ABOUT THE NUMBERSENSE COMPANION TEACHER GUIDE FOR FOUNDATION PHASE

The NumberSense Mathematics Programme consists of the NumberSense Workbooks, the NumberSense Companion Series and a range of resources to support the effective learning of mathematics from Grade R to Grade 7. The NumberSense Workbooks address the Number and Pattern components of the curriculum while the NumberSense Companion Series deals with Measurement, Space and Shape (Geometry) and Data Handling.

There are two NumberSense Workbooks for Grade R. Grade R teachers are expected to mediate the activities in the workbooks with the children. There are 12 workbooks altogether for Grade 1 to Grade 3 with four workbooks for each grade. This requires that a page be done each day for a workbook to be completed each term. In the Foundation Phase, the workbooks are used to consolidate the daily mat work sessions.

There are also 12 workbooks for Grade 4 to Grade 7 with three to four workbooks per year. Children complete pages in the workbooks in preparation for the focus group sessions with the teacher.

The NumberSense Companion Teacher Guides for Grades R to 3 describe classroom-based activities for developing Measurement, Space and Shape (Geometry) and Data Handling. The activities in the NumberSense Companion Teacher Guides for Grades R to 3 assume that teachers also have the NumberSense Activity cards and the corresponding range of resources.

In Grades 4 to 7, the NumberSense Companion Workbooks provide learning materials for the children while the Teacher Guides for the Grade 4 to 7 NumberSense Companion Workbooks provide page by page support (including answers) for teachers.

The Foundation Phase NumberSense Companion Teacher Guide

The NumberSense Companion Teacher Guide for the Foundation Phase has been designed to support teachers in creating learning opportunities for children to develop geometric and spatial reasoning, measuring skills and the ability to critically analyse data.

The Teacher Guide assumes that teachers have a number of resources, in particular the activity cards that are available individually or as a set in the NumberSense Companion Activity Kit.

This Teacher Guide is a first draft that will continually be updated and teachers are encouraged to visit the NumberSense website (www.NumberSense.co.za) frequently to ensure that they have the latest version. While the Teacher Guide remains under development, teachers can download the various drafts at no charge from www.NumberSense.co.za.

Children can engage with most of the activities described in this Teacher Guide independent of the teacher. The role of the teacher is to reflect on each activity with the children to ensure that learning takes place.
### RECOMMENDED PACING OF ACTIVITIES IN GRADE 3:

<table>
<thead>
<tr>
<th>Approximate Time (mins)</th>
<th>Activity</th>
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<tbody>
<tr>
<td><strong>TERM 1</strong></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Tangram Puzzle Activity Cards 10 to 14</td>
</tr>
<tr>
<td>50</td>
<td>Mosaic Puzzle Activity Cards 10 to 14</td>
</tr>
<tr>
<td>20</td>
<td>Connecting Cube Activity Card 2</td>
</tr>
<tr>
<td>40</td>
<td>Geoboard Activity Cards 15 and 16</td>
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<tr>
<td>20</td>
<td>GGeoGenius Construction Kit Activity Card 7</td>
</tr>
<tr>
<td>200</td>
<td>Time Activities 1 to 3 (Duration, Matching analogue, digital and written time and Telling the time)</td>
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<tr>
<td>75</td>
<td>Three length activities</td>
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<tr>
<td>50</td>
<td>Two mass activities</td>
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<tr>
<td>50</td>
<td>Two capacity/volume activities</td>
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<tr>
<td>100</td>
<td>Four opinion poll activities</td>
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<tr>
<td>50</td>
<td>Two ongoing data collection activities</td>
</tr>
<tr>
<td><strong>TERM 2</strong></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>Mosaic Puzzle Activity Cards 15 to 18</td>
</tr>
<tr>
<td>60</td>
<td>Geoboard Activity Cards 17 and 18</td>
</tr>
<tr>
<td>30</td>
<td>Connecting Cube Activity Cards 10 to 13</td>
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<tr>
<td>90</td>
<td>GeoGenius Construction Kit Activity Cards 8 and 10</td>
</tr>
<tr>
<td>60</td>
<td>GeoGenius Visualisation Kit Novice_1 Card Sets 3 to 7</td>
</tr>
<tr>
<td>200</td>
<td>Time Activities 1 to 4 (Duration, Matching analogue, digital and written time, Telling the time and Elapsed Time)</td>
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<td>Three length activities</td>
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<td>Two mass activities</td>
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<td>50</td>
<td>Two capacity/volume activities</td>
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<td>25</td>
<td>One perimeter activity</td>
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<td>100</td>
<td>Four opinion poll activities</td>
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<td>Two ongoing data collection activities</td>
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<tr>
<td>Approximate Time (mins)</td>
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<tr>
<td><strong>TERM 3</strong></td>
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<tr>
<td>60</td>
<td>Tangram Puzzle Activity Cards 15 to 18</td>
</tr>
<tr>
<td>60</td>
<td>Geoboard Activity Cards 19 to 21</td>
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<tr>
<td>100</td>
<td>GeoGenius Construction Kit Activity Cards 11 to 15</td>
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<tr>
<td>75</td>
<td>GeoGenius Visualisation Kit Novice_1 Card Sets 8 to 10</td>
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<tr>
<td>80</td>
<td>Connecting Cube Activity Cards 14 to 18</td>
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<tr>
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<td>75</td>
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<td>50</td>
<td>Two capacity/volume activities</td>
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<td>One perimeter activity</td>
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<td>50</td>
<td>Two area activities</td>
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<td>100</td>
<td>Four opinion poll activities</td>
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<tr>
<td>50</td>
<td>Two ongoing data collection activities</td>
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<tr>
<td><strong>TERM 4</strong></td>
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<tr>
<td>60</td>
<td>Geoboard Activity Cards 22 to 24</td>
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<tr>
<td>75</td>
<td>GeoGenius Construction Kit Activity Cards 16 to 18</td>
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<tr>
<td>100</td>
<td>GeoGenius Visualisation Kit Novice_2 Card Sets 1 to 4</td>
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<tr>
<td>200</td>
<td>Time Activities 1 to 4 (Duration, Matching analogue, digital and written time, Telling the time and Elapsed Time)</td>
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<tr>
<td>75</td>
<td>Three length activities</td>
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<td>50</td>
<td>Two ongoing data collection activities</td>
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INTRODUCTION

“Geometry begins with play” (van Hiele, 1999).

The activities described in this section of the study guide are informed by the research of Pierre van Hiele. According to van Hiele (1986), 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.

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.

Children at the descriptive level of geometric thinking recognise the properties of shapes. Children at this developmental level may identify a shape as a square because the shape has four sides that are the same length, or because the angles are right angles. However, at this level, the properties are not yet logically ordered or related. Children at this developmental level may identify a shape as an equilateral triangle because the shape has three sides that are equal in length, or because the shape has three angles that are equal in size. However, they don’t recognise a relationship between the properties and cannot yet see a relationship between the equal angles and the equal sides of the equilateral triangle.

Recognising the relationships between the different properties of shapes happens during the deductive level of geometric thinking. Children at this developmental level are able to deduce some unknown properties of a shape, from the known properties of the shape.

Teachers of children in the early grades typically work with children who are usually 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.

Van Hiele described five kinds of activities that promote the transition from one level to the next. These activities are as follows:

1. Free play (inquiry phase): Children are given materials that encourages them to explore and become aware of certain structures.

2. Focused play (direct orientation): Tasks are presented in such a way that the characteristic structures of the objects gradually appear to children.

4. More focused play (free orientation): The teacher presents tasks that can be completed in different ways and supports children in developing an awareness of what they have already noticed.

5. Integration (seldom included in geometric activities in the early years): Children are given opportunities to synthesize what they have learned (van Hiele, 1999).

In light of the activities described by van Hiele, developing geometric thinking in the early grades is reliant on play and playing with resources. Many resources can be made (like tangram puzzles) or collected (beads to put on string). Some resources have to be purchased.

This section of the teacher guide has been developed with the assumption that the teacher has a range of geometric resources in her classroom. By encouraging the children to use these resources in a range of carefully structured learning situations, teachers support children’s growing awareness of the geometric and other properties of shapes and objects.

To conclude, the role of the teacher in developing children’s geometric thinking is to:

- Organise the learning situations (activities) described in this guide so as to direct the children’s attention to the geometric properties of shapes and objects.

- Introduce terminology.

- Engage the children in reflective discussion on the activities, encouraging explanations that incorporate appropriate geometric terms.
## RESOURCES

<table>
<thead>
<tr>
<th>Resource</th>
<th>Number required</th>
<th>Available from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosaic Puzzle</td>
<td>1 for every pair of children</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>Mosaic Puzzle Activity Cards</td>
<td>1 set for every four children</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>Tangram Puzzle 10 cm by 10 cm</td>
<td>1 for every pair of children</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>Tangram Puzzle Activity Cards</td>
<td>1 set for every four children</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>Geoboard with 5-by-5 square pin grid array</td>
<td>1 per child</td>
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</tr>
<tr>
<td>Geoboard Activity Cards</td>
<td>1 set for every four children</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>GeoGenius Visualisation Kit</td>
<td>Minimum 1 set for every 12 children in class</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>GeoGenius Visualisation Kit additional Card Set_2</td>
<td>Minimum 1 set for every 12 children in class</td>
<td>Download from <a href="http://www.GeoGenius.co.za">www.GeoGenius.co.za</a></td>
</tr>
<tr>
<td>GeoGenius Construction Kit</td>
<td>1 Superkit for every 12 children</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>GeoGenius Construction Kit Activity Cards</td>
<td>1 set for every 12 children</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>Connecting Cubes</td>
<td>1 set of 40 blocks for every five children</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>Connecting Cubes Activity Cards</td>
<td>1 set for every 12 children</td>
<td>Brombacher &amp; Associates</td>
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</tbody>
</table>
TANGRAM PUZZLE ACTIVITIES

In this activity we expect children to develop:

- Confidence in recognising, identifying and describing 2-D shapes (the focus of the activities is on triangles and rectangles)
- An increased awareness of the properties of, and relationships between, the edges and angles of 2-D shapes

For this activity you will need:

- Tangram Puzzles (For these activity cards the Tangram Puzzle should be 10 cm by 10 cm)
- Tangram Puzzle Activity Cards 10 to 18

Teacher’s role:

Give the children a Tangram Puzzle Activity Card and Tangram Puzzle. Tell the children to complete the instructions on the card. The children are able to work on these cards independently of the teacher and may work individually or in pairs. The children should not pack away until the teacher has seen that they have successfully completed the activity or recorded their results appropriately.

When possible, the teacher should take the opportunity to observe how the children use the pieces and informally assess how the children think and talk about the shapes. The teacher should discuss the activity with the children after they have completed it. The real learning lies in the reflective discussion that the teacher facilitates.

In Activity Cards 10 and 12, the children are to fit the Tangram Puzzle pieces onto the Activity Card, but only the outline of the shape being covered is visible. The children can then decide which pieces to use to complete the shape.

In the other Activity Cards, the children have to put Tangram Puzzle pieces together to look like the outline of the shapes on the Activity Card. They cannot, however, place the pieces on the cards because the shapes are not the same size as shapes made with the pieces. This forces the children to reason why they are correct using an argument that is more sophisticated than “it fits”.

Draw the children’s attention to the edges and vertices of the shapes by asking:

- How many edges does this shape have?
- How many corners (vertices) does this shape have?
- What is the same about these shapes?
- What is different about these shapes?
What to expect from the children:

The main focus of these activities is for the children to play and gradually start to recognise some of the properties of polygons.

The children may start to notice that some pieces will fit either side up, while other pieces (the parallelogram) will only fit one way up. The children will also start to focus on matching edges that are equal in length and angles that are equal in size.

The children should know the names 'triangle' and 'rectangle' and recognise them as such. They may be able to explain that they know that triangles are triangles because they have three edges or three corners (vertices), whereas the other shapes all have four edges. The rectangle, however, is different to the other shapes with four sides because it has square corners (right-angles).

The children may notice similarities and differences between the rectangles and the other shapes. The children may describe the rectangles as being different to the five-sided shape (pentagon) because it has only four edges and that it is different to the parallelogram because the corners are square (i.e. right angles). The children do not have to know the name 'parallelogram' yet and could just say 'the other four-sided shape'.

The children should notice that the rectangle, trapezium and parallelogram have four edges and four corners (vertices), the rectangle has square corners (right angles), and the trapezium and parallelogram have sharp and blunt corners.

These activities also extend the notion of “the same” from “fitting on” to a more reasoned argument that deals with notions of similarity.

Activity Card 10 solutions:
Activity Card 10 solutions continued:

Activity Card 11 solutions:

Activity Card 12 solutions:
Activity Card 13 solutions:

Activity Card 14 solutions:
Activity Card 15 solutions:

Activity Card 16 solutions:

Activity Card 17 solutions:
Activity Card 18 solutions:
MOSAIC PUZZLE ACTIVITIES

In this activity we expect children to develop:

- Confidence in recognising, identifying and describing 2-D shapes (the focus of the activities is on triangles, squares and rectangles)
- An increased awareness of the properties of, and relationships between, the edges and angles of 2-D shapes

For this activity you will need:

- Mosaic Puzzles
- Mosaic Puzzle Activity Cards 10 to 18

Teacher’s role:

Give the children a Mosaic Puzzle Activity Card and a Mosaic Puzzle. Tell the children to complete the instructions on the card. The children are able to work on these cards independently of the teacher and may work individually or in pairs. The children should not pack away until the teacher has seen that they have successfully completed the activity or recorded their results appropriately.

When possible, the teacher should take the opportunity to observe how the children use the pieces and informally assess how the children think and talk about the shapes. The teacher should discuss the activity with the children after they have completed it. The real learning lies in the reflective discussion that the teacher facilitates.

In Activity Card 10, the children will focus on making different shapes. Make sure that it is understood what is meant by different shapes. For example, all these shapes are the same because if the children trace around the outside of one of the shapes and turn or flip it, they will see that it fits on all the other shapes.
The children should record their results on a piece of paper by tracing around the outside of the new shape that they create.

In Activity Cards 11 to 12, the children are to fit the Mosaic Puzzle pieces onto the Activity Card, but only the outline of the shape to be covered is visible.

In Activity Cards 13 to 16, the children have to put all the Mosaic Puzzle pieces together to look like the picture on the Activity Card. They cannot place the pieces on the cards because the shapes are not the same size as the shapes made with the pieces. This forces the children to reason why they are correct by using an argument that is more sophisticated than “it fits”.

In Activity Card 17, the children again focus on the meaning of same and different. They should be encouraged to work systematically through the investigation.

In Activity Card 18, the children focus on the properties of a rectangle.

Draw the children’s attention to the edges and vertices of the shapes by asking:

- How many edges does this shape have?
- How many corners (vertices) does this shape have?
- What is the same about these shapes?
- What is different about these shapes?

What to expect from the children:

The main focus of these activities is for the children to play and gradually start to recognise some of the properties of polygons.

The children should know the names ‘triangle’, ‘square’ and ‘rectangle’ and recognise them as such. They may be able to explain that they know that the triangles are triangles because they have three edges or three corners (vertices) whereas the other shapes all have four edges. The rectangle however, is different to the other shapes with four sides, because it has square corners (right-angles). The children do not have to know the names trapezium, parallelogram, quadrilateral or pentagon and could just say ‘four-sided shape’ and ‘five-sided shape’.

The children should notice that the parallelogram has four edges and four corners (vertices), whereas the other shapes have five edges and five corners (vertices). The children may describe opposite corners of the parallelogram as being blunt or sharp, but in the trapezium, the corners next to each other are blunt or sharp. The children may also notice that shapes can be convex (a reflex-angle) and describe this as ‘dented-in’.

These activities also extend the notion of “the same” from “fitting on”, to a more reasoned argument that deals with notions of similarity.
Activity Card 10 solutions:
1. There is only one shape that can be made by joining piece 1 and piece 2.

2. There are two different shapes that can be made by joining piece 1 and piece 3.

3. There are three different shapes that can be made by joining piece 1 and piece 4.

4. There are three different shapes that can be made by joining piece 1 and piece 5.
5. There are five different shapes that can be made by joining piece 1 and piece 7. Notice how these have been developed systematically in the illustration below. The teacher may need to support the children in developing a systematic strategy.

Activity Card 11 solutions:

Activity Card 12 solutions:
Activity Card 13 solution:

Activity Card 14 solution:

Activity Card 15 solution:
Activity Card 16 solution:

![House-shaped diagram made from pieces 2 and 3](image)

Activity Card 17 solutions:
1. There is one shape that can be made by joining piece 2 and piece 3.

![Shape diagram](image)

2. There are two different shapes that can be made by joining piece 2 and piece 4.

![Two different shapes](image)

3. There is one shape that can be made by joining piece 2 and piece 5.

![Shape diagram](image)

4. There are two different shapes that can be made joining piece 2 and piece 7.

![Two different shapes](image)
Activity Card 17 solutions continued:

5. There are two different shapes that can be made joining piece 3 and piece 4.

6. There are two different shapes that can be made joining piece 3 and piece 5.

7. There are three different shapes that can be made joining piece 3 and piece 7.

Activity Card 18 solutions:

1. Rectangle using 2 pieces:
2. Rectangle using 3 pieces:

3. Rectangle using 4 pieces:

4. Rectangle using 5 pieces:
Activity Card 18 solutions continued:

5. Rectangle using 6 pieces:

6. Rectangle using 7 pieces:
GEOBOARD ACTIVITIES

In this activity we expect children to develop:

- Confidence in recognising, identifying and describing 2-D shapes (the focus of the activities is on triangles, squares and rectangles)
- An increased awareness of the properties of, and relationships between, the edges and angles of 2-D shapes

For this activity you will need:

- Geoboard (minimum 5-by-5 square pin grid array)
- Elastic bands in varying colours and sizes
- Geoboard Activity Cards 15 to 24
- Pages of square-dotted paper (see print master at the end of the guide)

Teacher’s role:

Give the children a Geoboard Activity Card and a 5-by-5 geoboard with elastic bands. If the children have larger geoboards, you may want to restrict their use to 5-by-5 pins, otherwise there will be too many solutions for some of the investigations. Tell the children to complete the instructions on the card. The children are able to work on these cards independently of the teacher and should not pack away until the teacher has seen that they have successfully completed the activity or recorded their results appropriately.

The children will need square-dotted paper and a pencil for recording their solutions. The nature of the work on geoboards means that important learning often goes unrecorded. In these tasks the children are required to record what they do on the geoboard onto square-dotted paper so that the properties of the shapes can be discussed. It is recommended that children stick this square-dotted paper into their mathematics jotters.

The teacher should discuss the activity with the children after they have completed it. The real learning lies in the reflective discussion that the teacher facilitates.

In Activity Card 15, the children are to focus on the relationship between the number of edges, the number of vertices and the length of the edges of various shapes. Encourage the children to think of concave shapes and convex shapes.
In Activity Cards 16, 17 and 18, the children are to investigate how many different rectangles and triangles they can make within certain restrictions. They should be encouraged to work systematically through these investigations. The children should start with all the possible rectangles or triangles that have a base of one unit, then two units, then three units etc. Only then should they consider tilted rectangles or triangles.

In Activity Card 19, the children are to remove the vertices to investigate the effect on the number of edges and on the shape.

In Activity Cards 20, 21 and 24, the children’s focus should be brought back to the meaning of ‘different’ and ‘the same’.

In Activity Cards 22 and 23, the children change triangles into squares by performing “moves”. A “move” could be stretching the edge of an elastic band over a new pin, or moving the vertex of a shape from one pin to another pin.

What to expect from the children:

The children should start to recognise the properties of triangles, rectangles and squares, e.g., that triangles have three edges and three corners (vertices) and rectangles (squares included) have four edges and four corners (vertices). The children may describe right angles as being ‘square’ corners and although this terminology is not mathematically correct it conveys the meaning and is acceptable for young children. The teacher, however, should use the correct vocabulary.

The children should start to notice the differences and similarities between squares and other rectangles, and the similarities and differences between rectangles and other quadrilaterals. The children may not yet recognise that a square is a special rectangle.

The children should now realise that a polygon will always have the same number of edges as vertices, and when a vertex is removed, an edge is also removed.

Activity Card 15 solutions:
1. It is impossible to make a shape with five vertices and six edges.
Activity Card 15 solutions continued:

2. There are many solutions, of which the following are only a few:

3. It is impossible to make a triangle with three equal sides on a geoboard. This does not mean that a triangle with three equal sides does not exist – it just cannot be done on a geoboard.

4. There are many solutions, of which the following are only a few:

5. There is only one solution (when restricted to a 5-by-5 pin geoboard).
**Activity Card 16 solutions:**
Squares have been included in this solution for completeness. However, the children at this developmental level may not recognise that a square is a special type of rectangle. Accept the children’s solutions without the squares.

There are 16 different rectangles (8 if squares are excluded):

![Diagram of 16 rectangles](image)

**Activity Card 17 solutions:**
There are nine possible triangles which have 1 pin in the middle on a 4-by-4 grid:

![Diagram of 9 triangles](image)
Activity Card 17 solutions continued:

Activity Card 18 solutions:
For 1 pin inside, there were 9 different triangles on a 4-by-4 Geoboard (see Card 16 solutions). On a 5-by-5 grid, there are another 7 different triangles, so 16 different triangles in total:

For 2 pins inside, there are 7 different triangles:
Activity Card 18 solutions continued:
For 3 pins inside, there are 9 different triangles:

For 4 pins inside, there are 6 different triangles:
Activity Card 18 solutions continued:
For 5 pins inside, there are 2 different triangles.

![Diagram of 2 triangles formed by 5 pins]

For 6 pins inside, there are 4 different triangles.

![Diagram of 4 triangles formed by 6 pins]

There are no triangles that have more than 6 pins inside.

Activity Card 19 solutions:
2. 8 edges
3. 7 edges
4. 7 edges
5. 7 edges
6. 7 edges
7. When a vertex is removed, there is one less edge because an edge is also removed.
Activity Card 20 solutions:
2. 4 different triangles can be made by moving the elastic band from vertex A. Triangles 3 and 5 are the same.

3. 5 different triangles can be made by moving the elastic band from vertex B.

Activity Card 21 solutions:
2. 5 different shapes can be made by moving the elastic band from vertex A. Shapes 1, 2 and 3 are the same; Shapes 4 and 6 are the same and Shapes 7 and 9 are the same:
3. 9 different shapes can be made from moving the elastic from vertex B:
Activity Card 22 solutions:
All the triangles in this activity can be changed into squares using one move – stretching the longest edge to the opposite vertex.

Activity Card 23 solutions:
All the triangles can be changed into squares using as few as 2 moves.

Activity Card 24 solutions:
1. There is one way:
2. There are two ways:

![Diagram](image1)

and

![Diagram](image2)

3. There is one triangle that is the same when moving vertex A:

![Diagram](image3)

5. There are two triangles that are the same when moving vertex B:

![Diagram](image4)

and

![Diagram](image5)

There is one triangle that is the same when moving vertex C:

![Diagram](image6)
GEOGENIUS VISUALISATION KIT ACTIVITIES

In this activity we expect children to develop:

- Confidence in recognising, identifying and describing 3-D shapes (the focus of the activities is on square prisms, rectangular prisms and triangular prisms)
- Confidence in recognising 3-D objects from different positions and positioning 3-D objects in relation to each other
- Confidence in describing positional relationships (alone and/or as a member of a group) between 3-D objects and him/herself and a peer

For this activity you will need:

- GeoGenius Visualisation Kit (at least one kit per 4 children)
- Novice_1 Card Sets 1 to 10. These come with the GeoGenius Visualisation Kit
- Novice_2 Card Sets 1 to 10. These can be printed as per instructions from www.GeoGenius.co.za.
- Blank view cards. These come with the GeoGenius Visualisation Kit. More can be printed from www.GeoGenius.co.za or the Instruction Guide found in the kit.

Teacher’s role:

Arrange the children participating in this activity into groups of four. The desks should be arranged so that all four children in the group can face the middle of the table.

General GeoGenius Visualisation Kit instructions (also see the instruction book that comes with the kit):

The grid is placed in the middle of the table. For the card set that is being used, each child is given the card that corresponds to their view. Working together, the children in the group select the appropriate block(s) and arrange/rearrange them on the grid until the arrangement of blocks corresponds to the view on each view card. Each child should only look at their own card while the group works together to complete the task.
Initially, as children get used to working with the kit, the teacher may want to place the grid on top of a box in the middle of the table so that the grid is at the children’s eye level. Alternatively the children could kneel down to look at the grid from eye level.

In the beginning, the children struggle to accept that their cards do not show depth. The children often want to move the block(s) towards themselves so that they are up against the edge of the grid on the side that they are facing. To help them deal with this, the teacher could ask the children how they think the card would look different if the block was further back or further forward on the grid.

Allow opportunity for the children to complete blank viewing cards. To do this, tell the group to choose any one block in the GeoGenius Visualisation Kit and place it on the Visualisation grid. Give each child a blank view card. Each child in the group should then draw their view (A, B, C or D) of the block on the grid. They should label their view A, B, C or D. When they are done, the children should remove their block from the grid.

Swap viewing cards between the groups so that each group gets another groups set of cards. Ask the groups to use the cards drawn by the other children to reposition the block that that group chose on the grid. The groups may pick up errors. If so, ask them to justify how they can be sure that it is an error. Return the cards back to the original groups to correct errors if necessary.

When each child in the group is satisfied that the arrangement corresponds to the view on their card, lead a reflective discussion that includes answering the specific questions provided for each set of cards.

What to expect from the children:

Specific questions for each of the cards are provided for the teacher. The answers that the children are expected to give are suggested in green text after each question.

Questions for reflective discussion with expected answers:

**Novice 1 Set 3:**

- *Do the blocks look the same in all four cards?* No, however their shapes do look the same from opposite views (although positions differ).

- *Are the blocks in the same position in all four cards?* No, however opposite views are mirror opposites.
Novice 1 Set 4:

- Do the blocks look the same in all four cards? No, however their shapes do look the same from opposite views (although positions differ).
- Are the blocks in the same position in all four cards? No, however opposite views are mirror opposites.
- Why does the orange block look like a rectangle from View A and View C? Because the 2-D representation does not show depth, we cannot see when a face is sloping.

Novice 1 Set 5:

- In the other arrangements, the blocks looked the same from opposite sides. In this arrangement, the blocks look different in View B and View D. Why do you think this is? The tall blue block hides part of the red block in View B, but not in View D.
- Are the blocks in the same position in all four cards? No, however View A and View C are mirror opposites.

Novice 1 Set 6:

- How many blocks were used in this arrangement? Three.
- Could all the blocks be seen from all views? No, in View B we can’t see the yellow block and in View D we can’t see the orange block.
- Is there more than one way to position the orange block on the grid? No, because both View A and View B show us the triangular face of the block so there is only one way to position it.

Novice 1 Set 7:

- Do the blocks look the same in all four cards? No, but their shape does look the same from View B and View D (although positions differ). In View A and View C, the red block does not look the same and the purple block cannot be seen in View A. The orange block looks like mirror opposites in View A and View C.
- Are the blocks in the same position in all four cards? No, View B and View D are mirror opposites.
- Why does the orange block look like a square in both View B and View D? Because the 2-D representation does not show depth, we cannot see when a face is sloping.

Novice 1 Set 8:

- Do the blocks look the same in all four cards? No. The red block looks the same in View A, View C and View D (and the position is the same). The yellow block looks the same shape only in View B and View D (although positions are different). The dark blue block looks the same shape only in View A and View D (although positions are different).
- Is there more than one way that you can place the blocks to satisfy the arrangement from all views? Yes, there are four different ways that the children could place the dark blue block.
Novice 1 Set 8 continued:

- Why does the dark blue block look like a square from View A and View D? *It could be that the flat faces are showing.* However, even if a sloped view is showing, the 2-D representation does not show depth so we cannot tell if it is a flat face or the sloped face.

- In the absence of colour, could you have used another block in the place of the dark blue block to create the same arrangement? *Yes, the purple block could have been used in place of the dark blue block.*

Novice 1 Set 9:

- Do the blocks look the same in all four cards? *No.* The yellow block looks the same in View B and View D (but position is different) and the green block looks the same shape in View A, View C and View D (but position is different).

- Is there more than one way that you can place the blocks to satisfy the arrangement from all views? *Yes, there are four different ways that children could place the orange block.*

- Why can we not tell from View B and C that the orange block is triangular? *The orange block has been placed on a triangular face. Therefore we can either see the flat square and flat rectangular face or the flat square and sloped rectangular face.*

Novice 1 Set 10

- Do the blocks look the same in all four cards? *No.* The yellow block looks the same in View B and View D (opposite views) and View C (rotated). The red block looks the same in View A and View C and in View B and D (opposite views). The blue block looks the same only in View A, View B and View D.

- Take the three blocks off the grid and study them carefully. Which of these blocks could be viewed in three different ways? *Only the red block because it has three different dimensions (1-by-2-by-3).*
Novice 2 Set 1:

- Do the blocks look the same in all four cards? Yes. The green block is a 1-by-1 square and the purple block is a 2-by-2 square in all four views.
- Are the blocks in the same position in all four cards? No, however opposite views are mirror opposites.

Novice 2 Set 2:

- Do the blocks look the same in all four cards? Yes. The green block is a 1-by-1 square, the purple block is a 2-by-2 square and the blue block is a 1-by-3 rectangle in all four views.
- Are the blocks in the same position in all four cards? No, however opposite views are mirror opposites and View A is the same as View B and View C is the same as View D.

Novice 2 Set 3:

- Do the blocks look the same in all four cards? No. The yellow block looks the same in View A and View C and looks the same in View B and View D (opposite views). The orange block looks the same only in View A and View C.
- Are the blocks in the same position in all four cards? No, however opposite views are mirror opposites.
- Is there more than one way that you can place the blocks to satisfy the arrangement from all views? No. View B and View D show us which way the sloped face should go.
- Why can we not tell from View A and View C that the orange block is triangular? The orange 2-D representation does not show depth, so the sloped face looks like a flat rectangle.

Novice 2 Set 4:

- Do the blocks look the same in all four cards? No. The yellow block looks the same in View A and View C and looks the same in View B and View D (opposite views). The orange block looks the same only in View B and View D. The red block looks the same in View A and View C and in View B and View D (opposite views).
- Are the blocks in the same position in all four cards? No, however opposite views are mirror opposites.
- Is there more than one way that you can place the blocks to satisfy the arrangement from all views? No, because View A and View C show us which way the sloped face should go.
- Why can we not tell from View B and View D that the orange block is triangular? The orange 2-D representation does not show depth, so the sloped face looks like a flat rectangle.
- Take the three blocks off the grid and study them carefully. Which of these blocks could be viewed in three different ways? Only the red block because it has three different dimensions (1-by-2-by-3).
GEORGE CONSTRUCTION KIT ACTIVITIES

In this activity we expect children to develop:

- Confidence in describing, sorting and comparing 3-D objects according to the 2-D shape of the faces
- Confidence in observing and building given 3-D objects using concrete materials

For this activity you will need:

- GeoGenius Construction Kit (at least one Super Kit per 5 children)
- GeoGenius Construction Kit Activity Cards 7 to 18

Teacher’s role:

Give each child (or pair of children) a GeoGenius Construction Kit Activity Card and sufficient pieces from a GeoGenius Construction Kit and elastic bands. Tell the children to follow the instructions on the card. The children should be able to work on these cards independently of the teacher. The advantage of working in pairs is that the children can talk about what they are doing. The disadvantage of working in pairs is that only one child can actually do the building at a time. It is not recommended that these Activity Cards be done in groups of more than two.

In these activities, the children are going to recreate the polyhedra in the images on the cards, using pieces from the GeoGenius Construction Kit. If the children have not had the opportunity to play with this kit before, the teacher may need to help them by showing them how to use elastic bands to join the tabs.

As the children are working, the teacher could ask them:

- Which shape did you start with?
- Could you have started with a different shape?
• How did you decide which shapes to join together?
• Can you see any patterns in the shapes that you are joining?

Make time for constructions to be taken apart and packed away neatly so that the kit can be used again.

What to expect from the children:

The main focus of these activities is for the children to play with and gradually start to recognise some of the properties of polyhedra.

The children are not expected to use formal mathematical vocabulary yet.

The notes on specific cards give guidance to teachers on what the children may notice, but should not be explicitly taught to the children.

Activity Card 7:
In this activity, the children are to use 12 pentagons, 30 squares and 20 (equilateral) triangles to build a rhombicosidodecahedron.

The teacher may want to encourage the children to focus on the vertices and ask them what shapes they need to join to create each specific point. At every vertex there is a pentagon, a square, a triangle and another square.

Activity Card 8:
In this activity, the children are to use 8 hexagons, 12 squares and 6 octagons to build a great rhombicuboctahedron.

The teacher may want to encourage the children to focus on the vertices and ask them what shapes they need to join to create each specific point. At every vertex there is a hexagon, a square and an octagon.

Activity Card 9:
In this activity, the children are to build five types of prisms and compare the similarities and differences.

The triangular-based prism is made from two (equilateral) triangles and three rectangles. The square-based prism is made from two squares and four rectangles. The pentagonal-based prism is made from two pentagons and five rectangles. The hexagonal-based prism is made from two hexagons and six rectangles. The octagonal-based prism is made from two octagons and eight rectangles.

All the prisms are made by joining two identical shapes with rectangles. It is the shape joined by the rectangles that is different in each prism.
Activity Card 10:
In this activity, the children use 12 pentagons and 20 hexagons to build a truncated icosahedron. The teacher may want to encourage the children to focus on the vertices and ask them what shapes they need to join to create the specific point?" At every vertex there are two hexagons and a pentagon.

Activity Card 11:
In this activity, the children are to build five types of anti-prisms and compare the similarities and differences. The triangular-based anti-prism is made from two (equilateral) triangles and six interlocking (isosceles) triangles. The square-based anti-prism is made from two squares and eight interlocking (isosceles) triangles. The pentagonal-based anti-prism is made from two pentagons and ten interlocking (isosceles) triangles. The hexagonal-based anti-prism is made from two hexagons and 12 interlocking (isosceles) triangles. The octagonal-based anti-prism is made from two octagons and 16 interlocking (isosceles) triangles.

All the anti-prisms are made by joining two identical shapes with interlocking triangles. It is the shape joined by the triangles that is different in each anti-prism.

Activity Card 12:
In this activity, the children are to build a hexagonal-based prism, a hexagonal-based anti-prism and a hexagonal-based pyramid.

They are similar in that they all have a hexagonal base. Two hexagons are joined by rectangles in the prism and two hexagons are joined by interlocking triangles in the anti-prism. The pyramid only has one hexagon and the triangles joined to this hexagon meet at a point.

Activity Card 13:
In this activity, the children are to use 30 squares, 20 hexagons and 12 decagons to build a rhombicosidodecahedron.

The teacher may want to encourage the children to focus on the vertices and ask them what shapes they need to join to create the specific point. At every vertex is a square, a hexagon and a decagon.

Activity Card 14:
In this activity, the children are to use squares and (equilateral) triangles to build a snub cube. The teacher may want to encourage the children to focus on the vertices and ask them what shapes they need to join to create the specific point. At every vertex is a square and four (equilateral) triangles. The children also build a faceted cuboctahedron using squares and (equilateral) triangles. The equilateral triangles form a concave 'pyramid'.

Activity Card 15:
In this activity, the children build a stellated icosahedron using (isosceles) triangles. This is a concave polyhedron that has 10 (isosceles) triangles meeting at every vertex. It has 20 ‘points’, which each resemble a triangular-based pyramid.
Activity Card 16:
In this activity, the children are to build a stellated dodecahedron using (isosceles) triangles. This is a concave polyhedron that has 6 (isosceles) triangles meeting at every vertex. It has 12 ‘points’ which each resemble a pentagonal-based pyramid.

Activity Card 17:
In this activity, the children are to build a faceted icosidodecahedron using (isosceles) triangles and (equilateral) triangles. This is a concave polyhedron that has 6 triangles meeting at every vertex (2 isosceles triangles, 1 equilateral triangle, 2 isosceles triangles and 1 equilateral triangle). It has 12 ‘inverted pentagonal-based pyramids’.

Activity Card 18:
In this activity, the children are to build a small dodecahemidodecahedron using (isosceles) triangles and pentagons. This is a concave polyhedron that has 4 (isosceles) triangles and 2 pentagons meeting at every vertex (2 isosceles triangles, a pentagon, 2 isosceles triangles, a pentagon). It has 20 ‘inverted triangular-based pyramids’.
CONNECTING CUBES ACTIVITIES

In this activity we expect children to develop:

- Confidence in building given 3-D objects using building blocks
- Opportunities to describe one 3-D object in relation to another

For this activity you will need:

- 40 connecting cubes per child
- Connecting Cubes Activity Cards 2 and 10 to 18
- Square-dotted paper

Teacher’s role:

The children are able to work on these cards independently of the teacher and can work individually or in pairs.

Each child will need no more than 40 connecting cubes and an Activity Card. In these activities, the children are not expected to build the structures using the same colour connecting cubes as in the picture.

When possible, the teacher should take the opportunity to observe how the children join the connecting cubes and informally assess how the children think about the objects.

It is important that the children start to recognise that holding a shape in a different position does not make it a different shape. The two green shapes are the same and all the orange shapes are the same.

In Activity Card 2, the children are to investigate how many different shapes they can make with 3, 4 and 5 connecting cubes.

In Activity Cards 10 and 13, the children are to build shapes and analyse which are the same. The children are also expected to consider the possibility that some blocks could be hidden in the 2-D representation of the 3D arrangement.
In Activity Cards 11, 12 and 14, the children should start to consider what the 2-D representation of the 3-D arrangement will look like from different views. They are not expected to draw these representations yet. Ask the children what they notice about the opposite views. The should notice that these views are the mirror reflections of each other.

In Activity Cards 15 and 18, the children are required to draw the structure which they have built from different views. They will need square-dotted paper to do this (see the print master at the end of this guide).

In Activity Cards 16 and 18, the children are to build more complicated structures and consider where other blocks might be hidden.

What to expect from the children:

The main focus of these activities is for the children to play with and gradually start to recognise the interconnectedness of a 3-D arrangement and its 2-D representation.

The children should become aware that some blocks may be hidden in the 2-D representation depending on from what view it is represented.

When the children consider views, they often find it difficult to accept that the 2-D representation does not show any depth but only the outline of what we see.

Activity Card 2 solutions:

There are only two different ways to join 3 blocks.

![Two ways to join 3 blocks](image1)

There are eight different shapes that can be built using 4 blocks.

![Eight different shapes](image2)
Activity Card 2 solutions continued:

There are 29 different shapes that can be built using 5 blocks.
Activity Card 2 solutions continued:

None of the shapes are the same.

Activity Card 5 solution:
None of the shapes are the same.
Activity Card 6 solutions:
A and C are the same and B and D are the same. The others are different, however, there exists the possibility that there is a seventh block hidden behind A and a seventh block hidden behind B. The illustration below shows A and B from a different view where the possible seventh block is visible.

Activity Card 7 solutions:
A and B use only 6 blocks. C and D can use 6 or 7 blocks. The 7th block is hidden in the image that can be seen. The illustration below shows C and D from a different view where the possible 7th block is visible.

Activity Card 8 solutions:
A, B and C are not the same. It is possible to build A with a seventh cube that is hidden in the view given.

Activity Card 9 solution:
The shapes are the same because they all have 5 connecting cubes joined to form an ‘L-shape’. The position of the sixth cube, which is placed on top of the ‘L’, is what is different in each shape.

Activity Card 10 solutions:
A and C are the same. D is the mirror image of A and C, but they are not the same.

Activity Card 11 solutions:
6 blocks are used (presuming none are hidden)
Image 1 could be the view from D or from B.
Image 2 is the view from C and image 3 is the view from A.
Activity Card 12 solutions:
6 or 7 blocks can be used. If the children use seven blocks, image 2 is not possible from any of the four views so the children will need to revise their construction to use only 6 cubes.

Image 1 is the view from D, image 2 is the view from both A and C and image 3 is the view from B.

Activity Card 13 solution:
They are the same.

Activity Card 14 solutions:
This structure uses 5 blocks.

Image 1 is the view from C, image 2 is the view from A, image 3 is the view from D and image 4 is the view from B.

Activity Card 15 solutions:
The views of the orange structure are:

![View A](image1)
![View B](image2)
![View C](image3)
![View D](image4)

The views of the yellow structure are:

![View A](image5)
![View B](image6)
![View C](image7)
![View D](image8)

Activity Card 16 solutions:
In this activity, the children are to build a structure using at least 15 blocks. They are shown how to do this step-by-step.

In the first step, the children can only use 7 blocks for part of the bottom layer.

In the second step, the children can add four new blocks: two in the first layer and two in the second layer (represented in the diagram as blue blocks). However, it is also possible that the children add a fifth cube which is hidden in the view on the diagram. This hidden cube is shown in red here:
Activity Card 16 solutions continued:
In the third step, the children are to add at least four new blocks (represented in the diagram as yellow blocks). There may be up to another four other blocks hidden behind the structure.

The minimum number of blocks that the children can use to build this structure is 15. The maximum number of blocks that the children can use to build this structure is 20.

Activity Card 17 solutions:
In this activity, the children create a structure using the least number of blocks, which is 16, and then think about how many blocks they can hide behind the structure before the extra blocks become visible in the representation. Up to 8 blocks can be hidden behind this structure.

Activity Card 18 solutions:
8 blocks can also be used.

View A          View B          View C          View D
INTRODUCTION

Human beings have always had, and continue to have, a fascination with and a need to compare, measure and quantify. In this section, we want children to experience measurement as part of our natural desire to compare and contrast, doing so with increasing sophistication as they move through the early years of development.

Measurement involves the comparison of an attribute of an object or situation with a unit that has the same attribute: length with centimetres or metres; mass with grams and kilograms and so on. This section has been grouped into a part that deals with time and another that deals with the attributes capacity, mass (or weight), length, area and volume.

The study of measurement in the activities of these teacher guides also provides a very useful context for collecting data which can be meaningfully analysed to draw conclusions, i.e. a link to Data Handling.

RESOURCES

See resources under separate Time and Capacity, Mass (Weight), Length and Area sections.
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”. At this age, children are in the pre-operational stage, according to Piaget, and they 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: 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. in order to develop the time concept and its measurement in a concrete way.

_Time cards_

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 and on learning the language of time. It 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. 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 for 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 sorting events according to the time of day. The cards, each depicting an event, come in four sets arranged by colours: red, blue, green and purple and represent increasingly complex situations. In total there are 28 event cards that can be used in the tasks and games suggested here.

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.

The **NumberSense Telling Time Cards** 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 are a total of 52 cards in a pack.

The activities described in this guide should be repeated frequently, changing the cards and adding more cards as the children gain confidence with the different concepts associated with time.

**RESOURCES**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Number required</th>
<th>Available from</th>
</tr>
</thead>
<tbody>
<tr>
<td>NumberSense Event Cards</td>
<td>1 pack per class</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>NumberSense Telling Time Cards</td>
<td>1 pack per class</td>
<td>Brombacher &amp; Associates</td>
</tr>
<tr>
<td>Analogue wall clock</td>
<td>1 per classroom</td>
<td></td>
</tr>
<tr>
<td>Digital wall clock</td>
<td>1 per classroom</td>
<td></td>
</tr>
<tr>
<td>Analogue clock with moveable</td>
<td>1 per classroom</td>
<td></td>
</tr>
<tr>
<td>hands</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ACTIVITY 1: DURATION

In this activity we expect children to develop:

- Awareness of the duration of events
- The ability to compare the duration of two or more events
- Confidence in ordering events according to duration
- Vocabulary to describe the duration of events using words such as: faster, slower, longer and shorter

For this activity you will need:

- The red, blue, green and purple NumberSense Event Cards

Teacher’s role:

- Shuffle the cards.
- Let the children take turns drawing three cards from the pack. Let them place the cards side by side in any sequence. See the example below:
  
  I do my homework.
  I wait for the school bus.
  I have a bath.

- Tell the children to order the cards according to the duration of the events on the cards.
- Ask each child to say which of the three events on the cards takes the longest. And the shortest? Why do they say so?
- Ask the children to explain how they ordered the cards. Encourage children to use time words such as shorter, fast, longer and slower to describe the duration of the events.
- Make sure that they draw comparisons across all three events, for example:
What to expect from the children:

In this activity children develop awareness that events have duration. Understanding duration of events is an important part of learning about time and how life is organised around it. The focus is not just on learning about duration, but also on learning the vocabulary to describe duration. This includes words such as fast, slow, longer and shorter. Continue to encourage children to use these words.

Note that even if two events take almost the same time, this can form part of the discussion. For example, eating dinner and eating lunch might take the same amount of time for some children, but be different for others. You could ask questions like:

- Why does it take longer for your friend to eat lunch than it does for you?
- Why does dinner take longer than lunch at your house?
- It takes longer for your friend to walk home than it does for you to walk home. Why is that?
- Are there any events that take all of us the same time to complete?

When ordering the duration of the events on the cards, bear in mind that children may not all have the same daily routine, or that the events of their routines do not all take the same time. Allow for this variation when discussing their solutions.
ACTIVITY 2: MATCHING ANALOGUE CLOCKS, DIGITAL CLOCKS AND WRITTEN TIME

In this activity we expect children to develop:

- The ability to tell the time in hours, half hours, quarters of an hour and minutes on analogue and digital clocks
- An understanding of the different formats in which time is represented

For these activities you will need:

- The red, blue, green and purple NumberSense Telling Time Cards

Teacher’s role:

Part 1 (Matching clock faces and written time)

- Work with one group of children at a time on the mat. This activity can be included as a component in the daily mat routine once a week.
- Select cards from the NumberSense Telling Time Cards. Make sure that you select cards that are matched to the confidence level of the group that you are working with. Children should first work with whole hour times, then time involving half hours, then quarters of an hour and finally minutes. Use only the cards with the analogue clock faces and the cards with the written time. Set the cards with the digital clock faces aside for now.
- Place the cards with the written time on the mat in no particular order.
- Shuffle the remaining cards with the analogue clock faces.
- Let the children take turns to draw a card from the pack of cards with the analogue clock faces. For example:
  - Once they have drawn the card, ask them to tell the time on the clock (two o’clock).
  - Ask the child to find the matching card with the written time that has been placed on the mat and place the clock face and corresponding time card on the mat. For example:
  - The game can be repeated by using the cards with the digital clock faces instead of the analogue clock faces to match to the written time.
Part 2 (Matching analogue clock faces to digital clock faces)

- Select cards from the NumberSense Telling Time Cards. Make sure that you select cards that are matched to the confidence level of the group that you are working with. Children should first work with whole hour times, then time involving half hours, then quarters of an hour and finally minutes. Use only the cards with the analogue clock faces and the cards with the digital clock faces. Set the cards with the written time aside.

- Place the cards with the digital clock faces on the mat in no particular order.

- Shuffle the cards with the analogue clock faces.

- Let the children take turns to draw a card from the pack of cards with the analogue clock faces. For example:

- Once they have drawn the card, ask them to tell the time on the clock (half past three).

- Ask the child to find the matching card with the digital clock face that has been placed on the mat.

- The game can be played the other way around by placing the analogue clock faces on the mat and having the children match the cards with digital clock faces instead.

Part 3 (Match analogue clock faces, digital clock faces and written time)

- Use the purple cards from NumberSense Telling Time Cards.

- Place all the cards on the mat in no particular order.

- Let the children take turns to pick any one of the cards. It can be the digital clock faces, analogue clock faces or the written time. For example, in this case the child selects a card with the written time first.

- Once they have drawn the card, ask them to tell the time on the card (ten past seven).

- Ask the child to find the cards in the other formats that correspond to the one they have drawn. In the end the child should have three cards: the matching Analogue Time Card, Digital Time Card and the Written Time Card. For example:
What to expect from the children:

Telling the time on a clock is very confusing at first. For this reason it is important that the children are used to their teacher pointing to the clock on the classroom wall and saying, “It is two o’clock” etc. at regular intervals during the day. Only after they have experienced this for several weeks/months will they be ready for these activities. Ideally there will be a large analogue clock next to a large digital clock that the teacher can refer to.

This can be a challenging set of activities for children as they are converting between digital time, analogue time and written time. Because of the frequent references that the teacher has made to the clock on the wall in the class in the weeks before starting these activities, it is hoped that the children will gain confidence quickly.

It can be confusing for children that the numerals on the analogue clock have dual meanings. Not only do they refer to the hour, but also to multiples of five minutes. Explain the number of minutes in an hour and use skip counting in fives if necessary.

Children will initially be more comfortable to tell the time on the hour, but will find it more challenging as telling time becomes more complicated (telling time to the half hour, quarter hours and minutes) and the introduction of “5 minutes past” and “5 minutes to”.

• Continue in this manner until all cards are matched.
ACTIVITY 3: TELLING THE TIME

In this activity we expect children to develop:

• An understanding of the link between events in their daily lives and clock time
• Confidence in telling time in analogue, digital and written format and to associate times of the day with events in their lives
• Awareness of the time of the day at which certain events typically happen

For these activities you will need:

• The green and purple NumberSense Telling Time Cards and NumberSense Event Cards

Teacher’s role:

Part 1

• Work with one group of children at a time on the mat. This activity can be included as a component in the daily mat routine once a week.

• Select cards from the NumberSense Telling Time Cards and the NumberSense Event Cards. Make sure that you select cards that are matched to the confidence level of the group that you are working with. Children should first work with whole hour times, then time involving half hours, then quarters of an hour and finally minutes:

• Select the Event Cards that you will use and place them on the mat. From the Telling Time Cards select either the Analogue Time Cards, the Digital Time Cards or the Written Time Cards. Put the remaining Telling Time Cards away.

• Let the children take turns to select an Event Card, to say at what time the event typically takes place and to select the corresponding correct Telling Time Card.

• For example, if the child selects the Event Card: “I wake up” they may say that it happens at six o’clock and select the corresponding Telling Time Card (analogue, digital or written time, depending on what
the teacher has selected) that shows six o’ clock. The child then puts the two cards down next to each other on the mat.

Part 2

- Select cards from the NumberSense Telling Time Cards. Make sure that you select cards that are matched to the confidence level of the group that you are working with. Children should first work with whole hour times, then time involving half hours, then quarters of an hour and finally minutes.
- Use the cards with the analogue clock faces. Put the cards down on the mat in no particular order.
- Ask “At what time does ....?” type questions and let the children take turns to answer the question and select the corresponding Telling Time Card. Involve the rest of the group in a discussion on whether or not the child’s answer is reasonable. Possible questions include:
  - At what time do you eat breakfast?
  - What time of the day do you go to bed?
  - At what time does school close?
  - At what time is break?
  - At what time will you go to bed this evening etc.?
- The game can be repeated using the Digital Time Cards and Written Time Cards.

Part 3

- Select cards from the NumberSense Telling Time Cards. Make sure that you select cards that are matched to the confidence level of the group that you are working with. Children should first work with whole hour times, then time involving half hours, then quarters of an hour and finally minutes.
- Use the cards with the analogue clock faces. Put the cards down on the mat in no particular order.
- Let the children take turns to select a card (or work with the card that you provide to them). Each child must read the time on the card out loud and think of an activity that they do at this time of the day. Involve the rest of the group in a discussion on whether or not the child’s answer is reasonable.
  - For example, you can ask, “What happens at nine o’ clock?” Encourage the child to respond using a full sentence. For example, “At nine o’ clock I like to have a snack.”
- The game can be repeated using the Digital Time Cards and Written Time Cards.
What to expect from the children:

Children might not yet be aware of, or be able to connect the time of day and events that occur. Before attempting this activity, make sure children are confident in telling the time using digital and analogue clocks (Activity 4). Ideally, there should be a large analogue clock next to a large digital clock on the wall of the classroom that the teacher refers to frequently. The teacher should regularly point to both clocks on the wall, ask children what time it is and to describe what they are doing. Ask questions like:

What time is it now? What are we doing now?
• Can you remember what time you came to school?
• What time do we go home?
• It is now 10 o’clock. What do we usually do now?
• What happens at two o’clock?

Through these discussions children begin to understand how events in life can be described in terms of the time at which they occur. They also come to realise that, generally, life is organised by time. Eventually they will develop the ability to manage their lives in terms of time. When children say the time at which events occur, lead a discussion about how they know. They could respond by saying, for example, that their mothers tell them, or that they look at the clock to know. If they look at the clock, ask them to describe the clock face at that time.

The purple cards in Grade 3 will also require children to think about days of the week and times of the year. For example, the card “We drive to a holiday destination.” describes an event that does not happen every day, instead it happens only at certain times of the year and quite probably on certain days of the week. You should be able to lead a discussion around this.

It is an important developmental step for children to link events to the time of day. They should be given frequent opportunities to experience and describe the times of the day at which events typically take place and also to list events that typically take place and at different times of the day.
ACTIVITY 4: ELAPSED TIME

In this activity we expect children to develop:

- An understanding of elapsed time
- Confidence in calculating elapsed time using clock faces if appropriate

For these activities you will need:

- The blue, green and purple NumberSense Telling Time Cards and NumberSense Event Cards

Teacher’s role:

Part 1

- Work with one group of children at a time on the mat. This activity can be included as a component in the daily mat routine once a week.
- Use the NumberSense Telling Time Cards. Make sure that you select cards that are matched to the confidence level of the group that you are working with. Children should first work with whole hour times, then time involving half hours, then quarters of an hour and finally minutes.
- In Grade 3 you can use the blue, green and purple cards. If working with one set of cards is too challenging for the group, revert to an easier set of cards, before attempting working with the more demanding set again.
- Choose either the Analogue Time Cards or the Digital Time Cards.
- Select two cards from the card set. Start with a pairs of cards for which the difference in time between the two cards is a whole number of hours, for example:
- Choose one of the children in the group and ask the child to read the time on each card. Ask them first to sequence the cards from the earliest time to the latest time and then to say how much time has passed.
- Repeat for each child in the group. As the children gain confidence you can increase the complexity of the task by using cards that involve elapsed time in hours and half hours.
(using the blue cards), then hours and quarters and three-quarters of an hour (using the green cards) and finally hours and minutes (using the purple cards). The activity can be repeated with the Digital Time Cards and the Written Time Cards.

Part 2

- Use the NumberSense Telling Time and Event Cards. Make sure that you select cards that are matched to the confidence level of the group that you are working with. Children should first work with whole hour times, then time involving half hours, then quarters of an hour and finally minutes.

- In Grade 3 you can use the blue, green and purple cards. If working with a particular set of cards is too challenging for the group, revert to an easier set of cards, before attempting working with the more demanding set again.

- Choose either the Analogue Time Cards or the Digital Time Cards.

- Draw a card from the Event Cards and select a starting time for the event from the Telling Time Cards. For example:

  • Choose one of the children in the group and ask the child to read the time on the card. Ask them how long they think it will take to complete the activity. Let them state at which time they think the activity will end and select the corresponding correct Telling Time Card.

  • Repeat for each child in the group. As the children gain confidence you can increase the complexity of the task by using cards that involve time in hours and half hours (using the blue cards), then hours and quarters and three quarters of an hour (using the green cards) and finally hours and minutes (using the purple cards).

- The activity can be repeated with the Digital Time Cards and the Written Time Cards.

Part 3

- Use the NumberSense Telling Time Cards and NumberSense Event Cards. Make sure that you select cards that are matched to the confidence level of the group that you are working with. Children should first work with whole hour times, then time involving half hours, then quarters of an hour and finally minutes.

- In Grade 3 you can use the blue, green and purple cards. If working with a particular set of cards is too challenging for the group, revert to an easier set of cards, before attempting working with the more demanding set again.
Choose either the Analogue Time Cards or the Digital Time Cards.

Draw a card from the Event Cards and select an ending time for the event from the Telling Time Cards. For example:

Choose one of the children in the group and ask the child to read the time on the card. Ask them how long they think it took to complete the activity on the card. Let them state the time at which time they think the activity started and select the corresponding, correct Telling Time Card.

Repeat for each child in the group. As the children gain confidence you can increase the complexity of the task by using cards that involve time in hours and half hours (using the blue cards, then hours and quarters and three quarters of an hour (using the green cards) and finally hours and minutes (using the purple cards).

The activity can be repeated with the Digital Time Cards and the Written Time Cards.

What to expect from the children:

Before attempting this activity, make sure children are confident in telling the time using digital and analogue clocks (Activity 3). Ideally there should be a large analogue clock next to a large digital clock on the wall of the classroom that the teacher refers to frequently, pointing to the clocks on the wall, and asking children what time it is and to describe what they are now doing. Ask questions like:

- What time is it now? What are we doing now?
- Can you remember what time you came to school?
- What time do we go home?
- It is now 10 o’clock. What do we usually do now?
- What happens at two o’clock?

Children will typically employ different strategies to calculate elapsed time. These strategies will in all likelihood match their early calculation strategies including: count up from and count back to. Discuss these strategies used by the children with the group on the mat. When giving answers, ask children questions such as:
• How did you calculate that? Is there another way to work that out?
• How is your friend’s method different to yours?
• Which method makes the most sense to you and why?

Understand that elapsed time can be challenging for children who are still developing their concept of time. Calculating elapsed time is a shift from a concrete to a more abstract experience of time. Provide children with frequent opportunities to think about the elapsed time (duration) of events and later elapsed time between events.
The development of an understanding of measurement follows a similar progression irrespective of the attribute (capacity, volume, mass, length 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 develop from non-standard and informal units to more formal units.

3. Finally, the children come to 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, the early activities in this guide focus on children comparing objects by filling them in order to develop an awareness of volume/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; for example 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? How much longer is the larger object? In the early activities in this guide, children quantify (measure) attributes using non-standard, but familiar units such as cups, paper clips, unifix cubes, beans, marbles and toothpicks. The activities 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 involves the children in developing 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. That said, 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 this guide 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.

RESOURCES

About the resources, you will need:

- An assortment of objects /containers that can be filled, weighed, and whose length(s) can be measured. The container assortment should include containers that are similar in some regards, but different in others – for example similar in height, but different in capacity. We want the children to compare objects in terms of their different attributes. If the objects are too obviously different then the measurement activity becomes unimportant and children lose interest. The table on the following page has a list of suggested objects/containers.

- A range of informal non-standard units of measurement. These should include objects (units) that are different in size, weight and shape so that the children gain experience in filling, weighing and measuring large objects with different (smaller and larger) units. We want children to develop awareness that while a smaller unit may result in a more accurate measurement, measuring the attribute with the small unit is also more time-consuming. By contrast, the larger the measuring unit the less accurate the measurement, even if measuring the attribute was more time-efficient. The table on the following page has a list of suggested measuring units.

- A balance scale. If you do not have a balance scale, it is easy to make.
Resource | Number required
---|---
**Assortment of objects /containers that can be filled, weighed, and whose length(s) can be measured.**
Plastic containers: 250ml, 500ml, 1L and 2L etc. | 
Plastic cooldrink bottles: 250ml, 500ml, 1L and 2L etc. | 
Glass cooldrink bottles: 250ml, 500ml, 1L and 2L etc. | Enough for each group to work independently. 
Glass containers: e.g. jam jars, peanut butter jars and chutney bottles etc. | 
Cardboard boxes: e.g. milk cartons, packaging boxes etc. | 
**A range of informal, non-standard units of measurement.**
Water, rice, sand – these can be used with spoons, cups, scoops (such as a small yoghurt cup), zip lock bags filled, small bottles filled | Enough for each group to work independently, and enough to fill the largest container, balance the heaviest container and measure the tallest container. 
Beans, marbles, unifix or connecting cubes etc. | 
Toothpicks, paper clips, ice cream sticks etc. | 
**Other**
Tablespoons | 
Teaspoons | Enough for each group to work independently. 
Cup measures | 
Balance scale | Enough for one per group (see illustration of a balance scale that you can make yourself). 

OVERVIEW OF THE UNIT

In this unit we only describe the activity once. However, the same activity is repeated many times for length, for volume and for mass (weight) for perimeter and for area. Typically we expect that children will do up to two activities with length, volume and mass (weight) each term. A number of different suggestions are made for different combinations of objects and units. Teachers should adapt these for their classes and according to the resources that they have available.
LENGTH, MASS, CAPACITY AND AREA ACTIVITIES

In these activities we expect children to develop:

- Confidence in estimating, measuring, comparing and ordering objects in terms of capacity, mass and length using non-standard measures (e.g. spoons, cups, bricks, sandbags, hand spans, footsteps etc.) as well as introducing standard measures (e.g. litres, kilograms, metres)

For this activity you will need:

- Resources from the resources list as appropriate to each activity
- A recording table for each activity

Teacher’s role:

It is vital that the children actively participate in the filling, weighing and measuring experiences with a range of containers and measuring units. Furthermore, they should have many opportunities to do this throughout the year.

Managing these activities:

- Select the objects that the children will work with.
- Determine the attribute (capacity, mass [weight] and length) that the children will measure and the unit that they will use to do the measuring.
- Develop a recording table for the children to record their results on. Ask the children to estimate and record this in the table before they record their actual findings (so each block will have an estimation and a recorded value). Below you will find a number of examples with some notes on each one. Each of these suggestions should be treated as a separate activity completed on a different day. You should adapt these examples to the objects to be measured and the units that are available in your class.
- Make sure that the children know what to do and let them complete the table.
- **NOTE:** Children should complete each measurement to the nearest whole number of the measuring unit. At this stage we don’t want children worrying about parts of the measuring unit.
- Lead a reflective discussion with the students. Suggested questions to guide the reflection include:
  - Which container holds/weighs the most? Which container is the tallest?
Which holds/weighs the least? Which container is the shortest?

Did you know these answers before you completed the table? How could you have known?

Did you all get the same results? If not, why not?

Can you explain any irregularities that you observed?

Describe your reasons for choosing the units that you did.

Discuss the advantages/disadvantages of the different units.

What to expect from the children:

This activity allows for repeated practical experiences with filling, weighing and measuring various containers, using a range of units.

The focus here is for the children to gain experience and confidence in filling, weighing and measuring a variety of containers/objects, using a variety of units. Through this practical activity the children will experience measuring larger containers with smaller units, as well as measuring smaller containers with larger units. For each activity children will fill, weigh and measure the same containers using two different units. This should generate discussion about the suitability of the various units in measuring the specific attribute. In order to develop this awareness, the teacher suggests one unit, and leaves the children to choose their own second unit. Children should be encouraged to explain the reasons for selecting their unit of choice.

Children should develop an awareness of the different measurable and comparable attributes (capacity/volume, weight/mass and length) that an object can have. They should also develop an awareness of the suitability of the unit used to measure the attribute – 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. Using two different units for measuring the same attribute, in the same activity, draws attention to these issues. Awareness of these important issues is reinforced by creating discussion on the reasons for the children’s unit selection.

Through these activities children should develop the realisation that when comparing two or more objects, it is important to focus on the attribute that is being compared. For example, the taller container does not necessarily weigh more or have a greater volume than the shorter container.

As children develop an awareness of need to select suitable units to measure an attribute (often balancing the need for efficiency with precision) they will also start to realise the need for standardised units.
**Suggested capacity activities**

1. How many marbles and __________ fill each container?
   (select your own unit)

<table>
<thead>
<tr>
<th>Fill</th>
<th>2L cooldrink bottle</th>
<th>chutney jar</th>
<th>½ L cooldrink bottle</th>
</tr>
</thead>
<tbody>
<tr>
<td>marbles</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Teacher notes on capacity example 1:**
A good alternate measuring unit for this table would be a cup measure. The marbles, while providing greater precision, take a long time to use.

2. How many cubes and __________ fill each container?
   (select your own unit)

<table>
<thead>
<tr>
<th>Fill</th>
<th>peanut butter jar</th>
<th>yoghurt tub</th>
<th>ice cream tub</th>
</tr>
</thead>
<tbody>
<tr>
<td>cubes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Teacher notes on capacity example 2:**
A good alternate measuring unit could be the bags of water.

3. How many tablespoons of water and __________ fill each container?
   (select your own unit)

<table>
<thead>
<tr>
<th>Fill</th>
<th>chutney jar</th>
<th>1L milk carton</th>
<th>peanut butter jar</th>
</tr>
</thead>
<tbody>
<tr>
<td>tablespoons of water</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Teacher notes on capacity example 3:**
The activity deliberately uses an inefficient unit of measure. The expectation is that children will select the cup as their alternate choice for unit and may fill a cup with tablespoons of water, then fill the
containers with cups of water and top up with tablespoons of water, and finally calculate: number of tablespoons = number of cups \( \times \) number of tablespoons per cup + number of tablespoons to fill up the container. Don’t force this approach, just look out for it.

**Suggested mass/weighing activities**

1. **How many beans and ____________ balance each container?**
   (select your own unit)

<table>
<thead>
<tr>
<th>Weigh</th>
<th>peanut butter jar</th>
<th>yoghurt tub</th>
<th>ice cream tub</th>
</tr>
</thead>
<tbody>
<tr>
<td>beans</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   **Teacher notes on mass (weighing) example 1:**
   A good alternate measuring unit for this table would be marbles. The beans, while providing greater precision, take a long time to use.

2. **How many sandbags and ____________ balance each container?**
   (select your own unit)

<table>
<thead>
<tr>
<th>Weigh</th>
<th>2L cooldrink bottle</th>
<th>chutney jar</th>
<th>( \frac{1}{2} ) L cooldrink bottle</th>
</tr>
</thead>
<tbody>
<tr>
<td>sandbags</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   **Teacher notes on mass (weighing) example 2:**
   A good alternate measuring unit could be cubes or marbles which are also a good option.

3. **How many teaspoons of rice and ____________ balance each container?**
   (select your own unit)

<table>
<thead>
<tr>
<th>Weigh</th>
<th>chutney jar</th>
<th>1L milk carton</th>
<th>peanut butter jar</th>
</tr>
</thead>
<tbody>
<tr>
<td>teaspoons of rice</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Teacher notes on mass (weighing) example 3:

We have deliberately started with an inefficient unit of measure. We expect that some children will select the cup as their alternate choice for unit and may fill a cup with teaspoons of rice, then weigh the containers with cups of rice and balance with teaspoons of rice, and finally calculate: number of teaspoons = number of cups x number of teaspoons per cup + number of teaspoons to balance the container. Don’t force this approach, just look out for it.

Sandbags are also a good alternative here.

**Suggested length activities**

1. How many toothpicks and ____________ arranged end to end are the same length as each container? (select your own unit)

<table>
<thead>
<tr>
<th>Length</th>
<th>peanut butter jar</th>
<th>yoghurt tub</th>
<th>ice cream tub</th>
</tr>
</thead>
<tbody>
<tr>
<td>toothpicks</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teacher notes on length example 1:

A good alternate measuring unit for this table would be the cubes, as they would provide a more accurate measure than the toothpicks.

2. How many paper clips and ____________ arranged end to end are the same length as each container? (select your own unit)

<table>
<thead>
<tr>
<th>Length</th>
<th>2L cooldrink bottle</th>
<th>chutney jar</th>
<th>½ L cooldrink bottle</th>
</tr>
</thead>
<tbody>
<tr>
<td>ice-cream sticks</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teacher notes on length example 2:

A good alternate measuring unit could be the cubes.
3. How many toothpicks and __________ arranged end to end are the same length as each container? (select your own unit)

<table>
<thead>
<tr>
<th>Length</th>
<th>chutney jar</th>
<th>1L milk carton</th>
<th>peanut butter jar</th>
</tr>
</thead>
<tbody>
<tr>
<td>toothpicks</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teacher notes on length example 3:
Using toothpicks as the unit of length we may not be a good idea because of their inability to discriminate between the lengths (heights) of the containers that are quite similar in length. A shorter unit would be better. A good alternate measuring unit could be the cubes.

4. How many hand spans and ruler lengths arranged end to end are the same length as ...

<table>
<thead>
<tr>
<th>Length</th>
<th>classroom door</th>
<th>length of classroom</th>
<th>width of classroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>hand spans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ruler lengths</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teacher notes on length example 4:
We now move to measuring larger things. Children should still be able to guess/estimate which is the longest/shortest without doing any measuring. There should be no doubt as to the inefficiency of the units that the children have experienced thus far, in measuring the longer lengths, and therefore the introduction of a larger/longer unit is necessary. Using hand spans as the unit of length will generate a variety of observations/recordings, as people have different size hands. This should also become more obvious when comparing the measurements recorded with the hand spans and rulers. The lengths recorded using ruler lengths should be more consistent across the groups.

5. How many foot lengths and pace/stride lengths are the same length as ...

<table>
<thead>
<tr>
<th>Length</th>
<th>courtyard / quad</th>
<th>tennis court</th>
<th>playground</th>
</tr>
</thead>
<tbody>
<tr>
<td>foot lengths</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pace / stride lengths</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Teacher notes on length example 5:

Children should still be able to guess/estimate which is the longest/shortest without doing any measuring. Using both the foot lengths and pace/stride lengths as the unit of length will generate a variety of observations/recordings because people have different size feet and paces. This activity can be extended by introducing a non-standard length measure that is more consistent in length and longer – an example could be skipping rope lengths.

Suggested perimeter activities

1. Determine the distance around the shapes (perimeter) in beans and cubes (arranged end to end).

<table>
<thead>
<tr>
<th>Perimeter</th>
<th>NumberSense workbook</th>
<th>Peg board</th>
<th>Community newspaper</th>
</tr>
</thead>
<tbody>
<tr>
<td>beans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cubes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Children should be able to guess/estimate which shape has the greatest perimeter without doing any measuring. The reason to include this example is to provide children with the opportunity to practise measuring perimeter.

A good alternate measuring unit for this activity would be the paper clips, as they would also provide a more accurate measure, and may be more efficient than the beans.

2. Determine the distance around the shapes (perimeter) in ice-cream sticks and ____________ (arranged end to end).

<table>
<thead>
<tr>
<th>Perimeter</th>
<th>Community newspaper</th>
<th>Sheet of flipchart paper</th>
<th>Desk top</th>
</tr>
</thead>
<tbody>
<tr>
<td>ice-cream sticks</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teacher notes on perimeter example 2:

Children should be able to guess/estimate which shape has the greatest perimeter without doing any measuring. The reason to include this example is to provide children with the opportunity to practise measuring perimeter and selecting appropriate units. The shapes have increased in size from the first example and the choice of measuring unit should be longer to increase the efficiency of measuring the perimeter of the shapes.
A good alternate measuring unit for this activity would be a hand span although children should notice that different children’s hand spans are different and hence different children will get different results – a consequence of using non-standard units.

3. Determine the distance around the shapes (perimeter) in paces and ____________ (arranged end to end).

<table>
<thead>
<tr>
<th>Perimeter</th>
<th>Classroom</th>
<th>School hall</th>
<th>Sport field</th>
</tr>
</thead>
<tbody>
<tr>
<td>paces</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teacher notes on perimeter example 3:
The perimeters of these objects have increased further from the second example and require a larger unit in order to measure the perimeters efficiently. Given the significant difference in the perimeters of these shapes, using the same unit will not be efficient for all the shapes. The use of paces revisits the issue of the limitations of non-standard units.

A good alternate measuring unit for this activity would be a standard unit e.g. a skipping rope or a window pole.

Suggested area activities

1. How many beans and cubes cover each surface?

<table>
<thead>
<tr>
<th>Area</th>
<th>NumberSense workbook</th>
<th>Peg board</th>
<th>Community newspaper</th>
</tr>
</thead>
<tbody>
<tr>
<td>cubes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>playing cards</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teacher notes on area example 1:
The children should be able to guess/estimate which shape has the greatest area by simply placing the shapes on top of each other and without doing any measuring. The reason for including the example is to provide children with the opportunity to practise measuring area.

2. How many playing cards and ____________ cover each object? (select your own unit)
Teacher notes on area example 2:

Children should be able to guess/estimate which shape has the greatest without doing any measuring. The reason to include this example is to provide children with the opportunity to practise measuring area and selecting appropriate units. The shapes have increased in size from the first example and the choice of measuring unit should be larger to increase the efficiency of measuring the areas of the shapes.

A good alternate measuring unit for this activity would be pegboards or sheets of A4 paper.

3. How many newspaper sheets and ____________ cover each object?

Teacher notes on area example 3:

These objects have now increased in area since the previous example and require a more efficient set of units to measure the areas efficiently. The large difference between the area of the school desk and field creates awareness that the same unit will not always work well for different shapes and sizes. Children may become aware that a way of converting between the different units may be more effective.

A good alternate measuring unit for the school hall and sport field would be a large ground sheet. It is also expected that some children will start to realise that they don’t have to completely cover the area, it is enough to determine how many units are needed along the length and the breadth of each shape and then to think about the number of rows with a given number of units in them – leading up to the area formula.