National Research and Development Centre
for adult literacy and numeracy

Measurement

Debb Bouch and Christine Ness

Maths4Life

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For information on alterative formats, please contact:

Emily Brewer
Marketing and Publications Officer
Institute of Education
University of London
Tel: 020 7947 9501
Email: e.brewer@ioe.ac.uk

We welcome feedback on the content and accessibility of this publication. This should be sent to:

Publications
NRDC
Institute of Education
20 Bedford Way
London WC1H 0AL.

Telephone: +44 (0)20 7612 6476
Fax: +44 (0)20 7612 6671
email: publications@nrdc.org.uk

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For further details see ncetm.org.uk and maths4life.org. The Maths4Life website will be live and maintained until the end of March 2008 when it will transfer to ncetm.org.uk

Contents

Approaches to learning about measures

In this booklet, the term "measures" refers mainly to length, weight, capacity and temperature. Time and Money are covered in a separate booklet.

This booklet is aimed at tutors working with learners from about Entry Level 1 to Level 2. It is not a text book, or a list of recipes to teach particular aspects of measure. Instead, it suggests some approaches that we have found effective in enabling learners to use measures effectively and to relate them to other mathematical concepts.

It is important that learners understand the theoretical aspects of different units of measure but also understand how these units work in real life. An introduction to measure should include a strong emphasis on developing practical measuring skills, making estimates and reading scales and dials.

Many learners may feel that listening to the tutor and completing their own individual worksheets is the main way of learning. However, we believe that learners learn more if they actually enjoy the activity, have a chance to discuss what they do, explain their work and reach a shared understanding. There is now widespread recognition for the value of collaborative work in developing conceptual understanding (Collaborative Learning in Mathematics: A Challenge to Our Beliefs and Practices, Malcolm Swan, NRDC and NIACE, 2006).

Although the activities outlined in this booklet can be done individually, most of them will work better as collaborative tasks. This approach may be unfamiliar to many learners, particularly those whose previous mathematics was learned in a traditional, formal class.

Learning is generally most effective when learners are working collaboratively. The task can be pitched a bit higher, just outside an individual learner's comfort zone, so that it needs a second opinion; it may also involve practical equipment that needs a second pair of hands. An explanation of the benefits and ground rules is important for all learners before starting collaborative tasks, so that each group member gets a chance to express an opinion and challenge what others say.

In this context the tutor is not so much an instructor as someone asking the right kind of questions to move discussions on, and does not immediately confirm correct answers. The tutor will want to spend time listening to the discussion in small groups, and may join in, but should not try to replace whole class lectures with small group ones.

As with all learning situations, the tutor will have to make some snap decisions about how to react to situations that develop, particularly those where a group agrees about something which is in fact incorrect. Comparison with the work of other groups where learners have to justify their conclusions can be a more powerful checking strategy than simple validation from the tutor.

Collaborative learning situations tend to have a shared goal of producing an end product, such as a poster, a presentation to the group, or a set of questions for other learners. Discussion of the similarities and differences between posters from different groups can be a very effective way of addressing errors.

What is measure?

The core curriculum includes the following in common measures (MSS1):

money, time, length, weight, capacity, distance, temperature, area, perimeter and volume.

We use examples from most of these measures in this booklet to show how they interconnect. However, the main focus of the booklet is on the simple measures of length, weight, capacity and temperature. Time and money are covered in a separate booklet.

One definition of measure is "a system of standardising size or amount that enables comparisons to be made".

We think it is important to look closely at several aspects of measure suggested by this definition. "A system" implies that measures are not random and not isolated from each other. It also implies design. Our learners can't always perceive this design or the connections between the different parts of the measure system.

"standardising size or amount" implies a need for specific units. We need to allow learners the opportunity to explore units and to see what happens when you don't have standard units. We also need to give learners the chance to measure size or amount.

"to enable comparisons to be made" implies that once you have measured accurately, you need to do something with your results. It may be that you pay for goods by the gram or by the metre, or that you order a pint of beer and make sure you get full measure. Learners need to be alerted to how measure as they learn it in a mathematics class affects their lives in the real world.

What can you measure?

One of the first places to start is to ask learners to think of what they measure or have measured for them in life, as a way of collecting some possible definitions of the meaning of 'measure'.

If learners deny measuring anything, ask them if they ever cook following a recipe or watch the weather forecast to see if frost is likely.

Ask learners to think of what can be measured. This will generate lots of supplementary questions and an initial vocabulary of measure. Often it will elicit a surprising depth of knowledge and maybe spring a few surprises.

Now ask learners to list units of measure, and specify the equipment they would use to measure. This will be a useful indicator of their current level of knowledge.

Many learners instinctively measure by estimate and compare their results using non-specific comparative vocabulary such as long, short, heavy, light etc.

We can raise some questions about measure and encourage learners to think of their own questions, for example:

When do people use measures?

Why do we need to measure things?

How accurately do we need to measure?

Why do we need so many measuring units?

Why do we use these units instead of, for example pacing?

When is an estimate good enough?

Why do we have metric and imperial measures?

What is the difference between distance and length?

Why teach measure?

Many learners do not identify measure as part of mathematics, despite using measure more often than many other areas of mathematics.

Many adult learners grew up using the imperial system of measures and now have to use the metric system. This creates confusion both in the units they use and in the way they read the measuring instruments they choose to use.

Although learners may have heard the some of the terminology and recognise words, they don't understand how these words apply to real life situations.

Measuring may also be confusing because learners do not know how the units of length are related to each other. On top of this, these units may be expressed in several different ways, including using decimals, for example:

3 metres 460 millimetres

3m 46cm

3.46m

3.460m

3460mm

346cm

The language of measure

Much of the language involved in working with measures needs to be taught explicitly in context.

Learners should be encouraged to use the vocabulary that describes the concepts they are exploring.

However, some of the vocabulary can be applied across more than one context, or may have other accepted meanings outside of measure. For example, the word 'scales' has several different meanings, three of which relate to measures:

- **Weighing scales**
- **Scales and dials**
- **Scale on a map**

This can cause confusion for learners.

Length, weight and capacity
Words associated with these measures include:

- **Length/long/short**
- **Width/wide/narrow**
- **Breadth/broad**
- **Height/high/low**
- **Depth/deep/shallow**
- **Full/empty**
- **Heavy/light**
- **Perimeter**
- **Border**
- **Edge**
- **Distance**
- **Area**
- **Volume**

Temperature
Words associated with temperature include:

- **Hot/cold**
- **Boiling point**
- **Melting point**
- **Blood heat**
- **Degrees**
- **Fahrenheit**
- **Centigrade/Celsius**

Units
All the units have abbreviations which need to be recognised, some have more than one accepted abbreviation e.g. Inch, in. ” , kilo, Kg.

In addition, the units for measuring for area and volume are square units/units^2 and cubic units/units^3.

Metric units:

- **Kilometres/ metres/centimetres/millimetres**
- **Tonnes/kilograms/grams**
- **Litres/centilitres/millilitres**
- **°Celsius**

Imperial units:

- **Miles/yards/feet/inches/fractions of an inch**
- **Tons/hundredweight/stones/pounds/ounces**
- **Gallons/quarts/pints/fluid ounces/cups**
- **°Fahrenheit**

Note: not all imperial measurements are the same. For example, the US pint is 16 fl oz whereas the British pint is 20 fl oz. This can confuse learners especially if they try to follow US recipes.

Comparative words

- **Large/larger/largest**
- **Small/smaller/smallest**
- **Wide/wider/widest**
- **Long/longer/longest etc.**

Making connections

Learners sometimes do not consider measure to be part of mathematics and are consequently unable to make connections between it and any other part of the subject. This is compounded by the fact that measure is often taught as a discrete unit. As tutors, we can use measures in all our examples and practice exercises instead of just using number.

Meaningful connections help to make sense of mathematics making it easier to learn. We can use the knowledge and experience that all adult learners already have of measures.

Work on measures can be integrated into all mathematics topics; number, decimals, fractions, percentages, ratio, shape and data handling. Learners are expected to use measures at all levels of the numeracy curriculum.

For example, when teaching any of the four rules of number, why not use measure problems?

- Add up the weight of luggage to check it is within baggage allowances (addition and subtraction)
- Find out how many shelves can be made out of a given length of wood (division or repeated subtraction)

When teaching decimals and rounding, measures can help learners to make sense of why they sometimes round to two decimal places and sometimes to three.

There are many other areas of mathematics, such as fractions or ratio, where using measures in the examples can help learners both to understand the concepts and to apply their life experience.

Learners should be encouraged to develop their skills in multiplication and division by 10, 100, 1000 as these skills are integral to understanding and using measures. They use these skills every time they convert between units within a metric measuring system and as a starting point for when they need to convert between metric and imperial systems.

Their knowledge of the decimal system will be extended when they move into the other bases of the imperial system.

For example:

To convert measurements in m and cm entirely to cm, learners must be able to multiply by 100.

To convert measurements in litres and ml to fluid ounces, learners must be able to first multiply by 1000 and then divide by the relevant conversion factor.

Learners' knowledge of fractions will be extended when they consider buying ½ and ¼ Kg of fruit or working out how many ½ pints of beer there are in three pints.

Although the Adult Numeracy Core Curriculum identifies specific skills and knowledge about measures as elements at each level, this should not be seen as a set of hard and fast rules. If learners are encouraged to understand and explore measure concepts, their work on measures may well spread across more than one 'level'.

Teaching points

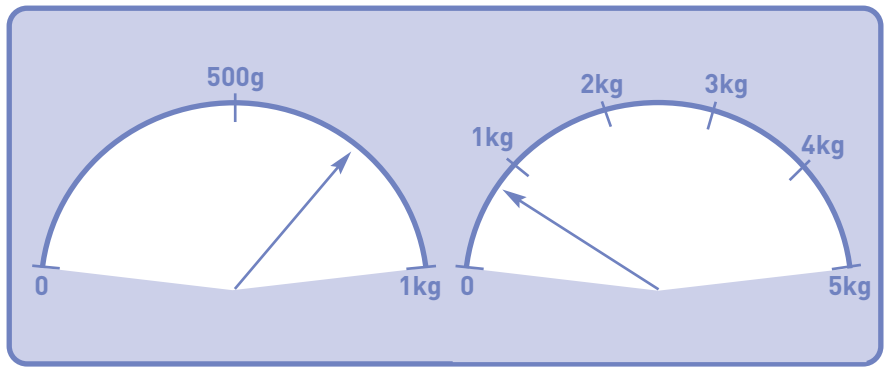
- Measure lends itself particularly well to practical approaches and use of realia. Learners should be encouraged to experiment and to try things at home, then report back to the class.

- To make learners appreciate the need for standard units, they should work with pacing and other body measurements in an investigation. For example, learners could be asked to individually pace the length of the room. One learner could be asked to measure the length accurately with a tape measure. The class then compare all the results.

- Learners need to understand that there is often a place for estimating before they measure accurately, and that accuracy of estimation improves with practice. They may begin to see that people who regularly work with measures and appear not to use measuring instruments may just have had sufficient practice to be very accurate in their estimation.

- Learners need to be carefully taught how to use the measuring instruments – this is a skill in itself and often many instruments that purport to measure the same thing operate differently.

- Learners also need to be shown how to read scales and dials. In particular, they need to know about setting scales to zero before use. They need to use the information given on the scale, such as the actual numbers and to count the divisions. For example:



Activity examples

Here are some example activities for developing learners' understanding of how big or small measures really are.

These can be differentiated by giving more information to lower ability levels, and asking higher ability groups to do their own research. You can ask higher level learners to think of extensions to the activities.

With all the activities, the method of working and the discussion is more important than the "right" answer.

There are 5 activities:

1 **How far?**
2 **Body measurements**
3 **Your weight in chocolate**
4 **Domino games**
5 **The restaurant**

1 - How far?

Present learners with this statement:

"To stay healthy we need to take 10,000 steps a day."

Ask the group to mathematically investigate this statement. You can prompt them with questions if necessary such as:

- **How long is a step? (measuring activity)**
- **How far is that in a day?**
- **How far is that in a year?**
- **How far is that in a lifetime?**
- **How far is it between places such as London and New York.**

Groups can present their results to the class and explain their reasoning.

2 - Body measurements

Give each group one of the following statements to check:

The distance round your head is the same as the length of your arm from your shoulder to your wrist.

The total length of all your fingers is equal to the length of one of your arms from your shoulder to the end of your fingers.

Your height is the same as the length of your arms outstretched.

Your height is seven times the length of your foot.

They might find the following check list helpful:

1	**Decide what you are going to do.**
2	**Decide how you are going to do it.**
3	**Investigate the statement.**
4	**Record the findings**
5	**Prepare report to show other groups**
6	**Present findings to others**

3 - Your weight in chocolate

Ask groups to answer the following question:

How many bars of chocolate would you need to make your weight in solid chocolate?

Make sure learners consider what they need to measure and how they could achieve this. What would they need to do with the results?

Extension: What if you used butter instead – do you need more or fewer packets? How much more or less?

4 - Domino games

Use the activity template software from *Thinking Through Mathematics: strategies for teaching and learning* (available at www.maths4life.org) to create a set of dominoes which require learners to convert between different units and so match their dominoes – for example, 2.73cm and 27.3mm.

5 - The restaurant

Set up 2 or 3 groups of learners, giving each a different type of catering establishment to think about – for example, a coffee shop, a restaurant and a fast food outlet. In whole class, brainstorm the differences between these establishments. This will highlight differences in, for example, décor, staffing, opening times. These differences are the ones to use for measure work – there may well be others useful for studying different parts of the mathematics curriculum.

Interpreting measures

Interpreting units

A way of helping learners to interpret units of measure is to get them to sort according to pre arranged categories. This can be very effective in encouraging learners to reflect on and discuss their reasoning. Later, learners can be encouraged to devise their own categories. They may sort according to size, weight, capacity, length of time, value, or according to whether statements about measures are true or false.

These sorting activities allow differentiation within the group, with learners using different classifications depending on their personal experience of measure.

	Less than one metre	More than one metre
Metric	36mm 100cm 1000mm	1500cm 1 km
Imperial	2'6" 16 inches	2 yards

Note: it is always useful to include some measurements that don't fit any category, for example, £2.50 – it promotes discussion.

Similar exercises can be done with units of capacity and weight.

Interpreting actual measurements

The best way to help learners to interpret measures is to enable them to practise measuring everyday objects using common measuring instruments. They can for example, measure some of the following, choosing from a range of measuring instruments:

- **The room to see how much paint is needed**
- **Ingredients for cooking**
- **Parcels for the post office**
- **Water to make up squash**

When learners have measured, they should apply common sense to check their answers. For example, if the learner knows the door is 2m high, the length of a pencil is unlikely to be 20 m. Similarly, if the learner knows that a can of drink holds 330ml, a teapot is unlikely to hold 30 litres.

Making estimates

It is important that learners are able to make realistic estimates easily. The only way they will achieve this is by practising estimating. As tutors we should emphasise the need to estimate before measuring, not the other way around.

Some useful rules of thumb:

1 metre is approximately the distance from a shoulder to the tip of the hand when the arm is outstretched.

1 cm is approximately the width of the tip of the little finger.

1 inch is approximately the top joint of the thumb.

1 foot is approximately the length of a size 9 foot.

1 gram is approximately the weight of a Smartie™.

1 Kg is the weight of a standard bag of granulated sugar.

A kilo (1 Kg) is just over 2 lbs.

2 gallons is approximately the capacity of a bucket.

A litre is a bit less than 2 pints.

A yard is a bit less than a metre.

A mile is a bit more than 1500 metres.

Evaluating statements about measure

We can find out a lot about how our learners think and what they already know about measure by listening to their discussions. Unfortunately, getting learners to discuss mathematics is never easy because often at school they were taught that mathematics is an individual activity. Also, because sometimes a question in mathematics has a single right answer, learners feel there is nothing to be discussed.

One way to encourage discussion is to prepare a set of statements about measure, each on an individual card. Ask learners to decide, in their groups, whether each statement is true always, sometimes or never and to sort the statements accordingly. Most importantly, they need to come to a consensus as a group. Once they do this, they have to be able to justify their decisions. They need to be able to give examples and convincing explanations when they present their findings to the rest of the class.

The statements may include common misconceptions as well as straightforward facts that they should (but may not) know. As part of the activity, learners should be encouraged to think of other statements for others to classify.

Here are some examples:

1 metre is bigger than 1 millimetre

You can count money by weighing

Painters and decorators need measure

1/2 Kg is smaller than 1/2 lb

You don't need scales to follow a recipe exactly

Length can be written as a decimal

A shower uses less water than a bath

1/2 litre is smaller than 1/2 a pint

You don't need fractions when dealing with measure

Pacing is an accurate way of measuring a room

Links outside the classroom

Measure is a topic where learners may have better experience outside the classroom than inside it. Learners often have ad hoc ways of measuring in real life, which do not necessarily transfer easily to formal mathematics problems. This is because they rarely have a need to calculate with measure or to measure accurately in real life.

It is important that we relate activities in the classroom to situations where learners encounter measures outside the classroom. For example, learners have to furnish their houses. They need to be able to know whether a TV stand will fit into a space before they buy it. They may want to make curtains for a bedroom without wasting expensive material or having curtains that are too short to do the job.

So classroom activities should reflect these needs. Practical weighing must use items that learners might want to use, or which have some meaning in daily life. For example, it may be helpful to know roughly how much I can lift, how many items will fit in the average washing machine load, or what an aeroplane baggage allowance feels like.

Similarly, learners don't need to know how many 200 ml beakers of water will fit into a bowl; it would be far more useful to know how many glasses of cola could be poured from a 2 litre bottle.

This requires us to be more prepared as tutors; we need to ask learners to bring in the realia we want them to use (but have some in reserve in case learners forget).

We can put together activities that relate to learners' experiences outside the classroom that encompass many aspects of the topic. For example, a learner about to take a caravan on a European touring holiday would need to be able to work out journey times, read timetables, calculate road distances, fuel consumption using distance and capacity, use weight to assess loads and know what clothes to take for the local temperatures. Although this scenario (taken from one of our Entry 1 learners) may not apply to all learners, the learners themselves will tell you what they are interested in doing.

Assessing understanding of measure

Modes of assessment

Traditionally, mathematics has been assessed summatively by the end of term test, or by the successful completion of examples or worksheets. Although we still need to use summative assessment to allow learners the chance to gain national accreditation, assessing them formatively by the use of appropriate questioning and observation may be more useful in assessing learners' skills and achievements throughout the year.

We need to use questioning and observation (our formative assessment tools) to enable us to:

- **build on learners' existing knowledge**
- **identify misconceptions**
- **identify rote learning without understanding.**

Class questions, which everyone has a chance to think about and answer, can provide a useful starting point for discussion. This means that we need to provide a way for all learners to take part without the quieter members of the class being overwhelmed by the more confident.

Allowing silence is surprisingly effective. It gives learners the time they need to think their answers through before expressing them. Also, listening to their explanations and to learners' discussions between themselves can be a more powerful assessment tool than any number of written diagnostic tests.

We need not abandon summative tests; we can make them work for us. Learners can use existing questions as models to write their own questions for each other. They must be able to calculate the answers before they can pose the questions. This can lead them to writing their own questions without a model, using their own interests and life experience to make them real. This process also builds up learners' confidence for when they are faced with the National summative tests towards the end of their course.

Assessment by questioning

Tutors can use questions to find out whether a learner knows the answer to a specific closed question such as how many millimetres there are in a metre. However, we can use questions much more imaginatively for formative assessment and to encourage mathematical thinking.

When we introduce a new topic, questions can help us to identify what learners already know, and some of the misconceptions already deeply embedded in their learning. For example, asking "What could you use to measure the size of this room?" might generate a list of standard measuring instruments or might start a discussion on what size means.

We need to plan our questions. Asking questions without having considered possible responses is a dangerous business. Even so, learners inevitably spring surprises.

Having asked questions, tutors need to consider how to react to the responses. You may need to ask supplementary questions to try to explore what has led to an incorrect response. Equally, it is often worthwhile to question a correct response. Sometimes learners have the right answer with totally the wrong reasoning. We need to be flexible when deciding how far to follow a line of enquiry which was not planned for the lesson.

Questioning learners about why they are doing something is a good way of uncovering their thinking processes. Devil's advocate questions (for example, isn't a litre more than a gallon?) or What if...? questions can help to see if learners have developed a good understanding of a concept.

Learner questions are also important. Some learners may be comfortable asking questions of the tutor and of each other, but many are not. We should set up situations where they need to question each other. In all situations, make sure everyone has time to think before they respond.

Some possible questions on measure

Checking understanding

In the following examples, encourage learners to estimate, and to measure accurately with appropriate equipment or to use whatever ad hoc means of measuring are available to them.

How long is this room?

Which bottle holds more than 250 ml but less than 1.5 litres? (Learners choose from a selection of different capacity bottles.)

Which is the odd one out? 500 ml, 500 g, 500 mm, 500 cm.

If 250 g is the answer, what is the question? Now make another question with the same answer.

Checking reasoning

Encourage learners to explain their thought processes as fully as possible. You may need to pose supplementary questions.

How do you know that is 620 g (when reading from a scale)? Can you show me? Can you teach Joe?

Why is 750 mm the same as ¾ of a metre?

Questions learners may ask

Learners may come to class with some burning questions that they need to have answered. For higher level learners this is a useful opportunity to turn the question back on them and ask them to do some of their own research and to bring back the answers to class. Other questions may arise spontaneously during the class. Sometimes you will need to answer these!

Why do they measure beer in firkins?

What's wrong with the "old" measures?

How do I know which side of the tape measure to use?

Analysing errors and misconceptions

Some misconceptions about measures may be immediately apparent. Asking questions to uncover learners' thinking processes may allow us to see less apparent problems and to identify lucky guesses.

We should encourage learners to voice their ideas, even if these ideas are based on misconceptions. This will give us a better understanding of how our learners think about measure; then we can develop tasks and activities to help learners to resolve their misconceptions.

Examples of common mistakes:

Mistakes while estimating

"I estimated it to be 10 cm. I measured it at 15 cm. So I'll change the estimate to 13 cm."	Learners need to think about whether their estimate is 'near enough' to confirm their accurate measuring.
"I estimated the length of this pencil by counting how many finger widths it was. But when I measured it with a ruler I was way out. So my finger must be much wider than a centimetre."	The learner may have counted each finger width but kept their place with another finger, thereby missing out every other finger width.

Mistakes using measuring instruments

"That's 50!" when the actual measurement was 1m 50cm.	The learner does not understand the units so did not supply any. She didn't estimate first so has no idea of the length of the item she is measuring. She doesn't know how to read the divisions on the tape measure so has ignored the 1 m division altogether.
"There are 2 sets of numbers and I don't know which to use!"	The learner has a measuring instrument which can give results in both metric and imperial units. Also watch for learners giving some measurements in each system.
"I've counted the divisions; they're every 100. So if that's 2Kg, the pointer shows 2Kg and 300g." when the actual weight was 1Kg 700g.	The learner does not know which way the pointer moves – it can vary over different types of weighing scales. The learner is also not confident in expressing g and Kg in the same measurement.
"I've weighed this full Kg bag of sugar and it doesn't weigh a Kg!"	The learner may not have set the scale to zero before weighing. Alternatively, he may have been touching the scale or have some other item resting on the scale or the scale may not be on a level

Mistakes using language of measure

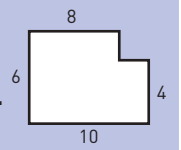
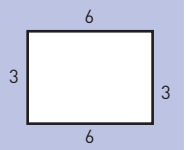
"I make it 50 centigrams" when the reading is 500g.	The learner has extended the language from centimetres and centilitres and created centigrams.

"I thought kilo meant a thousand but there's a thousand millimetres in a metre."	The learner expects the prefixes to work across the measure units. She does not realise that milli means thousandth.
"I know centimetres, millimetres and kilometres, but what's a perimeter?" **"Why does kilo mean Kg and not Km?"**	The language of measure is not always consistent. We do need to teach language carefully.

Mistakes in representing measures

"It's 4m and 5mm, so that's 4.5m."	The learner may not know how many millimetres there are in a metre, or he is not confident with decimal notation.
"The perimeter is 28cm^2."	The learner knows that some measures use square or cubic units but she does not know which measures use which type of units.

Mistakes in calculating with measures

"The perimeter is 28cm" for the shape shown here. 	The learner knows that perimeter is the sum of the length of the sides but he has not counted the unlabelled sides.
"The area is 6x3x3x6=324cm^2" for the shape shown here. 	The learner knows that area involves multiplication of the sides, but because all the sides are labelled, feels that she must use all the numbers.

Ways to help your learners

General approach

Do

Do
Find out what your learners know and start from there.
Use group work and make sure that activities are enjoyable and stimulating.
Encourage discussion.
Think about how groups are composed. This can encourage quiet learners to blossom and accomplished leaders to take a back seat.
Give lots of thinking time when you ask questions.
Support learners in checking their own and each other's work.
Encourage learners to make up questions for each other.

Don't

Don't
Give endless drills and practice tests.
Allow "death by worksheet".
Give out proformas or writing frames for lower level learners; they learn by making up their own format for recording data and become more independent.
Tell learners all the answers.
Let learners become too comfortable in their groups.

Do

Don't

Specifically related to measures:

Do
Talk about how to use measures in everyday life.
Encourage learners to estimate measures and to see the value of estimation.
Use lots of practical measuring.
Measure for a purpose.
Show measures in a variety of representations especially in realia.
Encourage learners to use their measure skills at home.
Make connections with other mathematics topics especially decimals.
Don't
Allow learners to compartmentalise measures or to see them as separate from all other areas of mathematics.
Teach learners to memorise conversion factors without practical experience of measuring and counting units.
Teach learners to memorise formulae for area, perimeter and volume.

Suggestions for resources

- **Readers are advised to read the background to these approaches. See the Thinking Through Mathematics ring binder for details (order it at www.maths4life.org)**
- **Measurement wasn't taught when they built the pyramids – was it? Mark Baxter, Eamonn Leddy, Liz Richards, Alison Tomlin, Topo Wresniwiro and Diana Coben (NRDC, 2006)**
- **Mini whiteboards and whiteboard pens and wipers**
  Use these to enable learners to jot down responses and work out ideas, freeing them from the worry of crossing out mistakes. They also enable tutors to assess everyone's understanding and progress rather than just the few who are prepared to speak out.
- **A range of measuring equipment:**
  Length: 30cm ruler, tape measures – steel, material and paper, metre stick, trundle wheel, pedometer.
  Weight: scales - balance pan, digital, postal, simple kitchen, bathroom, spring balance.
  Capacity: measuring cylinder, jugs, spoons, pipettes, cups.
  Temperature: thermometers – digital, mercury, max/min.
- **Realia to measure and discuss such as food packets and food, drinks bottles and water, maps, objects around the classroom**
- **Realia for measuring with, such as helium balloons and string**
  Use these to measure the height of a tall room (tie balloon to string) or use the string to measure round awkward shapes or measure roads on maps.
- **Squared paper especially useful for area and perimeter**
- **Dienes blocks**
  Use these to demonstrate unit cubes making up a volume.
- **2D and 3D shapes and nets**
  Use these to investigate area, surface area and volume.
- **www.bbc.co.uk/skillwise/**
  Use the quizzes and games. Although aimed mainly at E3 upwards, there are some that can be used with E1 and E2 learners.
- **www.mathsnet.net/numbercruncher/index.html**

Notes

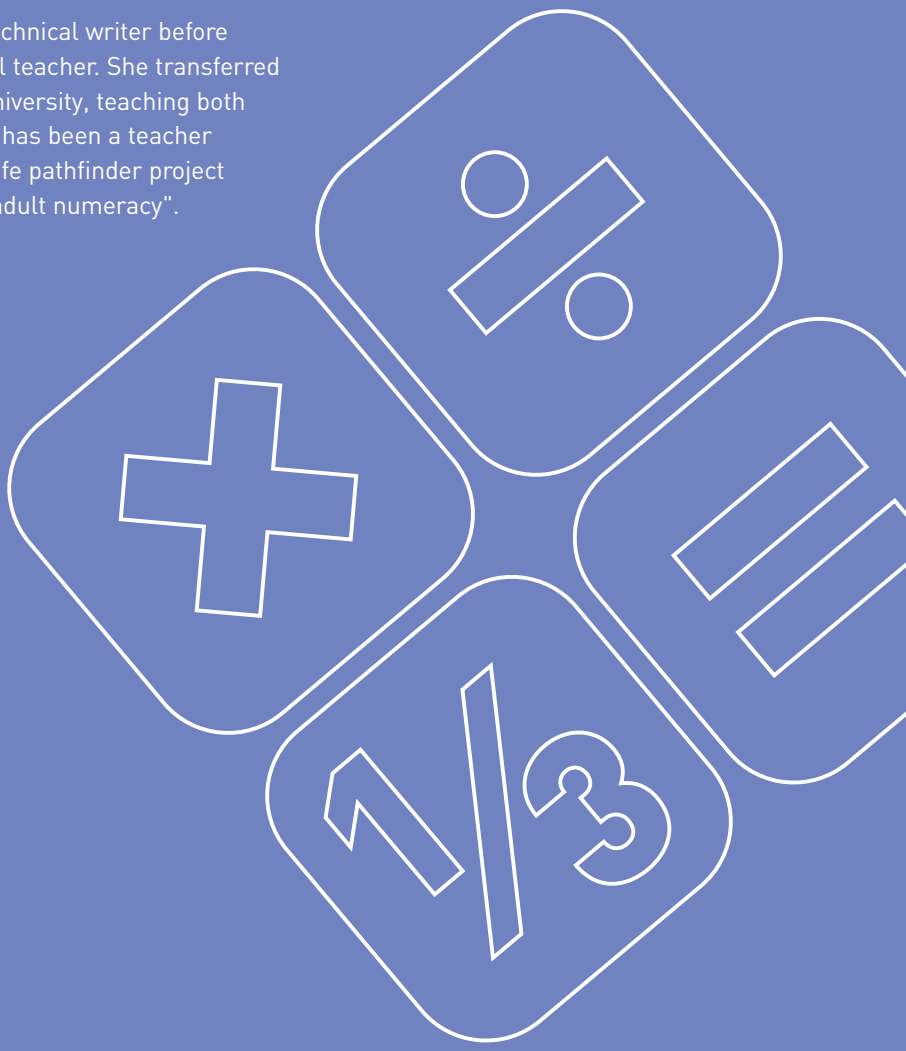
About the authors

Christine Ness

Christine leads the numeracy team in the Learning Skills department at Thames Valley University (formerly Reading College). She teaches Skills for Life numeracy classes, maths study skills sessions and numeracy teacher training courses. She has been a teacher researcher on two Maths4Life pathfinder projects - "Formative assessment in adult numeracy" and "Funds of knowledge".

Debb Bouch

Debb spent 20 years as a technical writer before training as a primary school teacher. She transferred into FE at Thames Valley University, teaching both numeracy and literacy. She has been a teacher researcher on the Maths4Life pathfinder project "Formative assessment in adult numeracy".



This booklet is produced by Maths4Life to provide teachers of adult numeracy with some ideas about how to teach measure. The aim is to examine why learners may find it difficult and to describe ways which the reflective teacher can overcome these difficulties.

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