



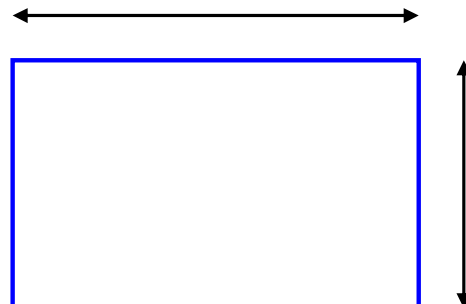
How Big is the Room?

What's this one all about?

This investigation is just brilliant! Great fun to do and a huge amount of possible learning, covering everything from introducing decimals to learning about medians. And this is all with 8-year olds!

You start by setting the children up for the fact that they are going to do a practical investigation, discuss all the team work expectations, and then finally give them the challenge. Then let them loose and see what happens!

The key is to use counting sticks, which have ten divisions marked, but no numbers, and this leads the children naturally into needing to use decimals to measure distances less than 1 metre. Averages come in when they discover that all the teams have different answers. And you can go on to investigate perimeter as well. Allow a week for this one if you want to maximise the learning opportunities.



The teacher bits...

Learning Intentions:

Measurement: I can measure with a counting stick to the nearest tenth of a metre. I can take steps to minimise sources of error. I understand that there are one hundred centimetres in a metre. I know the words 'length', 'width' and 'height' and understand when they should be used. I can estimate distances in metres. I know how to work out the perimeter of a rectangle.

Decimals: I understand that if a metre is divided into ten equal bits, each bit is called a tenth. I know how to write decimals with one (or two) decimal place(s).

Averages: I can find the median of a set of measurements.

Recording: I can draw a labelled diagram.

Ages: 7-10

What you need: Counting sticks (one metre long, divided into tenths, but with no numbers on) – one for each group. Base-ten tens rods may also be useful.

Note: The introduction to this investigation is deliberately designed to build suspense. The investigation itself is designed to throw the children onto using their own resources. Resist the temptation to 'prep' them for any of the concepts beforehand. The whole idea is that they discover the need for new ideas as they go along, and you support them by gathering the class together at appropriate points and discussing ideas.

The investigation

Initial Discussion

Explain to the pupils that they are going to carry out a practical investigation in teams. Ask what they think you will be looking for (discussing, listening to each others' ideas, working together etc). Discuss what will happen if they find another team in their way - be patient, move etc. Explain that each team will have a counting stick and discuss safety - holding it vertically etc. Explain the rule that no-one is allowed to have both feet off the ground at the same time - this prevents them climbing on to chairs or tables, but still allows them to walk normally!

Explain that they will be expected to record things in their book. Each time they get a number they should (all) write it down and note what it means so they don't forget. [It is probably best for each group to have a home base to return to where their books are, rather than carrying them around the room.] You will also be expecting them to use a diagram. Discuss what a diagram is (eg for instructions for furniture). Explain that the diagram they will need for this investigation is a rectangle. It should be drawn with a ruler, etc. Demonstrate on the board.

Explain that you will be interrupting regularly and calling them round to look at and discuss a particular group's work. They will need to be prepared to gather quickly. They may then need to do one of their measurements again after the interruption.

Arrange the children in groups of 3 or 4 with a counting stick each and get them to write the date in their books. Explain that you are going to give them the title of the investigation, but you are not going to answer any questions about what it means. They will have to discuss this in their team. Finally give them the title 'How Big is the Room?' Get them to copy it and then let them loose!

Measuring

The children will hopefully spend a little time discussing what they are going to do and then start moving around. Watch and listen. Intervene when appropriate to debate with them any problems you see in their measuring techniques. (eg metre sticks not going in a straight line, losing count, putting an extra finger (or shoe!) space between metres, differences in the width of the room at different points because of cupboards, etc.)

Discussing

At an appropriate point, stop everyone and gather them together round where one group is working and share the issues that you have discussed with different groups.

Discuss the meaning of the words length, width and height and their spellings and derivations from 'long', 'wide' and 'high'. Discuss the fact that the length is usually taken to be the longer distance. Agree which is the length and which is the width of your room.

The children will hopefully be discovering that the room is not an exact number of metres long or wide. Using one of the counting sticks, introduce the idea of 'bits' of a metre. Discuss the fact that the counting stick is divided into ten bits. Talk about measurements such as '5 and 3 bits' etc. Then introduce the idea that the bits are called 'tenths' since there are ten of them in a metre. Explain that for a measurement of (eg) 5 whole metres and 3 tenths we would say 'five and three tenths of a metre'.

Gather them round the board and introduce the idea of decimal notation to show (eg) 5 and three tenths = 5.3. Explore how they could use this to record other measurements.

Depending on the age/experience of the pupils, you may also wish to explore the idea of the second place of decimals. On many counting sticks the end 'bit' (tenth) is divided into ten little 'pieces'. Engage in dialogue about how many of these little pieces there would be in the whole metre. Establish that it would be 100. Discuss the fact that these little pieces would therefore be called 'hundredths' of a metre. They are also be called 'centimetres'. ('Centi' means 'one hundredth'). Explain how to show (eg) 5 whole metres, 3 bits and 7 little pieces as 5.37 etc. [If they are really firing on all cylinders, someone will ask about what you would call it if you chopped up one of the little pieces into ten tinier pieces. That would be crumbs! (millimetres)]

Discuss degrees of accuracy. Agree that for this investigation it would be appropriate to measure and record the length and width of the room to the nearest 'bit' (tenth) of a metre.

Discuss finding the height of the room. Discuss the idea of, and strategies for, estimating.

More Measuring

Set them to continue measuring and circulate, engaging in discussion with groups as before about their measuring and their recording.

Dealing with Different Answers

Draw/project a table on the board (see pupil copymaster below) where you can record the measurements of each group for the length, width and height of the room.

At an appropriate point, gather the children together and record in the table any measurements they have found, using the decimal notation (7.2, 5.6 etc)

Discuss the fact that the answers are all different. Debate why this is. [If appropriate, you may suggest that some re-measuring takes place.]

Discuss how to deal with the problem of the different answers. Discuss which answers they think are likely to be most and least accurate. Establish that the correct answer is probably somewhere between the answers in the table.

Get agreement that it would be fairest to arrange the numbers for each measurement in order (eg 4.8, 5.2, 5.4, 5.5, 5.8, 7.1) and choose the middle one. Explain that this is called finding the 'Median' of the measurements. Agree that if there is no middle one, you should find the number half way between the middle two. [The children will probably suggest writing a number such as $5.4\frac{1}{2}$ for this. Explain that you can't have fractions in decimals and that this would be written as 5.45. If appropriate, discuss why. Explain that you can then 'round this up' to the next biggest tenth, so you would use 5.5 as your answer for this.] Agree together on the median length, height and width for the room.

Further Development

If you have an hour for your lesson, it should nicely get you to the point above, but there is plenty more you can do in follow-up lessons.

Here are some options you may wish to explore:

- **Remeasure:** Note which groups' answers were closest to the medians and which groups' answers were furthest away. Discuss accuracy. Send everyone to re-measure to get more accurate measurements. Calculate the medians again using the new figures and compare with the previous ones.
- **Perimeter:** Introduce the idea of the perimeter (distance round the room.) Discuss different ways of finding this (doubling length and width and adding them etc). Explore how to do this using the median measurements for the length and the width. [This may involve adding tenths together to get whole metres, so you are already effortlessly into adding single place decimals. To explore this properly, you could gather the children around in a circle on the carpet and use counting sticks and some base-ten tens rods (make sure you use ones that are exactly 10cm long) to explore how 'bits' of metres can be added together to make whole metres. (eg 5.8 doubled is 10 whole metres and 16 bits. 16 bits is one whole metre and 6 bits. So 5.8 doubled is 11.6 etc.)

Consolidation

You may wish to reinforce the learning from the above discussions by giving the children an individual class or homework task. Two pupil sheets are provided for this purpose.

Depending on the age of the pupils, you may wish to hand-write the measurements from the class discussion onto the first sheet before photocopying.

Name: _____ Class: _____ Date: _____

Finding the Median Measurements

Here are the measurements for each group.

Group	Length	Width	Height

Put each set of numbers *into order* and find the middle one(s).

Length _____

Width _____

Height _____

Put the median measurements on this diagram.

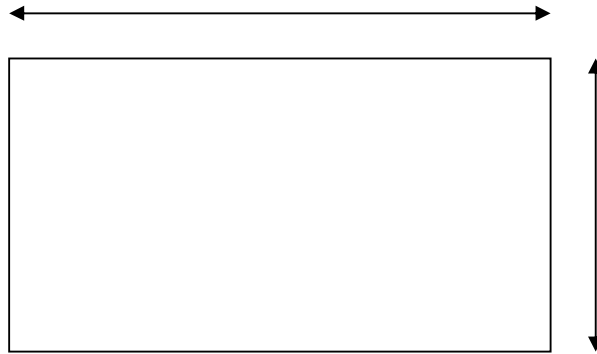


Name: _____ Class: _____ Date: _____

Finding the Perimeter

Diagram

Write the length and the width of the room on this diagram.



Calculations

Can you do some calculations to work out the perimeter?

Answer

Record your final answer here.

Perimeter = _____