

# MEASURES 1: MASS, CAPACITY, LENGTH, AREA AND PERIMETER



# STAGES OF TEACHING MEASUREMENT

## □ Identification of the attribute to be measured

Students recognize the quantity to be measured and make direct comparisons of size



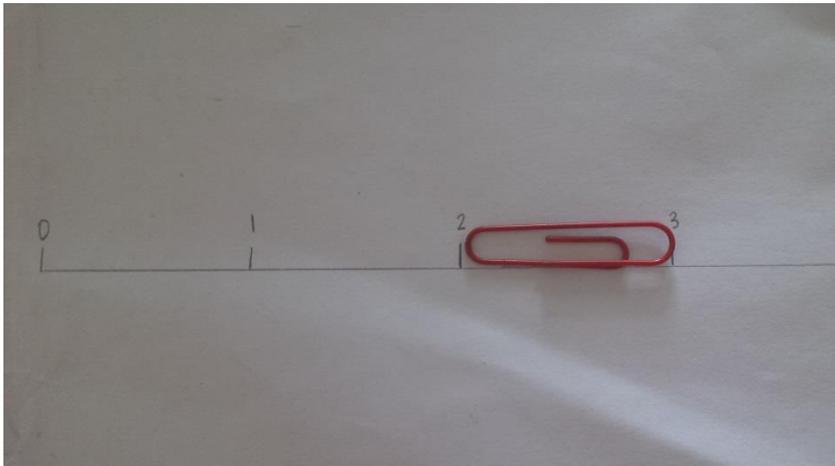
## ❑ Informal measurement

Students choose and measure with informal units to compare quantities.



## □ Structure of the iterated unit

Students are given only ONE unit with which to measure. Students construct the unit iteration and describe the spatial structure of length and area.



## □ Measure using conventional units

Students measure and record quantities with formal units, including centimetres, metres, litres, square metres and square centimetres and kilograms.



## ☐ Relationships between formal measurement units

Students investigate the calculation of length, perimeter, area and capacity and mass.



Hi kids! The recipe makes 24 muffins. I need to figure out the ingredients needed to make 12 muffins. Can you help me?

Ingredients to make 24 muffins:	Ingredients to make 12 muffins:	Space for Working
450g castor sugar	225g castor sugar	$\begin{array}{r} 450 \\ / 2 \\ \hline 225 \end{array}$
250g vegetable oil	125ml vegetable oil	$\begin{array}{r} 250 \\ / 2 \\ \hline 125 \end{array}$
250g self-raising flour	125g self-raising flour	$\begin{array}{r} 250 \\ / 2 \\ \hline 125 \end{array}$
250g carrots	125g carrots	$\begin{array}{r} 250 \\ / 2 \\ \hline 125 \end{array}$
4 eggs	2 eggs	$\begin{array}{r} 4 \\ / 2 \\ \hline 2 \end{array}$
1 teaspoon mixed spice	$\frac{1}{2}$ teaspoon mixed spice	$\frac{1}{2}$
1 teaspoon cinnamon	$\frac{1}{2}$ teaspoon cinnamon	$\frac{1}{2}$
10 walnuts	5 walnuts	$\frac{10}{2} = 5$

## The longest hot dog



The longest hot dog measured 204m and was made in Paraguay.

The meat weighed 120kg. The bun consisted of 100kg flour, 25 litres of water, 6kg yeast, 6kg sugar, 5kg butter, 2kg powdered milk, 2kg salt, and 1 litre malt extract. The hot dog was entirely edible. The hot dog was cut into 2000 portions and distributed to the public.

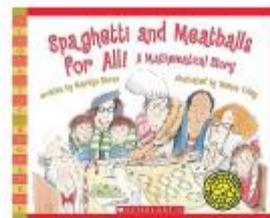
How many of each were needed:



Try making your numbers smaller.  
You might need to draw as well!

Write the list of ingredients to make a hot dog which is 408m long.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

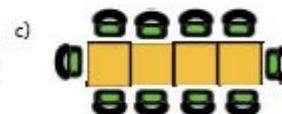
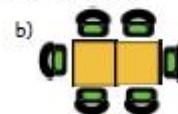
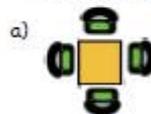


Suppose there were going to be just 12 people at the family reunion.

- What different table arrangements are possible? Find the layout which would be the cheapest for Mr. and Mrs. Comfort and draw it below.



- If each side of the square table is 80cm long, calculate the perimeter and area of these table layouts:



- Explain why there were extra chairs each time tables were moved together.

\_\_\_\_\_

\_\_\_\_\_

# Online Shopping

## Boys Tops and Outerwear

We communicate both UK and US sizes on our site and in our stores. Please refer to the size chart to ensure you are purchasing your correct size.

Display sizes in:  cms / kgs  inches / lbs

	XS	S	M	L	XL	XXL
UK	4 - 5 yrs	6 - 7 yrs	8 - 9 yrs	10 - 11 yrs	12 - 13 yrs	13 yrs XL
US	4 - 5	6 - 7	8	9 - 10	11 - 12	13 - 14
EU	110	116 - 122	128 - 134	140 - 146	152 - 158	164 - 170
Height (cm)	99 - 114	114 - 132	132 - 137	137 - 145	145 - 152	152 - 163
Weight (kgs)	15 - 20½	21 - 27¼	27¼ - 32¼	33 - 38	38½ - 43½	44 - 46¼
Chest (cm)	58 - 61	64 - 66	69	72	76	80 - 84
Sleeve Length (cm)	47 - 51	52 - 58	62	65	69	72 - 75

## How to Measure

Here are some tips to help you order the correct size. If you don't have a measuring tape, use a piece of string and hold it alongside a ruler.



### Chest

Lift your arms slightly and measure around your body, crossing over the fullest part of your chest.

### Sleeve

Place your hand on your hip with your arm bent at 90 degrees. Measure from the middle of the back of your neck, across the shoulder, and down your arm to the wrist.



## □ Knowing and representing large units

Students calculate and record measurements in kilometres. Students use a simple scale to calculate length and area on maps or diagrams.



E.5.1/F.5.1/G.5.1 Use read and write metric units of mass including their abbreviations and know and use the relationship between them (same for capacity and length)

E.5.2/F.5.2/G.5.2 Know the equivalent of one half, one quarter, three quarters and one tenth of a kilogram and convert weights in kilograms and grams to grams and vice versa (same for capacity and length)

G.5.3 Suggest suitable units to measure  
Suggest measuring equipment to estimate and measure length.

G.5.4 Understand, measure and calculate, the perimeter and area of rectangles and other simple shapes using non-standard units, counting methods and standard units.

G.5.5 Understand and use formula in words (L x B) for the area of the rectangle.

# Syllabus Reference

# IMPORTANT COMPONENTS FOR MEASUREMENT ACTIVITIES

## Estimation

Estimation is seen as an essential part of measurement, because it assists students to develop a sense of the size and structure of the units.

How far did it travel?

1. Estimate the distance your car travelled.

2. Choose the best tool to measure the distance.



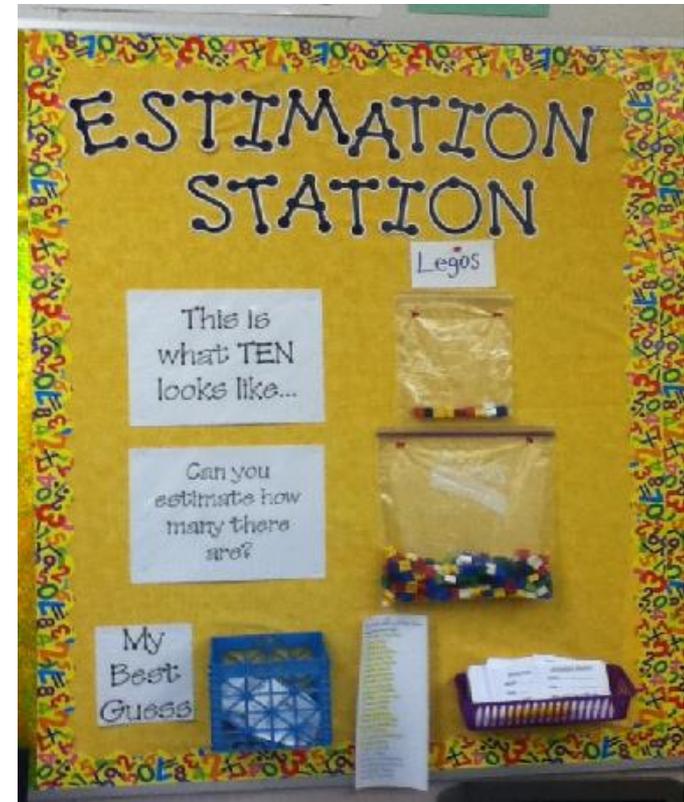
3. Measure the distance your car has travelled.

	Estimate Measure	Measuring tool used	Actual Measure
Car 1			
Car 2			
Car 3			
Car 4			
Car 5			
Car 6			

## Developing estimation skills

- using a **referent** or known quantity as a comparison measure, e.g. “the dog is shorter than me” or “the seat is about twice as long as me”, “a cup is about 200ml”, “an apple weighs about 200g”.
- **chunking** or breaking a quantity into more manageable parts by estimating a distance as several shorter sections (the distance from the floor to the top of the door is about ... and the distance from the top of the door to the ceiling is about...)
- ‘**unitising**’ or subdividing a quantity into smaller equal parts, such as estimating the height of a ten-storey building as ten times the estimate for one storey.

Fill a large jar and place it somewhere visible but secure, and children post their guesses for the best guess of the mass or capacity of the jar in kilograms or millilitres.



**Sharing** strategies for making estimates encourages students to think of an estimate as an informed, but informal, form of measurement rather than a “guess”.

Milk – 1 litre  
Cup – 200ml  
Jar - ???





**Body rulers** - This helps them familiarize with length and mass (weight) units. Give students a form or card for recording the sizes of their body rulers. Using their “body rulers,” students **estimate** the sizes of other things — books, pencils, desks, etc. — in the room, and then check them for accuracy with a ruler or tape.

<http://www.mathsisfun.com/activity/personal-measures.html>

# IMPORTANT COMPONENTS FOR MEASUREMENT ACTIVITIES

## Discussing and Recording Reasoning

An incentive for students to develop the precise language, they need to discuss measurement concepts. Common text types (procedures, recounts and explanations) can be consolidated and extended by asking students to write about what they did in measurement.

How long would it take me to walk

a) 100m b) 1km - 11 minutes 4 seconds

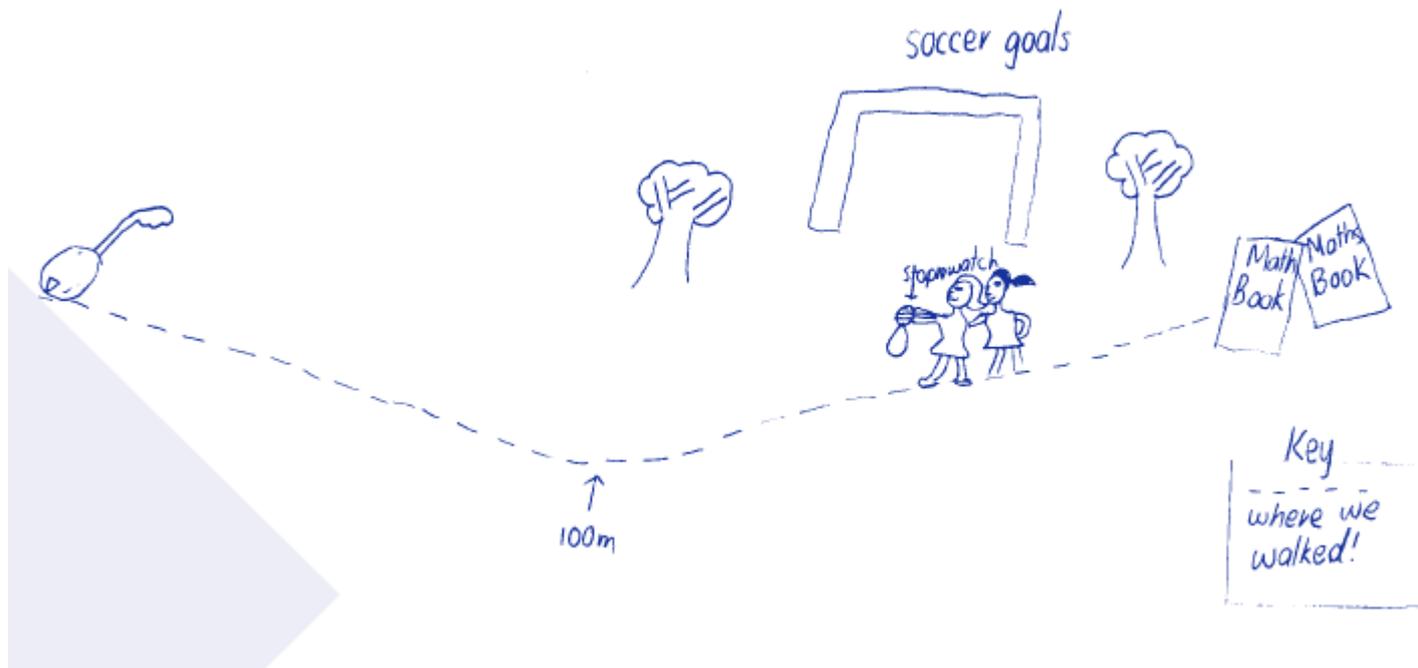
How far is 100 metres?  $\frac{1}{10}$  of a kilometre.

How many lots of 100 metres in 1km? 10

• First we walked with a trundle wheel. We counted 100 clicks. 1 click equals 1m. and we marked where we started.

• We got a stopwatch and walked 5 laps. We then doubled the time.

Students may be also be asked to draw their method of measuring. Drawing is seen as a bridge to link the practical activities to diagrams and plans.





“When children can talk or write about something, they have learnt it. It’s like when you have to teach something – that’s when you know if you really understand it”

Jennifer Pazuik  
Maths Specialist  
Toronto District School

Making Math Happen  
(ETFO 2004)

# IMPORTANT COMPONENTS FOR MEASUREMENT ACTIVITIES

## Questioning

- **Before giving a lesson**, decide what the students are to learn and the key questions that will indicate if they have learnt the concept, skill or strategy that was taught.
- Ask probing questions that **help students to clarify their responses**, to see the relevance to other ideas, to be more accurate or to explain or justify why it is so.
- **Encourage students to ask questions** to each other so that they begin to develop independence and maturity of thought. Before students ask questions they need to consider what they may not understand or what they do not agree with in an explanation.

What strategy did you use to identify a distance of 1 kilometre?

Why do we have slightly different answers?

# COMMON DIFFICULTIES:

## CONVERSIONS

**When to Multiply or divide?**

We want to know how many grams there are in 3kg.

We know that there are 1,000 grams in 1 kilogram – it is one “lot” of 1000g.

In the case of the 3 kilograms, we have 3 “lots” of 1000g. So we multiply  $3 \times 1000$  to get 3,000 grams. Multiplying gives us more, and we have more in the end if our unit gets smaller.

If we start with 3,000 grams and need to know how many kilograms that is. 1,000 grams still equal 1 kilogram, but this time we are “grouping” our smaller grams for larger kilogram at the end. So this tells us to divide 3,000 by 1,000 to get 3 kilograms. Dividing gives us less, and we have less in the end if our unit gets bigger.



Using measurement in **stories** and **real-world situations** can help students see that changing units is not pointless after all.

## Changing Olympic Records

The longest distance keeping a table lifted with the teeth is 11.80 m and was achieved by Georges Christen (Luxembourg) who ran this distance holding a 12 kg heavy table with a person weighing 50 kg sitting on it, on the set of 'Lo show dei record', in Madrid, Spain, on 9 February 2008.





Name \_\_\_\_\_

Date \_\_\_\_\_

# Rapunzel

Find the answers to the questions below.  
Use the answers to fill in the blanks in the story.

1. On his first day of climbing, the prince climbed 43 cm up the tower. What height of the tower did he have left to climb?

\_\_\_\_\_

2. On the next day, the prince climbed 136 cm up the tower. How many cm of the tower did he have left to climb?

\_\_\_\_\_

3. On his third try, the prince climbed 279 cm up the tower. How much farther did he have to go before he got hungry and climbed down?

\_\_\_\_\_

4. On the fourth try, the prince stopped at 458cm. How many cm of *Rapunzel's hair* did he have left to climb?

\_\_\_\_\_

5. Rapunzel's braided hair was 5.62m, but unbraided it was 826 cm. What is the difference in length?

\_\_\_\_\_

6. Rachel's unbraided hair is 413cm long. How long would it be braided if it was braided in the same way as question 5?

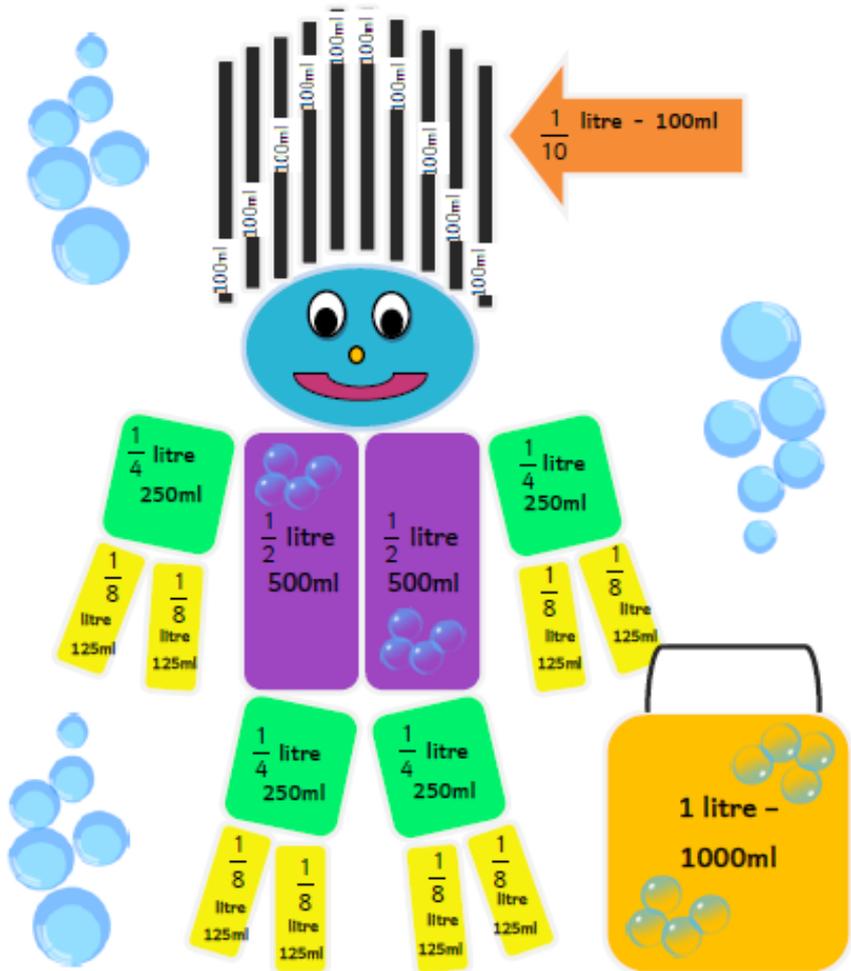
\_\_\_\_\_

7. Rapunzel bought books for her store, and the prince gave her books, too. The store had 683 books in all. The prince gave her 167 books. How many books did Rapunzel buy?

\_\_\_\_\_

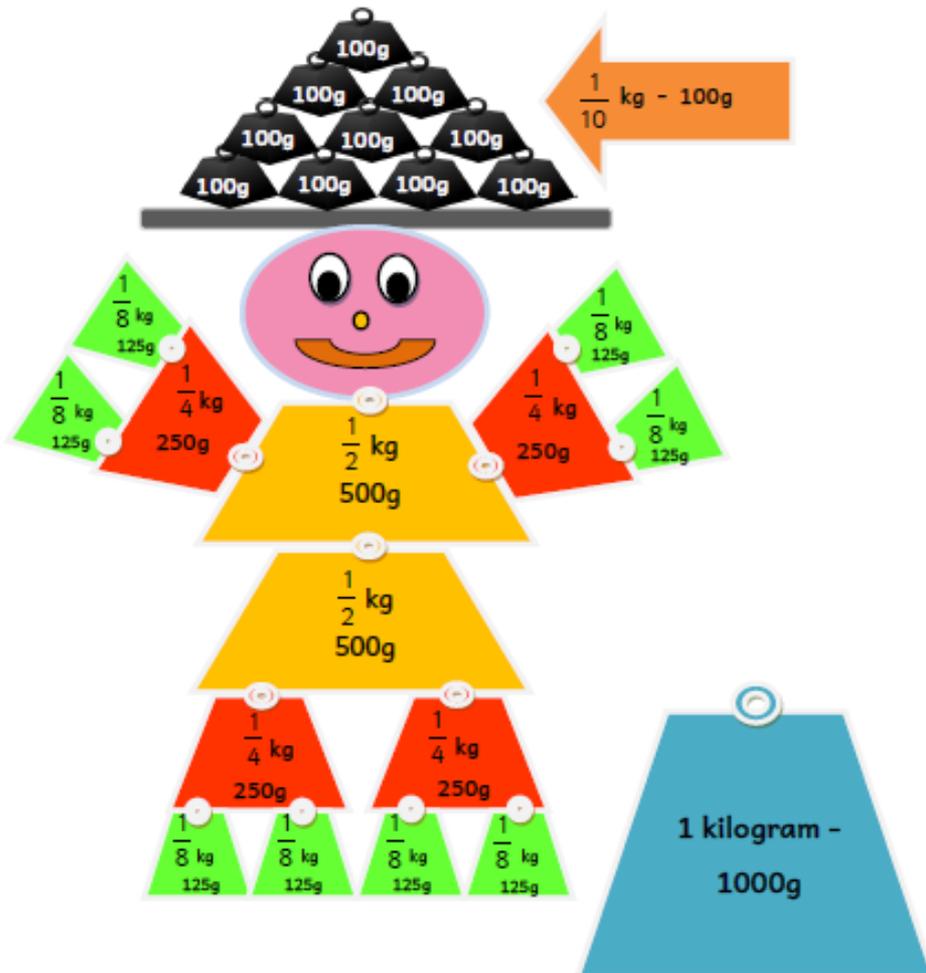
# A picture says a thousand words

Mr Peter Litre



For the  
visual  
learner

Mrs Kilo Gram

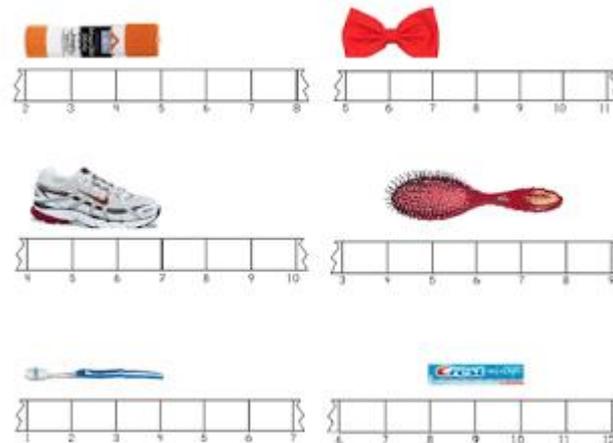
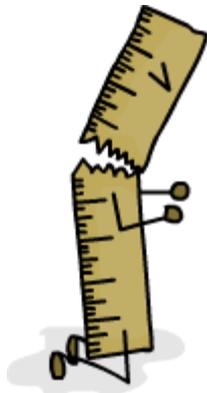


Seeing all the parts nested within one another helps make it clear that the smaller units are the building blocks of the larger ones.

# READING SCALES

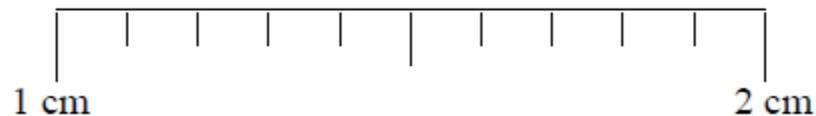
## Zero Point

- \* Lehrer (2003) notes that many children start with one rather than zero on a ruler.
- \* Only a minority of young children understand that any point on a scale can serve as a starting point provided they count the unit intervals corresponding to the length of the object they are measuring.

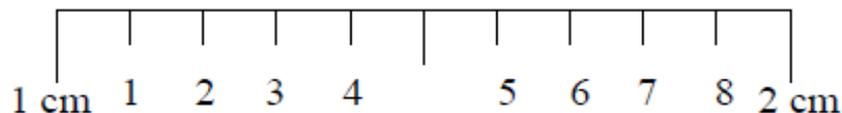


# Lines or intervals?

This difficulty with markers or spaces on rulers was highlighted in a study reported by Barrett, Jones, Thornton and Dickson (2003). Grade 2 students were given rulers with millimetre hash marks between the centimetre marks as shown:

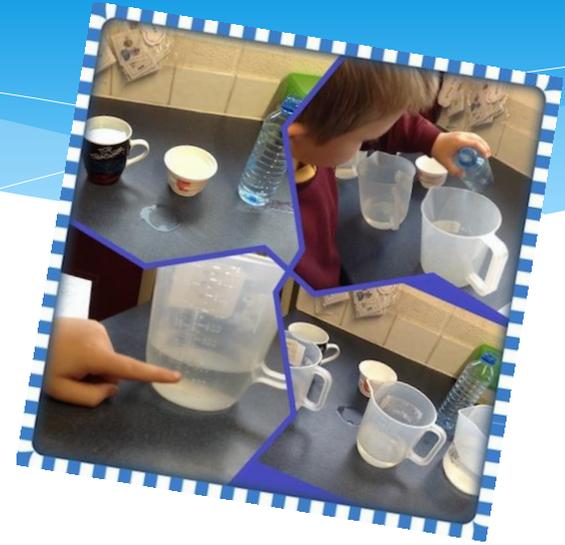


The students had recognised that the small hash marks represented millimetres and were asked to use the ruler to find how many millimetres in one centimetre. One student claimed that there were 8 millimetres in one centimetre. The diagram below shows her method of counting, where she counted the hash marks, but ignored the longer mark at 5 millimetres. She then revised her answer to 11, by counting not only the 5 millimetre mark but the end marks as well. Such misconceptions are common.



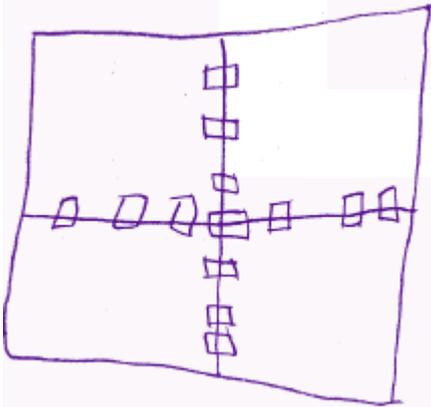
# Reading Scales

Students need to experience and understand that different measuring equipment have different scales.



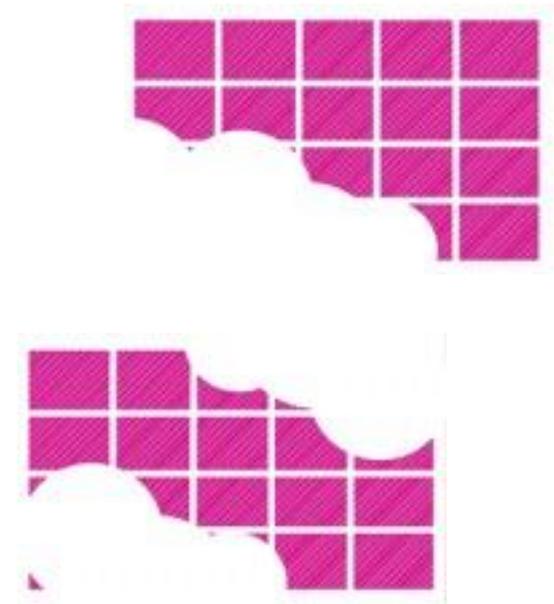
# Visualising

...spaces



We had to get 4 pieces of newspaper and rule them together. It had to be one metre one way and one metre the other way. Then we had to stick it together to make a square metre. This is what it looks like.

...the unseen



# Perimeter or Area?

It is very common that students confuse **perimeter** and **area**.

In such cases, the teaching and learning strategies can be planned to include:

- \*separate activities for perimeter and area.
- \*activities that contrast the two concepts.