



Module Area: NUMERACY/MATHEMATICS / Module 3 [ZAMBIA] :

Investigating Measurement and Data Handling

Section 5: Investigating distance

Key Focus Question:

What practical and imaginative approaches can you use to develop pupils' understanding of distance?

Keywords:

measurement; length; distance; comparison; active; practical; group; pair; investigative; proof

Learning Outcomes

By the end of this section, you will have:

- developed ways of teaching measurement of length in a more pupil-centred way;
- developed your ability to organise, support and assess practical investigations around distance.

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Introduction

This section will help you develop pupils' understanding of estimating, measuring, drawing, experimenting, constructing, interpreting and calculating lengths and distances.

Investigations can be done in class, individually or in groups. They can also be done at home by individual pupils, and either be presented to the whole class verbally or be formally as written work. Investigations are based on having an idea or a phenomenon that you want to find out about. To do this, you undertake various tasks in order to find answers to your questions. Investigations can include practical work, but can also take the form of research as you search books etc. for answers. For further information about investigation see **Key Resource: Using investigations in the classroom.**

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Any investigation needs to be planned and conducted carefully, otherwise the results might be incorrect or unreliable. In **Activity 1** you will look at a statement that needs to be shown to be right or wrong. Make sure your pupils have all they need before they start an investigation, and that they understand the task before they begin. Your role is to support them as they work by asking questions to stimulate their thinking and encouraging them to develop their ideas.

Case Study 1: Using questions to prepare for a practical investigation

Mrs Mwakapenda in South Africa wanted to give her pupils a practical investigation on length to find out who was the tallest or shortest in the class.

She prepared some questions for them to ensure that they understood the task properly. She began her lesson by discussing the questions with the whole class (see **Resource 1: Sample questions**). She was aware that the investigation was not just about measuring. It was also about collecting and recording data. She wanted to make sure her pupils understood exactly what it would involve.

After the investigation, Mrs Mwakapenda was very pleased with what her pupils had achieved. They had shown that they knew how to organise an investigation. They carried out a fair test and measured the distances well, too.

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Activity 1: Who can jump the furthest?

Begin by asking your pupils to consider the following statement and discuss (in groups of four) how they would investigate whether it is true.

'A tall person can jump further than a short person.'

Each group needs access to a tape measure or ruler or some other means of measuring e.g. string or rope. Discuss how they might answer the question and agree on a process. This might be like this:

- take two measurements for each person and measure everyone in the group;
- measure height by standing against a scale on a wall which you made before the lesson;
- the jump must be a 'standing' jump –the person stands on a line, and then jumps as far as they can;
- measure the length of the jump using a tape measure or string etc.

Ask the groups to discuss how they can show their results (see **Resource 2: Two ways to check**). Ask them if their measurements agree with the statement. If not, can they rewrite the statement to match their results?

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When exploring a topic such as measuring, it is important not to rush on to new concepts but to give pupils time to consolidate their learning and practise newly learned skills. This section provides more ways to explore pupils' understanding and abilities to measure length in different contexts.

Here, you will ask pupils to make comparisons between measures and think about any links. By using the same groups for a series of activities, you can discover whether they see the similarity between the investigations and are able to use the data and the strategies they used before.

Case Study 2: Organising pupils' own investigations

Mrs Mwakapenda decided to undertake a measuring task with her class but provide less guidance than she had before. She wanted them to be more independent and to use the skills learned from previous tasks. She decided she would listen carefully as they discussed how to proceed and find out who was volunteering to do tasks. She was interested to know who realised they could use the previous knowledge and ways of working for the new task.

She thought carefully about what task to set. The head teacher had talked of moving the school fence and school gate on one side of the grounds to a place he said was nearer, to help save money. Mrs Mwakapenda was not sure it was nearer and she decided this was a real problem to use with her class.

She set the problem in the morning and told her pupils they could work on it until the end of the day. They also had to do their language work but she said they could choose in which order to work. As she only had two long tape measures borrowed from the education offices, it limited the number

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of groups that could work with these at any one time. They could use other ways to measure, such as rope or string. She was pleased with how well they organised themselves and, as they worked, she noticed who understood the problem and how to solve it. All the groups agreed that the new site for the path was much nearer. She then asked them to work out how much money would be saved from the path.

They took their investigation to the head teacher who was very pleased with the information.

Activity 2: Investigating height against arm

Begin by telling your pupils that you have another investigation for them to do in the same groups as before.

- Ask them to find out if this statement is true:
 - 'Your height is the same as the distance between your fingertips with your arms outstretched.'

Ask them to discuss in their groups:

- How could they check these statements?
- What are they going to be measuring?
- What units of measurement should they use?
- How will they organise the work?
- How will they record their results?

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Next, ask them to do the investigation together, or at different times (depending on your resources), and go around and listen to them as they work, supporting them if they are having difficulty. Ask them to show how they worked out the answer. Display their answers.

Discuss with them what you have observed about how they worked as groups.

How can you help them work better in groups? (See **Key Resource: Using group work in your classroom .**)

It is important that pupils have a real-life 'feel' of what different lengths mean and are able to estimate and measure the length or height of an object. This is a very useful skill in real life. For example, will a tree fall on our house if it is chopped or falls down? To assess whether they have this 'feel' , you can use a question to solve on paper that requires them to use their understanding or give them a final investigation about a real object, such as that in the **Key Activity** .

When the task is complete, encourage your pupils to find out more about the indigenous trees of your country and have a go at measuring a large tree near your school if there is one. Working in this practical way will build their confidence in dealing with length.

Case Study 3: Assessing understanding of length

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Mrs Chamwala from Mongu wanted to find out if her pupils had a real understanding of different lengths, so she designed a paper activity that they had to do individually to assess this. She copied the activity onto the board (see **Resource 3: Question on length**). She asked her pupils, who were Grade 6, to work on their own and think carefully about the answers before they filled in the gaps. She collected their books and looked at their answers.

Mrs Chamwala realised that many of her pupils had not got a real feel for length yet and so she decided to do more practical activities. She asked them to measure the school grounds but they had to estimate the length of each side first and record this. Each group took it in turns to do the measuring as she only had one long tape. She had made a large table of the key measurements and each group put in their measurements as they finished. She did not display this until all groups had finished so they would not be influenced by others' results. (She planned to use this data later for a geography lesson to produce a scale map of the school site.)

When all pupils had completed the measuring, she discussed the variations in their measurements with them and then asked them why this was so. They were able to suggest some good reasons such as starting at different points and not holding the tape straight. She was pleased at how they saw the purpose for understanding measure.

Key Activity: How big is the baobab tree?

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Read **Resource 4: Baobab tree** before you plan for the lesson, but think how you might adapt this to your pupils' needs. You will need to find a very long tape measure.

If possible, take your pupils outside to where there is a lot of space; otherwise, use a large hall to try out the activities. You will also need about 20 pupils of average 1 m height and so you may decide to combine with another class. Work with the whole class together and ask guiding questions to help them solve the problem.

Show the picture in **Resource 4** to the class and read the following extract about the baobab tree to the class.

'In South Luangwa National Park there is a 1,000-year-old baobab tree, known as the kondanamwali. It is about 20 m high and has a circumference of 8 m.'

When you have finished outside, bring your pupils inside and ask them to answer the questions in **Resource 4** to assess their understanding.

Next lesson, ask them to make a display of all their measuring activities and invite other classes to come and see their work.

Resource 1:

Sample questions



Background information / subject knowledge for teacher

- What do you understand by the term 'height of a person'?
- How are you going to measure yourself?
- Should you have shoes on or off, while measuring?
- Should you lie down or stand up against the wall?
- What about those with long hair, should they squash it down?
- Where should you measure from?
- What should you measure with?
- How accurate should you be?
- How do you use a ruler or tape measure?
- How should you collect the measurements?

Resource 2:

Two ways to check



Background information / subject knowledge for teacher

- One way of checking that the statement is true is to make a table with two columns, one for the heights of the pupils going in order from the tallest down and the other for the lengths of the corresponding jumps. Only if the order is the same is the statement true.
- Another way is to make a mark with a cross on a grid using square paper with the pupil's height on the horizontal axis and the length of jump on the vertical axis. Only if the result of the crosses is a straight line is the statement true.

Resource 3:

Question on length



Teacher resource for planning or adapting to use with pupils

Some pupils in Grade 6 measured different things in school. These are the measurements they wrote down.

- (a) 4 metres
- (b) $\frac{1}{2}$ metre
- (c) 19 metres
- (d) $1\frac{1}{2}$ metres

Below is a list of the things they measured. Match each length or height against the most likely object.

Mwenzi, who is in Primary 3

The length of the school building

The length of the teacher's table

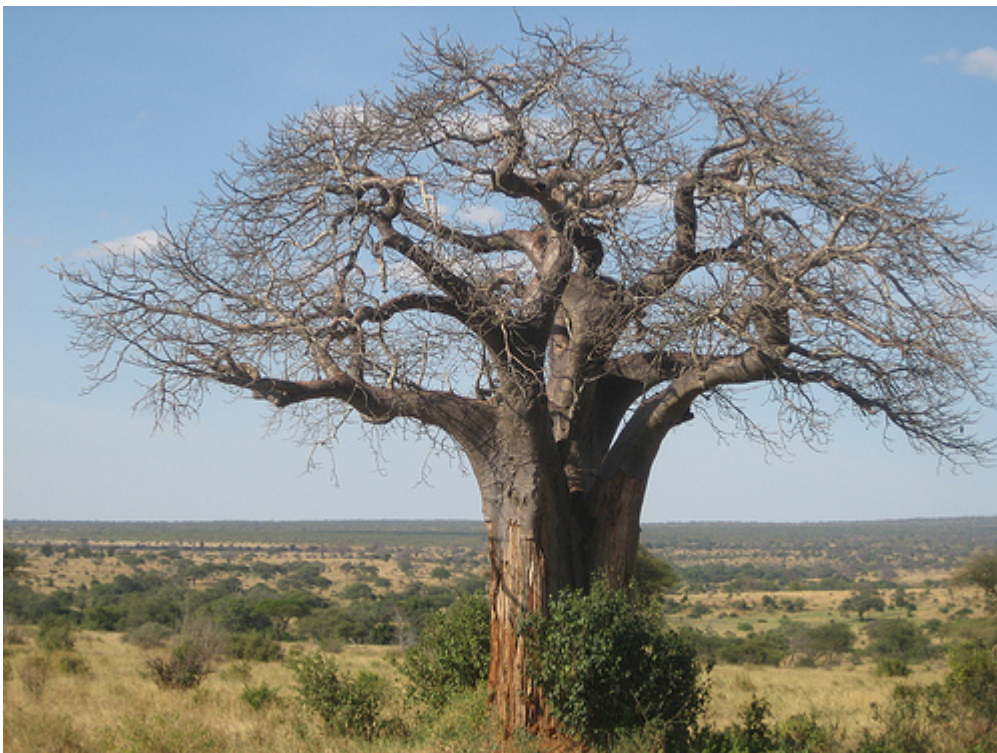
The height of the classroom

Resource 4:

Baobab tree



Teacher resource for planning or adapting to use with pupils



Original Source: <http://www.neatorama.com/category/neatorama-only//>

The height of the baobab tree

Remind your pupils that the height of the tree is 20 m. Ask them:

'Do you think if all the pupils here were to balance on each other's heads you would eventually reach to the top of this tree?

That would not be easy and so what else can we do? Yes, we could try lying down instead.

Let's do that.'

Ask about ten pupils to lie down and ask another pupil to measure and see if that is enough.

Now ask: How many pupils do you think it will take?

Add more pupils until how many it takes to make 20 m is reached.

Finally, ask someone to describe how tall the Big Tree is.

The circumference of the baobab tree

We are told that the circumference of the tree is 8 m. Ask your pupils:

'How many pupils do you think it would take if you wanted to make a ring around the tree, with fingers touching?'

Try it by asking one pupil to measure 8 m. Then form a circle and count the pupils – this will give you an idea of the circumference of the tree.

Now try these questions with your group:

1. Before this activity I thought 20 m was:
 - a. As tall as my school building
 - b. As tall as a mountain
 - c. As high as a tall tree
 - d. As tall as a telephone tower
 - e. Hadn't thought about it
2. It would take the following number of classmates to make a ring around the baobab tree
 - a. At least 7
 - b. At least 6
 - c. At least 5
 - d. At least 4

e. At least 3

3. 1 m in length is approximately:

- a. The span from the tip of an average person's nose to their fingers with arms outstretched
- b. The height of an average person
- c. The length of a small table
- d. The height of a cow