

# Estimation Games

**Objectives:**

- To develop pupils' ability to estimate standard lengths, weights or capacities.

**Learning Outcomes:**

I can estimate lengths, weights and capacities.

I can measure accurately using a variety of different measuring devices.

I can calculate differences between measurements.

**Method:** Whole class teaching followed by pair work.

**What you need:** Depending on the area of study: metre sticks (one between two), trundle wheels (one between two), sets of weights, objects to weigh, measuring jugs, containers to fill. If you are short of resources you can have different pairs of pupils working on different aspects of measure – ie some pairs working on weight while others work on capacity etc.

**Lesson 1 – The Metre Stick Game**

Show the pupils a metre stick. Discuss how many centimetres there are in one metre. Use the stick as a counting stick and get the pupils counting in tens up and down the stick (in chorus) using your finger as a marker.

Jump the finger around so that the pupils can confidently say the numbers in a variety of orders. (eg 0, 100, 50, 10, 90, 40, 60 etc.)

Now play 'night time'. Roll the stick over so that the pupils are looking at the (blank) back of the stick. Play the same game again, moving your finger around to different 'ten' positions. After each guess, roll the stick back over so that the pupils can see where the numbers actually are and how close their guess was.

**Pair Work:**

Get the pupils to play the game in pairs. One pupil plays 'teacher', the other one has to guess the number that the 'teacher' is pointing at. After each guess the 'teacher' should roll the stick over so that the 'pupil' can see where the numbers really are.

Explain the different levels to the game. First the 'teacher' may only point at 'tens' numbers. (20, 50, 70 etc). If you get really accurate at guessing you can make the game more challenging by allowing the fives numbers (35, 65 etc) and eventually allowing any number.

**Important Note:** Before you set the children off to play, point out by demonstrating with two children that when the 'teacher' is holding the stick with the numbers facing away from the 'pupil', the 'teacher' is actually looking at the numbers *upside down*. It is important that the pupils grasp this or total confusion will result!

## Lesson 2 – Estimation Games with error chart

Project the error table (see below) onto the interactive white board, or sketch it on an ordinary board.

Choose an object in the classroom which is between half a metre and a metre in length. Ideally choose an object which you can hold up so that all pupils can all see it. Ask for estimates of its length. Hopefully, having played the previous game the pupils will give an answer which is fairly accurate. If their answers are wildly out, you can ask a pupil to stand up holding a metre stick a little distance away from the object as a comparison.

Agree together on a reasonable estimate for the length of the object and record it in the chart. A reasonable estimate, as well as being about the right size should be a 'round number' – ie in this case a multiple of ten or a multiple of five. (The concept of reasonable degrees of accuracy is one that pupils find difficult - you can establish what is a reasonable by thinking how accurate you are *likely* to be when measuring. 'You must choose a multiple of ten or five for your estimate' is a good fall back instruction!)

Now choose one (or two) of the pupils to measure the object using a metre stick. Before they begin, discuss with the class the concept of '*sources of error*' when measuring. Sources of error are the things that you might do wrong which would result in an inaccurate measurement.

Your list is likely to include

- Not matching up the end of the stick with the end of the object
- Allowing the stick to move or slip during the measuring
- Miscalculating the 'in-between' marks if the stick only shows the tens or the tens and fives (a common error is for the pupils to count the in-between marks backwards if they are standing on the 'upside-down side' of the stick)
- Having the stick the wrong way round (ie measuring from the wrong end of the stick) – this error is most likely to occur and not be noticed if the object is about half a metre in length

List them on the board. Discuss which is the most serious error (the last one because you can be out by a large amount).

Now ask your chosen pupil(s) to measure the object. Ask the class to confirm that they are doing it accurately. Record the measurement in the chart on the board.

Ask for suggestions as to how to work out how far away the estimate was from the real measurement. Establish that you need to 'find the difference' between the two numbers. Use subtraction skills to work out the difference. If you wish, check the calculation using the Maths Investigations online skill check (projected on the board.)

**Pair work:**

Remind the pupils of health and safety points with metre sticks (taking care not to wave sticks around etc). Send them off to estimate, measure and record their differences for a variety of objects around the classroom which are less than one metre. Depending on the prior measuring experience of your pupils and your confidence in their ability to measure accurately, you can give them a pre-selected list (for which you know the answers) or give them free choice of their own objects.

Again, depending on how accurate you think your pupils will be in subtracting, if you have tablets or laptops available you may wish to ask the pupils to use the Maths Investigation skill checker to check their subtraction each time before they record their difference.

While the pupils work, circulate and note their accuracy in measuring and accuracy with subtraction, and give input/assistance as appropriate.

**Plenary:**

Gather the pupils together after a suitable time. Share experiences:

- What difficulties did they have?
- Did their estimates improve over time?
- etc

**Extension:**

Repeat the activity (perhaps on another day) estimating distances which are larger than one metre (eg length and width of the room, etc).

Again, before beginning, discuss possible sources of error and agree strategies to prevent these. In addition to the previous points your list this time should include:

- Avoid using a finger to mark where one metre has come to and then putting the stick the other side of the finger to measure the next metre. (The width of the finger is then missed out of the measurement). Instead put a finger *beside* the stick.
- Measure in a straight line.
- Agree where to measure from and to (beware of wall cupboards etc)

- Remember to turn the stick round when you reach the wall so that the zero is at the wall for measuring the last piece.
- Take great care with counting. (The largest potential error is miscounting the number of metres!)
- Be courteous to other groups measuring across your path.

This time the pupils will have to deal with larger numbers when measuring. Depending on the age of the pupils and their abilities with subtraction you can again agree on appropriate degrees of accuracy for both the estimate and the measurement.

Some suggestions are given below:

<b>Estimate:</b>	<b>Measurement:</b>
To the nearest metre	To the nearest metre
To the nearest metre	To the nearest half metre
To the nearest metre	To the nearest quarter metre
To the nearest metre	To the nearest 10cm
To the nearest 50cm	To the nearest 10cm
etc	

Again the Maths Investigations skill checker can be set up to allow pupils to check their subtractions.

If you are feeling brave, give the pupils free rein to record their measurements as they wish! You are likely then to get a variety of methods of recording (eg Estimate:  $6\frac{1}{2}$  metres, Measurement: 560cm). Listen in on the pupils' conversations and you will find pupils naturally converting eg  $6\frac{1}{2}$  metres to 650cm etc. You may be surprised as to the level of competence of some pupils with this because they are working in a real life context.

### **Plenary:**

As before, gather the pupils to discuss challenges and how they feel their estimating skills have improved.

### **Further Extension:**

Repeat the activity outdoors. Use chalk or other markers to show a particular distance. Estimate it and then measure it using a large measuring tape or a trundle wheel.

Again, precede the activity with a discussion of potential sources of error and appropriate degrees of accuracy in both estimate and measurement.

## Capacities and Weights

Exactly the same approach can be used with children estimating and measuring capacities of containers and weights of objects.

Depending on the age of your pupils, decide whether you are working with:

- Whole kilograms or litres only
- Fractions of kilograms or litres (  $\frac{1}{2}$  kg,  $\frac{1}{4}$  kg etc)
- Grams or millilitres (eg to the nearest ten – 340g, 250ml etc)

This time, teaching input will need to be given on reading scales and, if appropriate, on the number of ml in a litre and the number of g in a kg. Pupils find the 1000 conversion factor for  $g \rightarrow kg$  and  $ml \rightarrow l$  more of a challenge than the 100 for  $cm \rightarrow m$  so this may require some prior consolidation. (There are plenty of options in the Maths Investigations online skill checker and pattern builder to help with this.)

The pupils' innate sense of the estimation for weights and capacities is likely to be considerably poorer than that for linear measure, but the principles are exactly the same. As before, work with the whole class initially to 'guess the weight' of 'guess the capacity' of some objects or containers. Record estimates, again discussing appropriate degrees of accuracy –ie whole numbers, or possible half kilograms or litres. Then measure and calculate the difference.

When you think they are ready, send pupils off to do likewise.

**Note:** If you have insufficient measuring equipment, then give teaching input on everything and then divide your class into four groups and have one working on capacity, one on weight, one on small linear measures (less than 1m) and one on large distances (eg length of the room etc). Joint plenaries will help all pupils when they come to their next activity.

Rotate to a different activity each day.



Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

## Estimation Game - Classroom Objects

Object	Estimate	Measurement	Difference
Book			
Pencil case			
Folder			
Pencil			
School bag			
Height of chair			
Width of door			
Width of table			
Height of table			





Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

## Estimation Game - Classroom Distances

Distance	Estimate	Measurement	Difference
Length of table			
Width of table			
Height of table			
Height of door			
Width of door			
Length of room			
Width of room			









