children to the correct terminology and expanding their expressive language.
- engaging children in discussions that encourage problem solving and the explanation of their thinking.
- allowing opportunities for reflection and mediating these thoughts to advance their thinking.

Additional resources for hands-on Space and Shape activities

It is expected that Grade R teachers will already have a collection of manipulatives and learning materials in their classrooms and there is no need for NumberSense to duplicate these materials.

These materials included, but are not limited to:

- blocks and construction toys
- jigsaw puzzles
- ice-cream sticks and/or match sticks
- pegs and peg boards
- beads
- playdough
- 3D recyclable objects
- sand and water play equipment
- art resources (2D and 3D)

All of these materials are available locally from multiple sources. Activity cards can be sourced online, downloaded and printed to give direction to children's play and to support their progression to higher levels of geometric thinking.



Capacity, Length, Weight, Area

The development of an understanding of measurement follows a similar progression irrespective of the attribute (capacity, length, weight or area) being measured.

1. First, children must develop an awareness of the attribute. This is achieved through comparing, ordering and matching different objects with the attribute.
2. Next, children must learn to quantify the attribute accurately, using units which progress from non-standard and informal units, to more formal units.
3. Finally, the children must use standard units and perform calculations in measurement contexts.

Developing an awareness of attributes

To support children in developing an awareness of the different measurable and comparable attributes that an object has, early activities focus on children comparing objects by filling them in order to develop an awareness of capacity, using a balance to compare objects in terms of their weight, and comparing the lengths of objects by both direct comparison and using informal length units.

Quantifying attributes

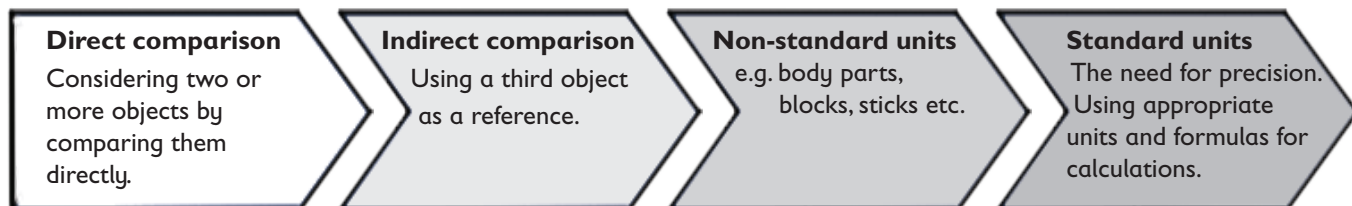
Objects can often be compared in terms of one or other attribute by means of direct comparison. This can be done by holding them next to each other or picking them up to feel which is heavier and which is lighter. As the difference in the attribute being compared becomes smaller, so it becomes harder to compare the objects by direct comparison and it helps to be able to quantify the attribute. Initially, this is done using informal units. Quantifying the attribute also helps to answer questions such as, 'How much more does the larger object hold?', 'How much heavier is the larger object?' or, 'How much longer is the larger object?'

The workbook activities (in later grades) are carefully structured to help children develop an awareness of how the choice of measuring units can impact on both the efficiency (ease) with which the attribute is measured and the precision of the measure. Throughout the activities, children should be encouraged to estimate before measuring. Initially, these estimates may be no more than guesses. Estimating helps the children develop a sense of the 'muchness' of the unit. Children should also reflect on the appropriateness of the units used to measure an attribute. For example, using a cup to determine the volume of a bucket is probably more sensible than using a tablespoon. The activities also support the development of the awareness that using non-standard units (e.g. hand spans, arm lengths and paces for length) creates difficulties and that there is value in using standardised units.

Using standard units and calculations

The value of using standardised units often follows from the experiences of different people using different informal and non-standard units to measure and compare the attributes of objects. However, children should also realise that the choice of standard unit is for the most part arbitrary and the metric system as we know it is no more than a widely-accepted convention to use specific units to measure certain attributes.

The activities in the workbooks (in later grades) provide the practical experience and opportunity for children to develop an understanding of measurement in a meaningful way. The progression of the activities has been deliberately planned so that, with the appropriate facilitation and guidance of the teacher, the activities reveal the mathematics in a meaningful way.

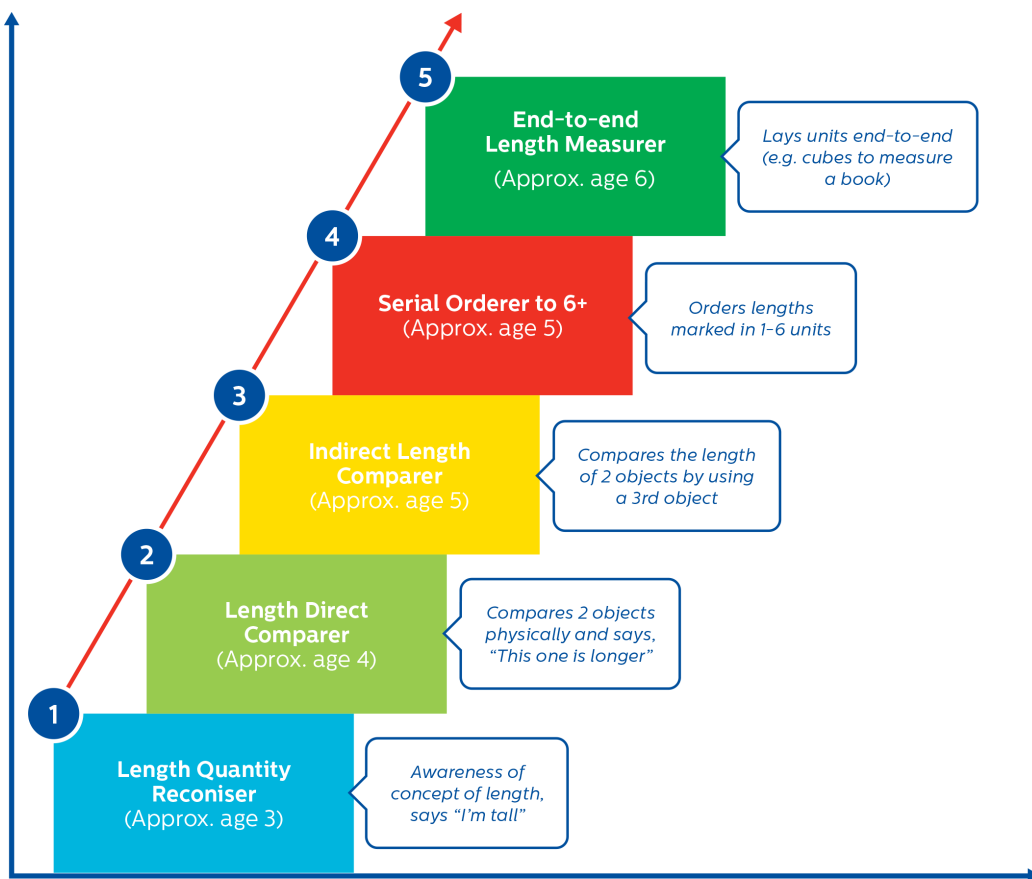


Measurement activities

The focus of the activities in the later workbooks is on the children gaining experience and confidence in filling, weighing and measuring a variety of containers or objects, using a variety of units. Through these practical activities, the children will experience measuring larger containers with smaller units, as well as measuring smaller containers with larger units.

Children should develop an awareness of the different measurable and comparable attributes (capacity, weight and length) that an object can have. They should also develop an awareness of the suitability of the measuring unit. Larger units are quicker but less accurate and not as suitable for smaller containers. However, smaller units are more time-consuming - especially as the size of the container increases - but more accurate.

Measurement in Grade R



Developmental levels for measuring (Adapted from Clements, Sarama & DiBiase, 2004)

*Sample trajectory for length

In making comparisons, the children should develop the awareness of the attribute that is being measured. They should also begin to notice that the tallest container may not necessarily hold or weigh the most and that the heaviest container may not be the tallest or hold the most etc.

The trajectory for length on page 28 provides a helpful developmental trajectory for measuring. Grade R children may be functioning at any of these five levels. The role of the teacher is to identify at which level a child might be at and to facilitate their progression through the levels to catch up with their chronological age.

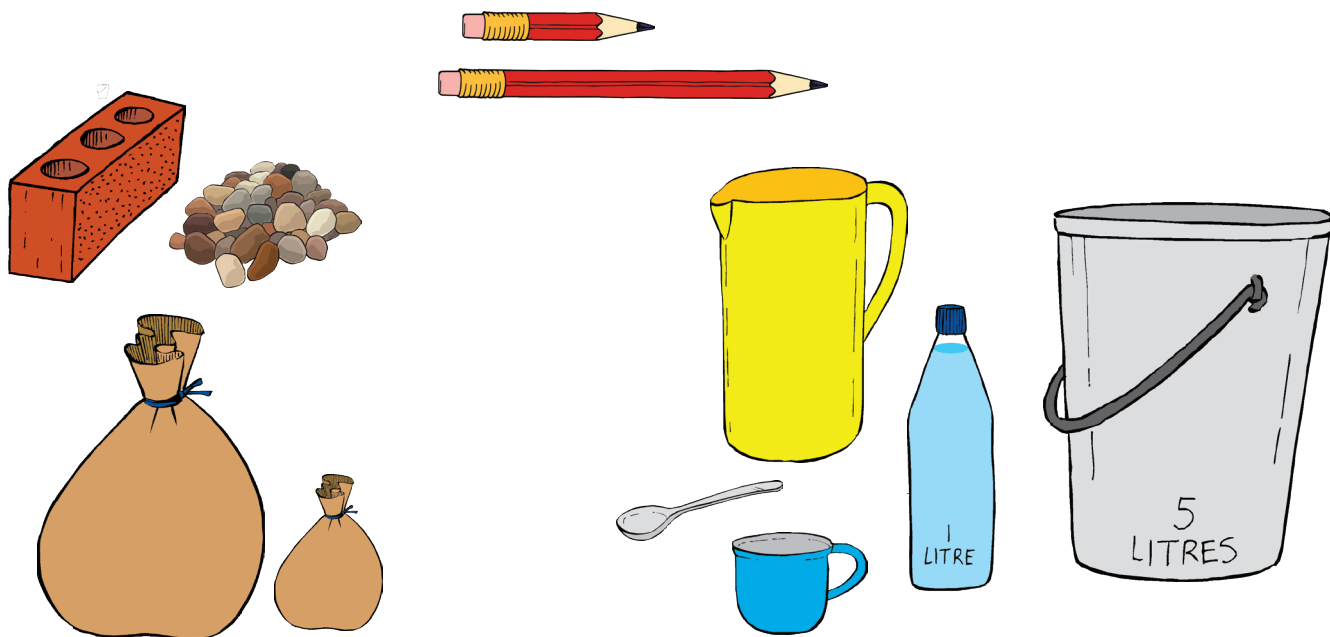
In Grade R, the goal of measuring is to answer the question, 'Which is larger/smaller?' We do this by moving from activities where two objects can be directly compared to those that need to be indirectly compared. The measuring skills being developed include comparing, ordering and matching according to attributes.

Direct comparison involves considering two or more objects and comparing them in terms of the relevant attribute.

Indirect comparison involves using a third object as a reference to compare two other objects that cannot be directly-aligned or compared. Because it is not always possible to compare objects directly, we use a different (but common) object that can be compared directly to each of the objects to act as a reference.

Resources

It is useful to have a range of boxes, bottles, containers and objects that can be used as informal units. For every stage of development, the container selection should include containers that are very different in length/capacity/weight so that children are able to estimate which is 'bigger/smaller'. By simply looking at the containers, the children should be able to order and compare. A homemade balance scale is also useful (see image). If you do not have a balance scale, it is easy to make.



Grade R measurement activities

- There are no measuring activities in Workbook 00 and 0. It is expected that measurement concepts will be developed through concrete, play-like activities and through the daily activities of the Grade R classroom.
- The Grade R child needs to learn the language of measurement which can be supported through the teacher's questions.
- Sand and water play are very important in helping children develop a sensory-motor concept of capacity, weight and volume. Carefully-considered resources provided to Grade R children can assist in encouraging different types of skills development.
- Block play helps to develop a child's sense of length and height.
- For sand, water, and block play, the teacher can consider setting challenges for the children. For example, 'Which of these containers holds the most/least water?' or 'What is the tallest tower you can make using these blocks?'

Time

The main focus in the early years is to develop children's understanding of how the world is organised through time. This happens by providing children with a concrete experience of time on an everyday basis. Children in Grade R and at the beginning of Grade 1 who have not yet been exposed to the structured school environment, would mostly have developed an understanding of social time at home – 'I go to bed when mom says so', or 'When I finish my drawing, I will have juice'. According to Piaget (1964), children at this age are in the pre-operational stage of development and cannot engage in logical thought, separate ideas, make mental representations of ideas or reverse the sequences of events. This limits their understanding of time.

As children start attending school (5-7 years old), learning about time should be aimed at developing formalised ideas about time and the understanding that, culturally and socially, life is structured through time. The focus is on learning the language of time and talking about time in the context of the routines at school. Learning time words such as before, after, morning, afternoon, evening, tomorrow, yesterday, last week, early, late, longer and shorter, is of particular importance. Sequencing events is another important part of learning about time that is supported by the learning of the language of time.

At this stage, one can start to associate schedules with clock time: 'Break is at 10 o' clock', 'School starts at 8 o' clock', etc. Children at this age will have difficulty understanding elapsed time and time in the future. Awareness of when events occur is still limited. For instance, a child might not know today is their birthday unless someone tells them.

Children in Grade 2 and 3 (age 8 -9) are beginning to move towards the concrete operational stage. They have a better understanding of so-called physical time that is measured with clocks and watches. They are also ready to start keeping track of time using clocks and watches and to learn about units of time.

At first, telling the time using an analogue clock is very confusing for children. The numerals on an analogue clock have dual meanings. Not only do they refer to the hour but also to multiples of five minutes. Having a clock on the classroom wall that the teacher points to regularly during the day and says 'It is now eight o' clock' etc. plays an important role in the development of an understanding of time.

Although children are able to think more logically at this point, working with the time concept should still be concrete and related to their day-to-day experience of time. Children can be given hands-on-activities such as using stop watches to time the baking of a cake, how long it takes to eat lunch, etc. This develops the time concept and its measurement in a concrete way.

Time activities

It is with this background in mind, that we have developed a set of cards that can be used to facilitate the learning of time in the Foundation Phase. Teaching with the cards as a resource takes the approach that the learning of time is experiential, with a strong focus on developing children's ability to sequence events. It also focuses on learning the language of time and aims to develop children's understanding of time as a real-world experience.

The **NumberSense Event Cards** are designed to offer tasks and games that develop children's ability to sequence events, whereas the **NumberSense Telling Time Cards** are aimed at developing children's knowledge of physical time.

The Time card tasks are intended for small group teaching on the mat and to be used in conjunction with the workbook pages. The complexity of the tasks and games increases as more cards are added.

The **NumberSense Event Cards** illustrate events that generally form part of a child's daily routine. This provides familiarity with the duration of events and for an everyday point of reference. The activities start by sequencing a small number of events and, as more events are added, the activity becomes more interesting and complex. The tasks centre on sequencing, duration of events and the sorting of events according to the time of day. The cards each depict an event that represents increasingly complex situations and come in four sets arranged by colour - red, blue, green and purple. In total there are 28 event cards that can be used in the tasks and games suggested in the workbooks.

In Grade R, the concept of duration is expressed as comparison (and not a measurement of time). For example, sleeping takes longer than bathing.

The **NumberSense Telling Time Cards** add the dimension of physical time. The purpose of this set of cards is for children to learn to tell time using analogue and digital clocks in 12-hour time and to develop children's ability to associate hours of the day with events. Children progress from telling the time in hours, then half hours, quarter hours and finally, five-minute intervals. They become familiar with the different time formats as they match the analogue clocks, digital clocks and time in word cards. They practise elapsed time by comparing the time on clock faces. These also come in four sets that represent increasingly complex measures of time. The sets are arranged by colour and each set of cards consists of a card with an analogue clock, a card with a matching digital clock face and one with the matching time given in words for each of the times in the set. There is a total of 52 cards in a pack.

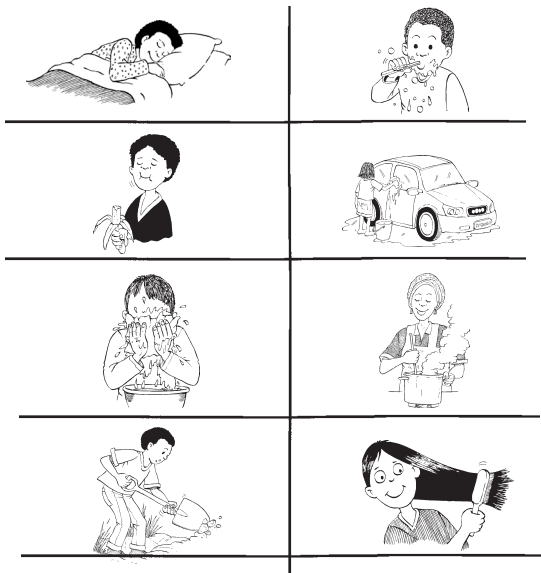
In Grade R, the focus is on exposing children to whole hours e.g. 8 o'clock. Only the red Telling Time cards, which depict whole hours for analogue and digital, are used. There is no expectation of being able to tell the time (even in whole hours) or understanding the parts of hours. The main aim is to develop an understanding of real-world time of day and attach a basic understanding of whole hours. For example, a Grade R child might have a partial understanding that they wake up at 6 o'clock in the morning; school starts at 8 o'clock; break time is at 10 o'clock; school finishes at 1 o'clock; supper is at 6 o'clock and bedtime is 8 o'clock in the evening.

In later grades, the activities throughout the workbooks are repeated frequently, changing the cards and adding more cards as the children gain confidence with the different concepts associated with time.

Grade R time activities

- Time should be referenced throughout the day and not restricted to mathematics lessons. For example, 'In 5 minutes it will be 10 o'clock and that is break time. Let's pack away and get ready for break.' Or, 'We've done our good morning song, what do we do next every morning?'
- There are a few workbook activities. In *Workbook 00*, on page 31, children are asked to compare the duration of certain activities and colour the one that takes the longest. *Workbook 0* p. 7 introduces the o'clock terminology and then there are 6 opportunities to practise (p. 12, 17, 19, 25, 27, 34).

Which takes the longest?
Colour in the picture.



What is the time?

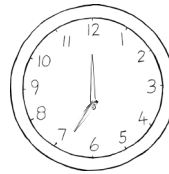


1 o'clock

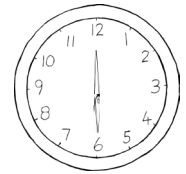


2 o'clock

What is the time?

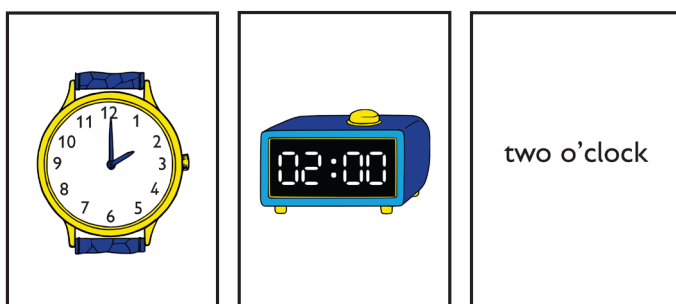
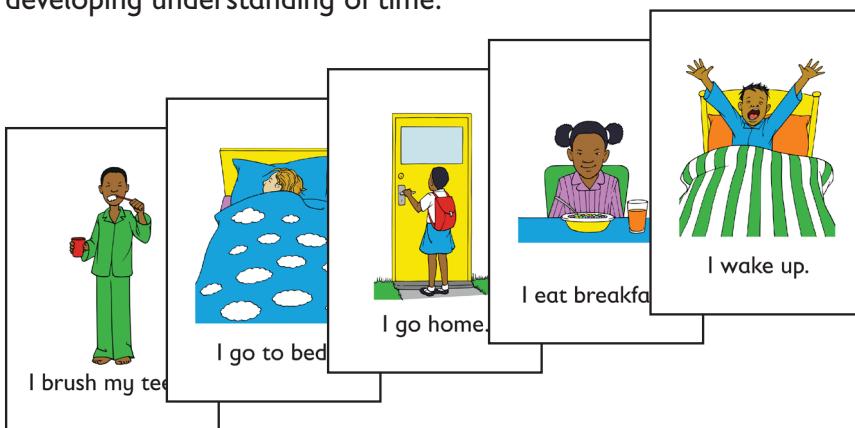


_____ o'clock



_____ o'clock

- The red NumberSense Telling Time Cards can be used to help children practise telling the time in whole hours.
- Teachers can promote conversations about the sequence of events and comparative length of activities using vocabulary such as 'before, after, later, then' and 'longer, shorter, quicker, slower, sooner, later'. The red NumberSense Event Cards can be used for these discussions. Children can sort the events into things they do in the morning, afternoon and evening. A few event cards can also be used for an ordering activity where children order them from the shortest to the longest in duration.
- Daily calendar discussions (years, seasons, months, weeks, days) help contribute to the Grade R child's developing understanding of time.



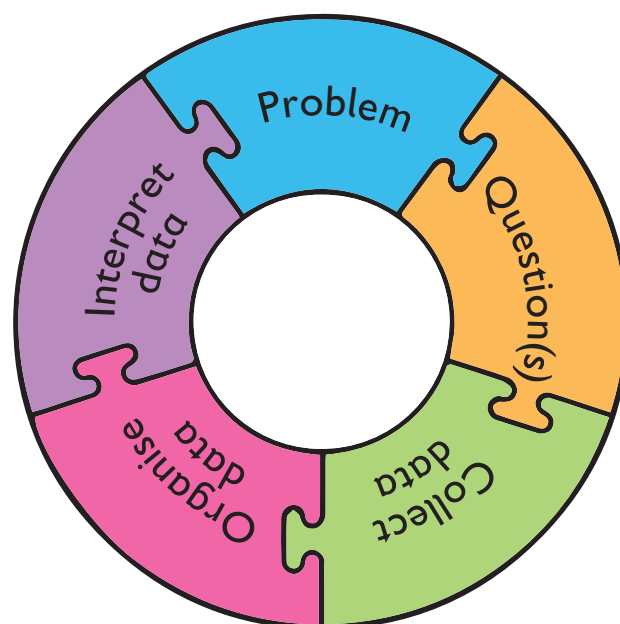
DATA HANDLING

The data handling component of a typical school curriculum draws attention to the different stages of a problem-solving approach in which data is collected to answer a question. From comparing the price of a particular commodity across a range of shops to determine the 'best deal', to canvassing the opinion of friends and family about a restaurant before deciding to go there, we collect data to make decisions every day.

As individuals, the decisions we make based on the data we collect may not be high stakes and may not have significant consequences. However, the stakes are very high and the consequences significant when, for example, drug companies collect data to make decisions about the efficacy of new drugs. The study of data handling in the mathematics curriculum should be focused on developing an awareness of the role that different choices made at each stage of the process have on the outcome of the process.

In the early years, it is enough for children to develop an understanding that data can help us to better understand situations and make informed decisions. As children move through school, they need to become increasingly aware of the choices that they make at each stage of the process and how these choices impact on the conclusions that can be made.

From the early to the later years, we want children to experience data handling as a process or sequence of events - a cycle. Classroom activities should expose children to all of the elements in the cycle in order for data handling to be meaningful. In particular, when using data to solve a problem, they should be exposed to each of the events of the data-handling cycle together, not separately. In other words, we don't do one activity where we collect data and another separate activity where we draw graphs. Instead, we structure learning activities to include all of the stages in the cycle: collecting data, organising (summarising and representing) data, and interpreting the summarised data - all with the purpose of solving a problem or answering a question.



Usually, the data handling cycle starts with a problem - something that needs to be solved or better understood. A question that needs to be answered in order to solve the problem is then identified. Next, appropriate data is collected in order to answer the question. Once the data is collected, it may need to be organised in a way that makes it easier to answer the question. This usually involves summarising to reduce the amount of data and representing it in a way that makes the trends clear to see. Finally, the data is interpreted in terms of the problem and question that started the process so that the question is answered and the problem solved.

Data handling activities

During activities, teachers need to continuously ask children questions about their data. For example, 'How has the data been sorted/organised?', 'Why has it been represented in the way that it has?' etc. In answering questions based on the data, children need to develop the skill of making statements that they can then justify in terms of the data.

When children start sorting according to their own criteria, they might sort objects:

- 'just because' they belong together. At this stage, children are typically at the visualisation stage of geometric thinking (van Hiele, 1999).
- according to certain attributes such as shape, colour, size or the material from which the objects are made, etc.
- according to function: objects that we eat, wear, play with, throw away etc.

It is very important that teachers support children in explaining the reasons they used to sort the objects in the way that they did. Explaining their decision forces children to reflect, and it is through reflection that they develop their understanding.

Children will typically begin sorting by one characteristic at a time. This should be encouraged as a regular activity with a variety of materials with which to sort. Progression is also important in moving from sorting according to a single attribute and later introducing more complex examples whereby children then sort according to two or three attributes.

Grade R activities

- There are a few Data Handling activities in Workbook 00.

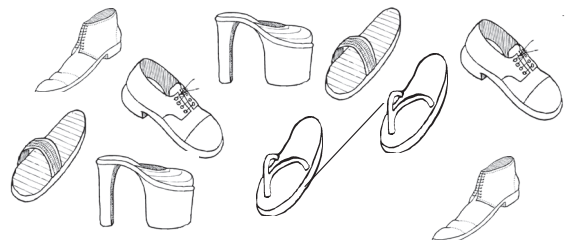
Workbook 00 p. 2

Colour in the big shells.



Workbook 00 p. 15

Find the other shoe.



Workbook 00 p. 13



Mum



Dad

Colour Mum's clothes red.
Colour Dad's clothes blue.



Workbook 00 p. 14

Winter

Cold



Summer

Hot



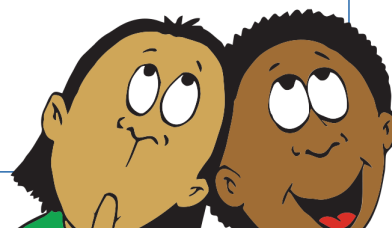
Colour the winter clothes red.
Colour the summer clothes green.



- In Grade R, most Data Handling activities will involve hands-on sorting of concrete objects or pictures. For example:
 - sorting manipulatives according to colour, shape, size.
 - sorting animal pictures into animals that live on land and animals that live in the water.
- Consider using sorting and classifying activities in Life Skills lessons.
- Encourage children to express the reasons for their thinking. For example, 'How did you sort these?' 'Why?' 'Is there another way to sort them?'
- The focus here is on the children gaining experience and developing the skill of interpreting data by engaging in discussion which is mediated by the teacher.

Understanding the page: checklist

	PROMPTS	MY NOTES
PRE-TEACHING QUESTIONS	<p>Things to think about:</p> <ul style="list-style-type: none"> • What learning am I supporting (task: the page)? • What learners am I supporting? • What resources do I need to facilitate learning? • What reflection or discussion would be useful? <ul style="list-style-type: none"> - For what purpose? • What responses/solutions do I anticipate? 	
	<p>Differentiation:</p> <p>Who and what will need scaffolding, consolidating, extending?</p> <ul style="list-style-type: none"> • Does this mean: <ul style="list-style-type: none"> - Whole class? - Mixed groups? - Streamed groups? • Do I need to adapt the task? <ul style="list-style-type: none"> - Do I need a parallel/similar problem? • Do I need to use supporting resources? • Do I need to give more input prior to the activity? 	
TEACHER-LED	<p>What is the purpose of the task?</p> <ul style="list-style-type: none"> • What mathematics does the page intend for children to notice? • Have we done something like this before? • Will this be problematic for some/all? • Can I make links to similar, previous tasks? 	
	<p>Anticipated/desired strategies (age- and grade-level appropriate):</p> <ul style="list-style-type: none"> • What strategies do I anticipate that the children will use? • Which strategies do I aim to encourage? 	
INDEPENDENT WORK	<p>Monitoring:</p> <ul style="list-style-type: none"> • Will I need to pair certain learners for this? • Will I need to monitor for understanding during the task? • Will I need to identify different strategies being used to draw on during the reflection session? • Which learners can I select to explain their work? 	
REFLECTION	<p>Discussion (can include marking):</p> <ul style="list-style-type: none"> • Where/how can I make links to previous tasks? And how can I build on these? • Use the question bank to select specific questions to ask about the task/page (to reveal what we want the children to notice). • How and when will marking take place? • Which activities will corrections be useful for? 	



Understanding the page: key prompts

As part of your preparation, complete the workbook page and these key prompts.

Notice

What mathematics does the page intend for children to notice?

Plan

Parallel activities: Which activities on the page require a similar activity to sufficiently prepare the children for the page by scaffolding, checking for understanding (consolidating) or extending?

Anticipated/desired strategies (age- and grade-level appropriate): To think about while planning: what strategies do you anticipate that the children will use?

Reflect

Use the question bank to select specific questions to ask about this page during the reflection session (to reveal what we want the children to notice).

Question Bank

Questions that scaffold thinking

1. What did you already know that helped you?
2. What did you notice?
3. Have we seen this before?
4. How does that help us with this activity?
5. How is this the same and how is it different?
6. What has this activity taught us?
7. If you don't know how to do this, what do you know that can help you?

Questions that build on learners' ideas develop understanding

8. What strategy did you use?
9. How did you decide what to do?
10. Can you explain how/why it worked?
11. Did anyone use a different strategy?
12. Why did you do it differently?
13. Which of these ways will always work?

Questions that develop reasoning

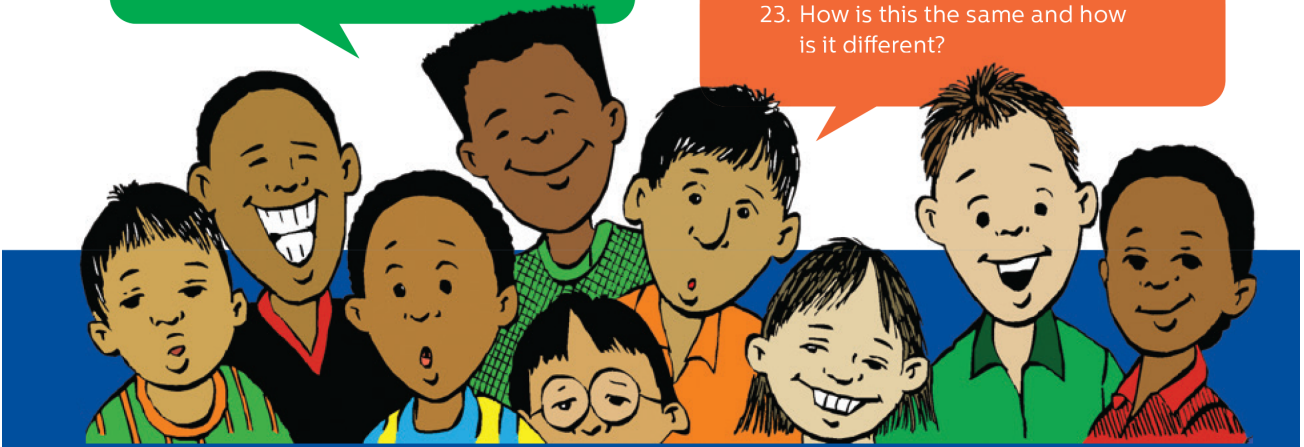
14. How did you do that?
15. Can you explain why it worked?
16. What did you notice?
17. If you do know this, what else do you know?

Questions that strengthen the concept (though the noticing of the connections between different mathematical representations)

18. Have we seen this before?
19. How does that help us with this activity?
20. How is this the same and how is it different?

Questions that reveal misconceptions/errors

21. Have we seen this before?
22. How does that help us with this activity?
23. How is this the same and how is it different?



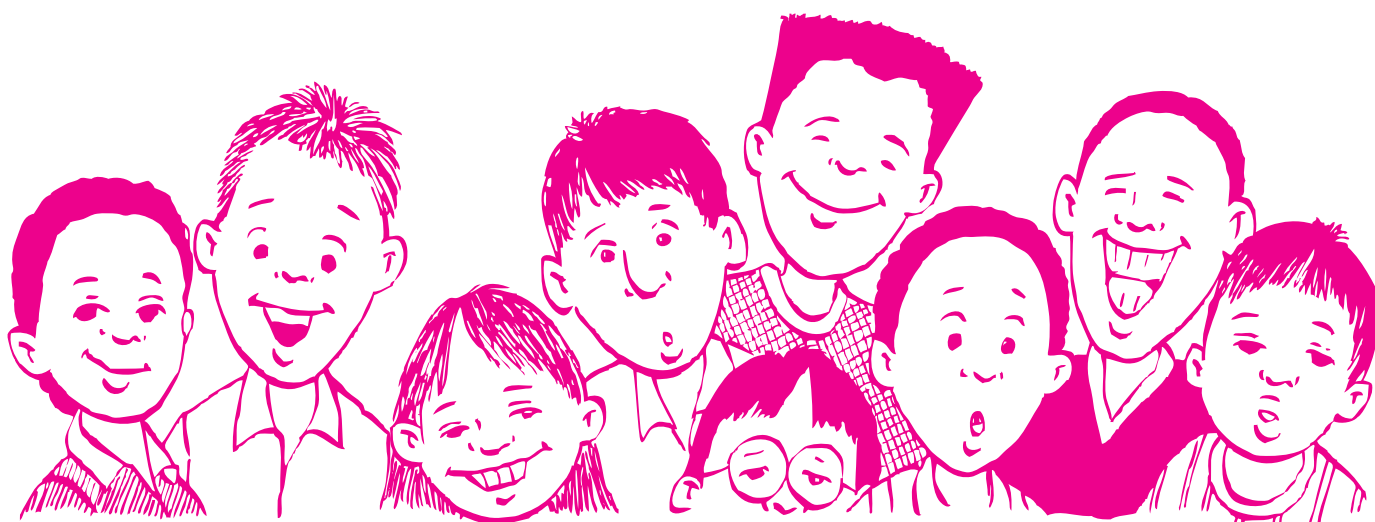


Notes

NUMBERSENSE MATHEMATICS PROGRAMME RESOURCES PER GRADE

Grade	NumberSense Workbooks	GeoGenius Construction Kit (super)	GeoGenius Visualisation Kit	Activity Kits and Resources	Additional Resources
R	Grade R: 00, 0			Grade R Activity Kit, which includes: - Number & Pattern resources - Space & Shape resources - Measurement (time) resources	Teacher Guide
1-3	Grade 1: 1, 2, 3, 4	1 per class		1 x Activity Kit (super) per class, which includes: - Activity Kit (standard) which contains all the Activity Cards - Attribute Blocks x 3 packs - Connecting Cubes x 3 packs - Tangram Puzzle x 1 pack (10 sets) - Mosaic Puzzle x 1 pack (10 sets)	Teacher Guide Mental Arithmetic booklets
	Grade 2: 5, 6, 7, 8				Teacher Guide Mental Arithmetic booklets Geoboards
	Grade 3: 9, 10, 11, 12				2 per class (optional) Teacher Guide Mental Arithmetic booklets Geoboards

* Note: We do not stock geoboards, but these can be purchased via Takealot, Greenbean or Smile. We suggest the 5-by-5 square pin grid array.





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