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TEACHING Measurement

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A PRACTICAL APPROACH

At Right Angles
A Resource for School Mathematics

Measurement

Measurement occupies a unique position in the curriculum, for various reasons. As it is an essential everyday activity in human life, children are naturally exposed to measurement in various situations at home and elsewhere. Also, measurement overlaps both with numbers and geometry. It involves spatial dimensions as well as counting. In measurement, one is measuring one attribute in terms of another attribute. Also one is expressing a non-discrete quantity in terms of discrete numbers. Since there are different ways of measuring the given length or mass, the choice of the measure is dependent on the purpose that needs to be served. Children need to understand that some contexts require precision to a fine degree while some require approximate figures. A strong foundation in measurement concepts leads to a better understanding of decimal numbers in particular.

The focus of the teaching of measurement needs to be more on developing a proper concept of measuring rather than on practising measuring activities. As the topic is developed, children need to begin to appreciate under what situations measurement can be used, and the suitability of different measures in different situations. It is also important to create activities to the extent possible which have an inbuilt task in them, a task which is sufficiently interesting and challenging for the children to take up with enthusiasm.

I have focussed only on length, weight and capacity in this article. Measurement includes many other measures as well: measurement of time, of temperature, of speed and so on. I shall go into these in a subsequent piece.

Measurement activities often require tools which may be limited in supply. Also typically the activities require children to cooperate (like holding a rope tight or bringing two things together). It is best to organise children in groups of four and set each group a task.

Young children require both experience and maturity to understand measurement concepts. The awareness of quantity and appropriate language associated with that happens simultaneously. Words such as big, small, more and less are learnt at a very early age. However, they may take time to understand the principle of conservation of quantity or number. It is dependent on the experiential understanding and maturity of the child and develops slowly and varies from child to child. Also, they may hold false assumptions about weight or volume. For instance, they may believe that between two objects, the one that looks larger also weighs more. Or they may think that a taller container can hold more than a shorter container. However, a teacher can quicken the pace of development by exposing the children to meaningful activities and guiding them along by getting them to articulate their observations and ideas. Through conversation, a teacher can clear some of the misconceptions and help the child to acquire right understanding. The principle of conservation is a prerequisite in developing an understanding of the principles of measurement.

Keywords: *Measurement, length, height, weight, capacity, size, comparison, estimation*

Preliminary activities for young children (3 to 5 year olds):

To understand the attribute of LENGTH:

Materials: Straws, used sketch pens, ice-cream sticks or toothpicks, coloured paper strips or wooden rods of different lengths, coloured ropes or shoe laces of different lengths, pencils, beads and rope for threading.

Selection of materials is to be done carefully so that children can focus on one attribute. Large 2-D shapes and 3-D objects can be introduced at a later point as they have more than one measure (length, width and height).

Language to be introduced: long, short, tall, longest, shortest, thick, thin, wide, narrow, distance - related words (far, near).

Comparison of two objects of the same type: Let children compare two standing objects like two trees or two children standing on level ground to identify the taller and the shorter. Since the objects stand at the same level, there is no scope for confusion. Let them now do the same for two sticks or two paper strips to identify the longer and the shorter. An advantage of measuring strips is that they can be placed one over the other. To compare the strips, the children will need to bring them close to each other. At this point, the teacher must check to see that the child has placed the strips so that the lower ends have the same starting point. If not, the teacher will need to help the child understand that in order to compare lengths, the objects must be aligned at the starting point.

Comparison of two objects of different types: Let them compare the lengths of a pen and scale, chalk and duster, a pencil and scissors.

Task 1: Give each child a straw and ask the children to get an object as long as the straw. They may find a pencil, a book, a leaf or a broom stick. In the process of locating the object, they would have tested it against many objects and acquired practice in comparing lengths of objects.

Comparison of more than two objects: Given a set of objects (pencils, chalks, paper strips, sticks and so on) with different lengths, they can arrange the objects in order of their length. Children can make bead chains and hang them in length order. Note that bead chains provide an opportunity to make numerical comparisons too: "The blue bead chain is two beads longer than the red bead chain."

Task 2: Ask children to form groups of four and have each group stand in height order.

Task 3: Sorting activity: Materials: Coloured straws or crayons of four different lengths as shown in the picture shown in Figure 1, with a few of each size. Ask the children to sort the straws or crayons into groups of equal length.

Introduce the words 'wide' and 'narrow' in various contexts: Opening and closing the door, pointing to the gap (wide and narrow); or wide/narrow paper strip. Young children enjoy physical activities and they can demonstrate the meanings of these words by opening their eyes ('wide open', 'tightly shut'), parting their fingers, etc.

Provide opportunities for checking other forms of lengths like *width* and *thickness*. Again, ensure that they

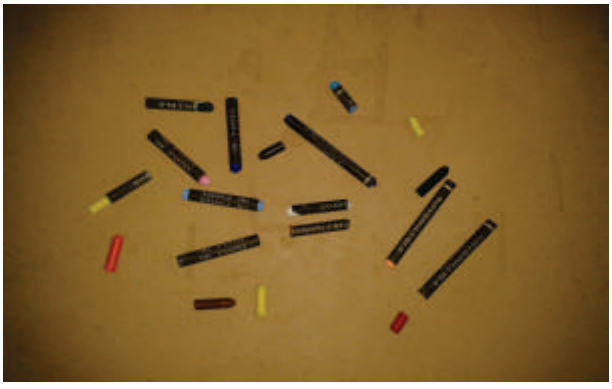

Figure 1

have aligned the objects correctly. Let them compare the widths of two note books, widths of two pencil boxes, etc. Encourage them to use appropriate words: "The English notebook is wider than the Math note book" or "His pencil box is narrower than her pencil box", etc. Let them compare the width of a chalk box and a pencil box, width of a duster and ruler.

Similarly introduce words like *thick* and *thin* by pointing to a thick book and a thin book, and a thick line and a thin line. They can observe the different fingers on their hand and describe them in terms of these words.

Task 4: Let each group of students collect four sticks and use the words thick, thin, thicker than, thinner than, as thick as, in between, etc to describe them. Let them arrange the sticks in order of thickness.

Comparisons of objects with more than one attribute: In the case of 2-D shapes and 2-D objects, comparisons can be made based on different attributes. "The text book is longer and wider than the note book." "The door is taller than the window, but the window is wider than the door." "The bench is wider than the table, but the table is taller than the bench." And so on.

The teacher may pose a problem: "Is there a box in which I can keep the duster?" Let the children experiment with various boxes in the class and give reasons for why it will fit or why it will not. "Can it fit into the chalk box? No, the chalk box is not long enough. Can the duster fit into the pencil box? Yes, it can as the box is longer than the duster and wider than the duster." Many more questions of this kind can be posed. Can the book go into this bag? Will the map fit in this space?

To understand the attribute of CAPACITY/ VOLUME:

Materials: Large tub or a decent sized sand pit, cups of different sizes, narrow tall containers, wide short containers, discarded transparent plastic bottles, transparent plastic bowls, cardboard boxes of different sizes, sand, beads, cubes and boxes, bricks or wooden blocks. Bucket, mugs, funnel, sieve and water.

Children need to experience activities involving filling, pouring, packing, fitting and emptying to understand the principles involving capacity. With small children we do not use the words *volume* or *capacity*. Instead we pose questions such as: "Does this hold more than that?"

Children take great pleasure in filling slightly damp sand into containers and inverting them to get sand moulds. This is potentially an excellent opportunity to bring out concepts related to shape and capacity. Once the children have made several sand moulds with different objects on the ground, an interesting question to pose is: "Identify the container used to make each mould." Secondly, moulds come in interesting shapes based on the containers used: cylinders, cones, truncated cones, cuboids and cubes. Children can describe these shapes in their own way. Thirdly, a discussion can ensue on finding the bigger mould.

Let children compare capacities of two containers by filling one with sand and then pouring out the same sand into the other container. Let them repeat this activity with different containers. Initiate a conversation with the child to check whether the child has realised that if the sand does not fill the second container, then the second one has greater capacity. And if it overflows, then the first one has greater capacity.

It is quite common for young children to think that a tall container has greater capacity than a short container. It is only through experiences of filling and testing that they begin to realise that this may not always be true. Usage of transparent containers makes it easier for children to see the capacities of different containers. Give children two plastic containers of equal height, one with a narrow base and one with a broad base. Let them fill each one with a cupful of water. Ask: "Why is the height of the water in one more than in the other?" Let them understand that the size of the base is more in one than in the other. Devise more such experiments to remove misconceptions.

Figure 2

To understand the attribute of WEIGHT:

Materials: Large tub, few cups or mugs of same size, small cardboard boxes, sand, water, beads, used pens, leaves, chalk pieces, different objects of varying weights.

Let children pick up one object in one hand and one in the other to compare their weights.

Let children play around with filling a cup with various materials such as sand, chalk pieces, stones etc, and ask: "Which material is the heaviest?" "Which is the lightest?"

Children may have notions about length and weight or volume and weight which are incorrect. Give simultaneously opposite examples as given below to prevent and clear any misconceptions that may arise with regard to weight.

A larger object does not always weigh more.

Give children a large balloon and a tennis ball. Let them compare their weights and see that even though the balloon is larger in size, it weighs less. Also, give two other objects where the larger object does weigh more, say a thick book and a thin one.

A larger quantity does not always weigh more.

Fill a large packet either with cotton or saw dust. Fill a smaller packet with sand so that the weight of the sand packet is more than the sawdust packet. Let children lift both objects and find out which has greater weight.

Objects of the same length may have different weights.

Give children different objects of the same length, say a paper strip and a wooden or metal rod. Let them pick up the objects one in each hand and compare the weights. Do the same with more pairs of objects of the same length.

Weight of a larger number of one type of object is not always more than the weight of a smaller number of some other type of object.

Give children five balloons or table-tennis ('ping pong') balls and a cricket ball. Let them compare the weights of both and see. Let them realise that a greater number does not necessarily imply more weight.

Tie a rope from one end of the class to another with a basket hanging from it as shown in figures 3 and 4. Pull it taut. Let children experiment with placing different objects in the basket to find the heaviest and the lightest.

Measuring activities for 5 to 7 year olds:

Measurement of LENGTH with 5 to 7 year olds:

Comparisons of objects which need another object to be used as a measure:

Task 5: Is the cupboard in the class wider than the door?

This requires comparison of objects which are fixed and cannot be placed next to each other.

Questions of this kind require the use of another object to be used as a measure, say a string. The cupboard is first measured with a string and a blue mark is made on the string marking the endpoint. Then the same string is used to measure the door and a red mark is made on it at the new endpoint. From the two marks we can determine which one is the wider object. Or two strings can be used and laid next to each other for comparison.

Children can be encouraged to use their feet or arms to make comparisons of fixed objects. Example: The width of the classroom steps is longer than my foot, and the width of the steps on the slide is shorter than my foot.

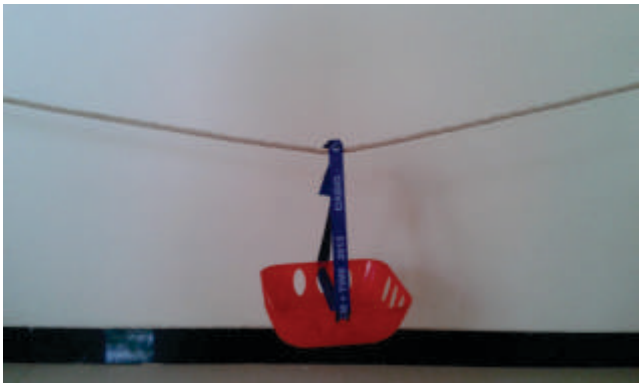

Figure 3

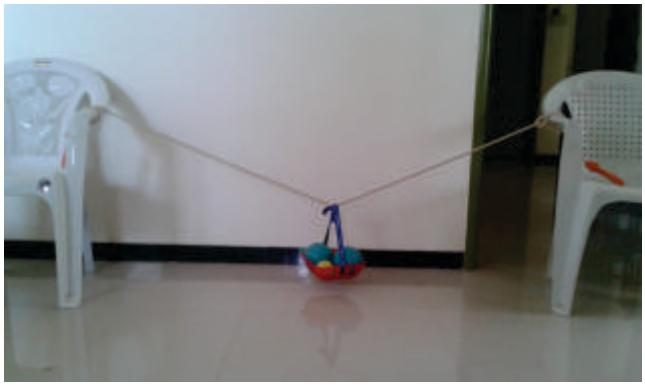

Figure 4

Task 6: Who has the biggest head? Let children work in pairs and use a string to measure the length around the forehead. They can mark the strings and lay them out straight for comparison.

The level of accuracy needed in measurement depends very much on the context. In many of our day to day activities, we use non-standard units (NSUs) routinely as we need only approximate values. By approaching measurement through the usage of NSUs, the measurement concept becomes clear to young children. A scale with numbers and fine divisions can be better appreciated by the child when he or she constructs the scale and marks the numbers on it.

Pose a task: Is the length of the class more than the width? If so, by how much?

Children select a unit available in the class like a straw to measure the length of the room and the width of the room in terms of number of straws and determine which is bigger. Selection of the unit should be attempted by the child on his/her own. He/she needs to develop the skill of choosing the right unit. It is only through trial and error that the child begins to realise that a large unit will not give a useful answer, while a very small unit will make the number large and unwieldy. Later, guide the children to use straws or wooden blocks for measuring longer lengths and ice-cream sticks or paper clips for measuring smaller lengths. Beads can be used for measuring very small lengths but they tend to roll.

While they measure with NSUs the teacher needs to watch out for the following:

- Do the children know where to begin and end? Have they left any gap at the start, or is it aligned correctly?
- Have the children placed the units one after another without gaps or overlaps?
- Have they managed to form a reasonably straight line or has the line become curved?

If the teacher notices that any of the above conditions have not been met satisfactorily, he/she should initiate a discussion or demonstrate to them why it would give an incorrect result. Also, while using straws and sticks an uncovered space might result at the end. Teacher can help them to do rounding.

I once asked a group of preschool children, varying in ages from 3 to 5, to make the longest possible train in the class using blocks. It was very interesting to see the engagement that ensued. One child began to form a line of blocks from the middle of the room. Soon they laid out a string of blocks and reached one end of the room. Just as they thought they had finished another child noticed that they had started from the middle and that they could extend it in the other direction too. Quickly more blocks were picked off the shelf and unloaded to complete the train to the other end as well. Since they had not lined the blocks against the wall, their train was not absolutely straight. When I asked 'how many bogies are there in your train?, with great enthusiasm they counted off in chorus and found it to be 114 bogies. The counting itself did not go smoothly as the younger ones were uncertain about some numbers. But the older ones corrected them, and they finally arrived at the correct number. I then asked them: "How many bogies long is the room?" They took some time to respond and this time it was the older ones who saw the correspondence between their train and the length of the room and answered correctly.

Measurement of curved lines: Let children use small units like ice-cream sticks or paper clips and measure the length of curved lines or length around a circular shape. "Whose shape has the biggest round?" "How much bigger is this flower pot than the other?"

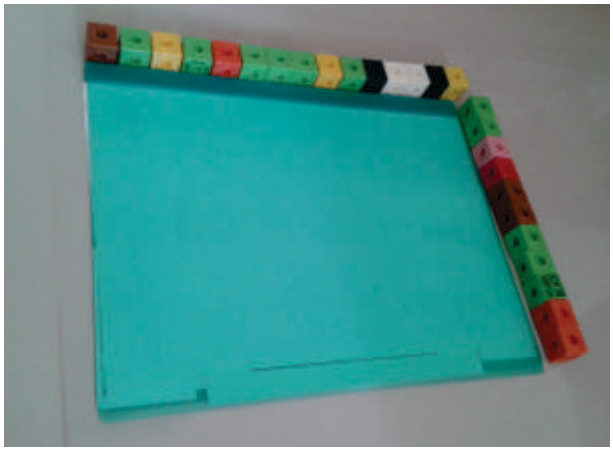

Figure 5

As children go through the experience of measuring lengths with NSUs they need to absorb certain essential principles involved. One principle is that they need to use the same unit repeatedly while measuring one object. Secondly to make comparisons between two lengths they need to use the same unit for measuring both. Thirdly they begin to see that measurement with a larger unit will result in a smaller count and measurement with a smaller

unit will result in a larger count. They will later be able to appreciate that the choice of the measuring unit depends on the level of accuracy that is needed.

The teacher can devise activities which lead to an understanding of measurement processes and skills.

Materials: A long strip, three measuring units of different length (chalk, tooth pick, straw).

Let children measure the long strip with each unit. They will see that when they measure with straws they get a small number, when they measure with a chalk they get a larger number and when they measure with a toothpick they get a still larger number.

Body lengths: Let children work in pairs. One child lies on the floor, and the other traces the outline of his body with a chalk. Let each child measure the length of his body using straws or sketch pens.

Help them to record the information. Similar activities can be done by tracing the foot or palm of each child and selecting a suitable measurement unit.

Using body measures as NSUs: Children now begin to measure lengths using the foot as a unit of measurement. They also use hand span and paces, though this requires greater motor co-ordination to get it right. Sports and games activities provide many measurement opportunities.

Task 7: Mark a circle on the ground outside or in the veranda of the school. Let children take turns to stand in the circle and throw a stick, one by one. Let them measure the distance thrown using feet or paces.

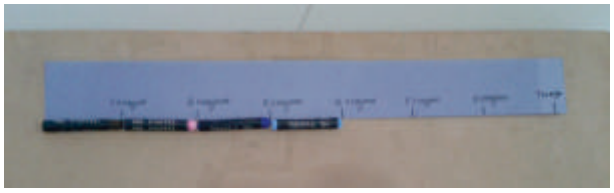

Figure 6

Constructing Rulers of different units: Let children build cardboard rulers using a straw or ice-cream stick as a unit, as shown in Figure 6. Let them number the markings as '1 straw' or '1 stick.' This will help them understand that '1' points to the place where one straw ends and the second one begins. Children often make errors in measuring by not aligning an object with zero on the scale as they do not understand that the number '1' is at the end point of the measuring unit.

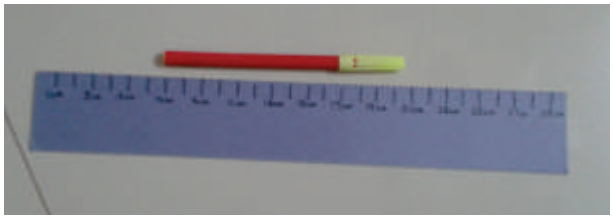

Figure 7

Show them why aligning the starting end of an object with zero facilitates reading of information. At the same time, expose them to measuring lengths of objects which are not aligned, as shown in Figure 7, so that they understand the need to subtract the first number from the second number in order to determine the length of the object.

Measurement of **CAPACITY** for 5 to 7 year olds:

Materials: tub, plastic bottles, plastic containers (some with small base and some with large base), cups or glasses, cardboard boxes (all these items should be of different sizes), plastic or wooden cubes for fitting into the boxes, sand and water.

Figure 8

Children can compare the capacities of two or more containers by filling the containers with sand measured with a cup and count the number of cupfuls each one holds. Ask questions which require them to apply their understanding: "Does this cup hold double of that cup?" "Will the container fill up if I pour one more cupful?"

Let each group of four children select one large container and three differently sized cups for measuring the capacity of the container. Ask questions which will require them to reason out their answers. "How many small cupfuls of sand did you use to fill the bowl?"

"How many big cupfuls of sand did you use to fill the bowl?" "Why did you get a smaller number?" Point to a size which is in-between and ask: "What will happen if you use this cup?" Point to a bowl which is smaller in size than the one measured and ask: "How many small cupfuls of sand will this hold?"

They can measure the capacities of their water bottles. Children's water bottles come in various shapes and sizes, and as they measure them they will see that objects which look different in size and shape may have the same capacity. They can also measure the capacities of their tiffin boxes by filling it with cubes.

Measurement of **WEIGHT** for 5 to 7 year olds:

Materials: Give children a collection of objects and ask them to pick up pairs of objects which are similar in weight.

Building a sense of weight: Give children some identical cardboard boxes each containing an object which they have handled before (examples: chalk, duster, crayon box, tennis ball, stapler, punch), of different weights. Mention the names of the objects used. Let children pick up each box in turn and guess the object in the box based on the weight.

Hanger balance: Build a hanger balance as shown in Figures 9 and 10 for children to compare weights of different small objects.

Figure 9

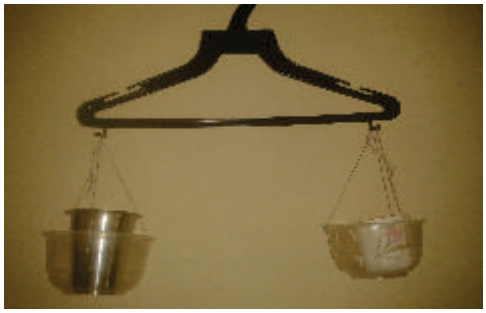

Figure 10

With older children in the primary school, the teacher should use the knowledge and experiences that children already possess with regard to usage of length, weight and capacity. Children would have already witnessed usage of length while buying cloth, when they visit a tailor, while buying shoes, height chart in a doctor's clinic, etc. They would have experienced weights while buying vegetables and sweets, on packaged products, in a doctor's clinic, in baking activities, etc. They would have experienced capacity while having cool drinks, buying milk or oil, drinking water cans, metre readings of petrol consumption, etc.

Measuring activities for 7 to 9 year olds

Measurement of LENGTH for 7 to 9 year olds:

Need for standard units: Select a long object in the classroom, say the blackboard or a wall, for measuring its length. Ask different children to measure it using hand spans. The teacher can also measure using his or her hand span. It will be noticed that slightly different answers are obtained. Discuss with the children the reasons for such differences. Point out the difficulties that can arise if we had to ask a carpenter to make a frame for the board and we specified the dimensions using NSUs. Bring in the need for standard units as measures.

Sense of centimetre: Now one can make the transition to the standard units of centimetre and metre. Show a centimetre ruler to the children and help them understand the markings. Typically, the zero mark is a little off the edge of the ruler. The teacher must explain this so that the children clearly see that the cm length begins at the zero mark.

Normal rulers come with millimetre markings as well. If one wishes to avoid teaching millimetres at this stage, it is good to prepare and keep centimetre rulers in the class, so that one can introduce millimetres at a later point. During the days when wooden rulers were available, I used the back of the ruler to create cm markings. However, if children are curious and ask about the smaller divisions within the centimetre markings, the teacher can explain about millimetres as well. Let the children count the divisions and see that 10 millimetres makes a centimetre, and that a millimetre is useful for very small lengths. However, while recording measurements they can write lengths as 1 cm and 5 mm, or 15 mm. Decimal notation can be taught later.

Construct a ruler with only centimetres marked: Even though children have rulers of their own, it is still worthwhile to get children to build rulers with cm markings and number the markings as 1 cm, 2 cm, etc. In the act of constructing and making markings and labelling them, their understanding of a measuring scale and its divisions becomes clearer.

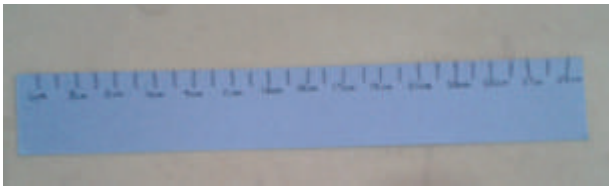

Figure 11

Let them now observe a normal ruler and describe it in terms of the main divisions they see, how each division is further divided into subdivisions, the numbering on the ruler, etc. Verify whether they understand this completely and whether they are able to use it correctly.

Let children measure various objects in their bag, recording the information in a table form. Some questions are always big hits with children: "Who has the widest smile?" "Who has the longest nose?" "Who has the longest palm?" While measuring length, ensure that children do not confuse length with area measure. Length is a linear measure whereas area is a surface (2-D) measure.

Building estimation skills using body measures: Let children find and look for cm sized parts in their body. Ask: "Which finger nail is about 1 cm wide?" Once that is clearly established, they can learn to use their sense of a centimetre to estimate lengths of other small objects.

Practice activities: Children can be given coloured streamers to cut 1 cm pieces without measuring. They can later make a collage and hang it in the class. Toilet roll paper can also be used for cutting and estimation activities involving bigger lengths like 10, 15, 30 cm.

Let them go on a cm hunt and find natural objects which are about a cm long.

Shoe size: Let them measure their foot size and see how it corresponds with their shoe size.

Footprints: Make children into groups of four. Using old newspapers, each group can print their footprints using poster colour. Other groups have to match the footprint with the right person.

Let children collect some small objects like screws, pen caps, chalk pieces, bottle caps, etc. Let them make a table listing these objects and write their estimations before checking and writing the actual measurements next to them.

Construction activities: Measurement becomes meaningful when children are given construction tasks for which they need to use measurements. Create a box to hold a given object. Make a paper T-shirt for a friend, using a newspaper. Create a streamer decoration for the classroom. Make a *rangoli* design in the centre of the floor.

Sense of metre: Show them a metre ruler and demonstrate usage of it in measuring a few objects in the class. It is good to cut and keep a few 1 metre pieces of rope for measurement activities. Let the children use it for measuring arm length, height, etc. They can describe these measures in terms of "my arm is less than a metre," "my leg is less than a metre," "my height is more than a metre."

Building estimation skills using body measures:

Demonstrate that the distance from one shoulder to the tip of the opposite arm is roughly a metre (for an 'average' adult). They can now begin to use this as a rough measure in various estimation activities.

On a daily basis, pose questions about the lengths of new objects inside or outside the class which require them to use their sense of cm and metre. To reinforce the sense of how large is a metre, ask questions such as: "Guess the length of a cycle and a car. Guess the width of a road." They can later measure the width of a narrow road and a broad road, and the width and length of a car.

More on metres:

Materials: Measuring tapes, metre rulers.

By class 5, they can measure lengths of paths from the school gate to the school, or the length of the school veranda, or the road in front of the school. At this point one needs to discuss rounding to the nearest whole figure.

They should also be given tasks which require them to measure lengths in parts and add them like total length around a building or a garden bed. They can also be given broken up tasks so that pairs of children measure lengths from opposite directions and add them to arrive at the total figure.

Different routes: Ask the children to think of the various paths they can take from the school gate to their classroom. Let them guess the length of these routes. They can then measure these lengths and share their measurements in class.

Children of primary school find it difficult to develop a sense of kilometre. However, sports events which involve running on 50 m, 100 m and 200 m tracks will help children develop a sense of these measures.

Task 8: Given a simple local map depicting lengths in kilometres, children will be able to work out the lengths of the shortest routes connecting various pairs of places.

Foot and inches: Since many measurements are done using feet and inches as measures (rather than metre and cm), children can be taught these in a subsequent year once they thoroughly understand cm and metre.

Building estimation skills using body measures: Let children use the knowledge of their own height to estimate the heights of various objects in the class. Get them to articulate how they think about it. They may say: "this seems to be double my height" or "This is slightly more than half my height" or "This is close to my height," etc.

Let them estimate height of the door, height of the class room, height of the tube light, bench, chair, height of the flag pole, etc. This can be followed by actual measurement activities using a foot ruler or a metre scale.

Task 9: Match object and length.

Prepare a set of object cards and length cards. Object cards can have labels and pictures of familiar objects and animals with varying heights (dog, elephant, coconut tree, table, stool, flower pot, doorstep) and the length cards can have possible heights in metres, centimetres.

Children will have to use their sense of length to match these cards.

Measurement of CAPACITY for 7 to 9 year olds:

Materials: Litre bottles, half litre bottles, 100 ml, 50 ml, 250 ml measuring cups, measuring spoons, 5 ml and 10 ml measuring caps of medicine bottles, normal glass, standard cup, paper cups, spoon, bucket and bathing mug, containers with labels showing capacity, sand, water, cardboard boxes, cubes

Building sense of capacity of everyday objects (drinking glass, teacup, spoon, water bottle): Let children fill a tumbler using a 100 ml measure and check its capacity. Let them also fill a tea cup and a spoon with appropriate measuring units and check their capacity. As 1 litre bottles are widely used, children are quite familiar with them. They can also measure a bath mug and a small bucket. Once they are completely familiar with the capacities of these objects, they will be able to use this knowledge for estimating the capacities of other containers.

Create a calibrated bottle: Let children use a standard transparent bottle. They can fill it with 100 ml measure and mark on the bottle with a marker pen. They can record in multiples of 100 or 250, 500, 750, etc.

Let children use cubes to fill different cardboard boxes (toothpaste box, soap box) and compare capacities of these boxes.

Task 10: Building boxes with interlocking cubes or plain cubes: Give each group of children 36 cubes.

One challenge could be to build open boxes with them. What is the maximum capacity of these boxes? Another challenge can be to make all the

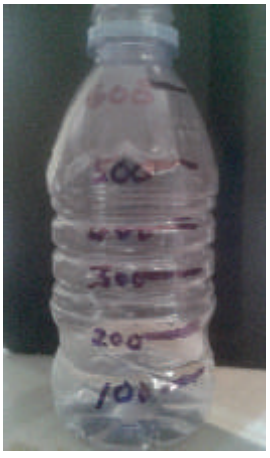

Figure 12

Figure 13

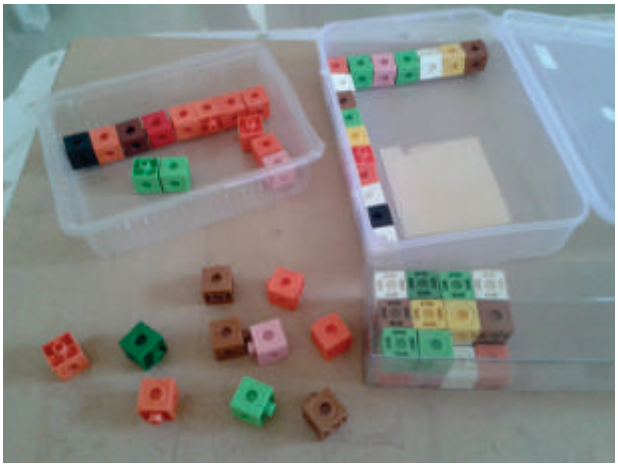

Figure 14

possible types of cuboids with them to see how many differently shaped cuboids can be made from the same number of cuboids.

Checking capacity through displacement: Place a small bucket filled completely with water in a tub. Lower a closed bottle into the bucket. Let the water which has spilled out be collected carefully and poured into the immersed bottle. What is noticed?

Measurement of WEIGHT for 7 to 9 year olds:

Use a rubber band and a clip along with a basket as shown in figures 15 and 16. Let children select three objects and guess the heaviest and lightest among them. Children can now hang the objects from the hooks and measure the lengths of the stretched rubber band. Do they see a relationship between the weight of the object and the length of the stretch?

Materials: Balance made by the children, real balance if possible, 50 gm weight, 100 gm weight, 250 gm weight, 500 gm weight, 1 kg weight (it is easy to put together some stones of equivalent weights packed into cloth bags).

Let children measure the weights of many everyday objects.

Let them build a sense of the weights of some objects they use every day, weights of their tiffin box, water bottle, notebook, biggest textbook, pencil box, pencil, etc. They should use actual weights for the measurements and record the results. Using knowledge of these weights, they should be able to estimate the weights of other objects in the class.

Game: Find a match! One child picks up any object, e.g. a rubber ball, and asks the others: "Find a match for the rubber ball." The other children try to find another object with a similar weight. They can later compare the actual weights using the balance. Whoever comes closest is the winner.

Figure 15

Figure 16

Home project: Let children look around in the house, particularly the kitchen, and ask their parents to make a list of items bought in gm, kg, litres, etc. Discuss the need for smaller measures like gm in medicines and cooking, and the need for larger measures like tonnes.

Building estimation skills: Estimation is a skill learnt through trial and error. One learns from the feedback one gets and the skill gets refined. Children use estimation frequently in daily life. They may not even be aware that they use estimation when they race or jump or leap from one place to another, when they estimate the length of paper needed to make a paper plane or the time they need to complete their homework.

Build the estimation skills by specifying the measure of one object to determine the measure of other objects. If the weight of an orange is known, weights of other fruits like apple, sweet lime, banana, lemon and coconut can be estimated by comparing them mentally and then multiplying or dividing by a suitable factor. Similarly, if the height of the classroom is known, then other heights like the height of the building, the flag pole, the gate, the door, the black board can be estimated. Another important approach used in estimation is to estimate the length or weight of a small portion of the actual object. Example: If one wants to estimate the height of a book shelf with 6 divisions, one will estimate the height of one division and then multiply by the appropriate factor.

Activity: Find the unit used.

Create a worksheet or a set of cards which give measures of various objects without specifying the unit used. Let children use their sense of measure to decide which unit has been used. Example: Rishi is 120 ___ tall; weight of this apple is 125 ___; the handkerchief is 25 ___ long; the shoe is 130 ___ long; this jug's capacity is 2000 ____.

Body awareness: Height: Class room can be a place where the heights of children are recorded on the wall (behind the door) with a pencil. Children can record their height in centimetres, or feet and inches, in their math notebook at the start of the year. They can check it again half way through the year and at the end of the year.

Weight: A weighing scale can be brought to the class at the start of the year and children can record their weight in their note book. They can repeat this activity at the end of the year.

The Teacher can discuss the results. Correlation between increase in height and weight can be observed in many cases.

Padmapriya Shirali

Padmapriya Shirali is part of the Community Math Centre based in Sahyadri School (Pune) and Rishi Valley (AP), where she has worked since 1983, teaching a variety of subjects – mathematics, computer applications, geography, economics, environmental studies and Telugu. For the past few years she has been involved in teacher outreach work. At present she is working with the SCERT (AP) on curricular reform and primary level math textbooks. In the 1990s, she worked closely with the late Shri P K Srinivasan, famed mathematics educator from Chennai. She was part of the team that created the multigrade elementary learning programme of the Rishi Valley Rural Centre, known as 'School in a Box'. Padmapriya may be contacted at padmapriya.shirali@gmail.com