

GCO D: Students will demonstrate an understanding of and apply concepts and skills associated with measurement.

Outcomes

KSCO: By the end of grade 3, students will be expected to

- i) *identify and use non-standard and standard units of measurement and appreciate their role in communication*

SCO: By the end of grade 3, students will be expected to

D1 estimate and measure length in metres, decimetres, and centimetres

D2 estimate and measure capacity in millilitres and litres

... Estimation in measurement activities helps students focus on the attribute being measured, adds intrinsic motivation, and helps develop familiarity with standard units. (Elementary School Mathematics, p. 310)

Suggestions for Teaching and Learning

D1 Students should continue to estimate and measure lengths in metres and centimetres. They should also be introduced to the decimetre as the unit equivalent to 10 cm or 0.1 m. Although the decimetre is not commonly used in everyday life, it is a convenient size unit for students to use in the classroom. It is represented easily with a base-ten rod. By laying out 10 centimetre cubes, students can see that the line has the same length as 1 rod. They should also line up 10 rods along a metre stick to see that the two are equal.

Note: Measurement is an ideal context for the development of decimal concepts ($6 \text{ dm} = 0.6 \text{ m}$).

The following are some worthwhile activities to reinforce measuring lengths with different units:

- Set up a mini-Olympics in which students compete in events such as a kleenex kick, a penny thumb toss, and a cotton ball puffing. Have students measure results to the nearest decimetre, and then record and compare them.
- Have the students measure the width of the front of the classroom. Ask them to estimate how many students would be needed, lying head to toe, to cover this distance. How many would be needed if they all stretched their arms over their heads, fingers to toes? Ask students to explain what things they must consider when estimating.
- Have students estimate and then determine how much money they would have if they had a metre of pennies. Nickels? Dimes? Quarters? Loonies? Ask how many "metres of dimes" they would need to buy a bicycle.

D2 Students should continue to estimate and measure capacities, using the litre. They should also be introduced to the millilitre. Graduated measuring cups can be used to provide students with a sense of 25 mL, 100 mL, 250 mL, etc. Students should realize that millilitres are extremely small units and recognize that cans and containers usually contain hundreds of millilitres. Graduated medicine cups which typically accompany children's medication or medicine droppers also provide good examples of things measured using a small number of millilitres.

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Suggestions for Assessment*Performance*

D1.1 Ask the student to estimate the heights and widths of some objects in the classroom using a metre reference (e.g., doorknob height). Have him/her check the estimates by doing the actual measurement.

D2.1 Ask the student to find the average capacity of a cereal bowl.

Interview

D2.2 Ask the student to tell how he/she might estimate the capacity of a bathtub.

D1.2 Ask the student to find objects in the classroom that are about a decimetre in length, 2 decimetres in length, etc. Ask the student to compare and describe a decimetre in relation to a ruler and to a metre stick.

D1.3 Tell the student that a bald eagle was measured to be 109 cm from beak to tail. Ask him/her to estimate and show how long that would be and then to check the estimate by measuring.

D1.4 Ask the student to show you, with his/her fingers/hands, how long 6 cm might be. 24 cm? 32 cm? 58 cm?

D1.5 Tell the student that a child is 6 dm tall. Ask him/her for an approximate age of the child.

Presentation

D1.6 Ask small groups of students to estimate the length of each person's stride. Ask them to predict who has the longest stride and to give reasons for their selection. Have students develop a table to compare long jump lengths to stride lengths and present it to the class.

D2.3 Ask the students to devise a plan to determine how much water is wasted when the tap is not turned off while brushing one's teeth. Have them use this information to find how much water is wasted over a longer period of time. Ask them to find how much water would be wasted if all the students in the class neglected to turn off the tap for one brushing.

Resources

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SCO: By the end of grade 3, students will be expected to

D1 estimate and measure length in metres, decimetres, and centimetres (**Cont'd**)

D2 estimate and measure capacity in millilitres and litres (**Cont'd**)

D3 estimate and measure mass in grams and kilograms

Suggestions for Teaching and Learning

Note: A cube the size of a base-ten unit cube will hold a mL of liquid; one the size of the thousand block will hold 1 litre, or 1000mL.

- Have students discuss which unit (mL or L) is more likely to be used in measuring
 - a dose of medicine
 - punch in a punch bowl
 - pop in a can
 - water in a bathtub

D3 Students should continue to estimate and measure masses, using the kilogram. They should also be introduced to the gram. Students need to understand that grams are used to measure very light objects. As with all measurement units, it is important that the students have a personal benchmark/referent for gram and kilogram.

Note: A cube the size of a base-ten unit cube will hold 1 ml of water which has a mass of 1 gram; the 1000 block (dm^3) will hold a litre of water which would have a mass of 1 kilogram.

Suggested mass activities:

- Could you eat a 1 kg cantaloupe? 1 kg of popcorn?
- If sliced meat sells for \$3.50/g, is it expensive?
- Measure 20 g of unpopped popcorn. Will the mass be greater, the same, or less after it has been popped? Have students compare the volume of the popped and unpopped popcorn.
- Have students discuss which unit (g or kg) is more likely to be used in measuring:
 - a bag of potatoes, a box of paper clips, a baby
- Estimate and then measure the mass of different objects in the classroom.

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Suggestions for Assessment*Portfolio*

D2.4 Have the student check containers at home/at the stores/in flyers and make a chart of the various sizes for different products.

D2.5 Tell the students that it has been suggested that we need to drink at least six glasses of water a day. Ask: About how many litres would that be? What would a container look like that would hold enough water for you for a week? Have the students write a report explaining how they solved the problem.

D2.6 Have students keep a personal record (in millilitres) of the beverages they consume in one week. Encourage the students to translate the total consumption for the week into litres and choose a container (or combination of containers) which would hold the amount.

Performance

D3.1 Ask the student to estimate and then measure, using a pan balance, the mass of a selected object.

Paper and Pencil

D3.2 Ask: Which unit, g or kg, would be the most appropriate to use to measure the mass of

- a box of paper clips?
- a carton of books?
- a dog?

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D4 estimate and measure area in non-standard units and square centimetres

Let students measure to check estimates. However, it is only necessary that one or two students or one team do the measurement if the focus of the activity is on estimation. If all students are required to follow their estimates with a measure, they may correctly wonder why they bothered estimating. (Elementary School Mathematics, p. 311)

Suggestions for Teaching and Learning

D4 Students should use non-standard units and square centimetres to measure the area of common items. For example, they might lay a transparent grid or index cards over an object to see about how many units it takes to cover it. They might also try filling the bottom of a box with marbles or tennis balls.

As with all measurement activities, encourage students to estimate prior to doing the actual measurement.

Eventually, students should see that, if they use different grids or objects, they will get different numbers for the areas. At this point, introduce a centimetre grid and explain that a square centimetre is one standard unit for finding area. Students should have numerous opportunities to find the area of different surfaces, using square centimetres.

They should also understand that objects of different shapes or perimeters can have the same area.

The following are some interesting activities involving area:

- Have students devise a way to measure the surface area of an apple. (They could place the peels on a transparent grid and cover with tape.) Several apples could be measured this way and ordered by surface area.
- Have students find the area of an animal drawn on grid paper.
- Have students compare the areas of different-sized pieces of paper, pattern blocks, or envelopes.
- Have students find the area of typical school photographs.

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Suggestions for Assessment

Performance

D4.1 Have the student arrange a loop of string into three shapes. Ask him/her to estimate and then determine which of the shapes has the greatest area.

D4.2 Have the student find the area of an envelope, using postage stamps as units. Request an estimate before he/she measures.

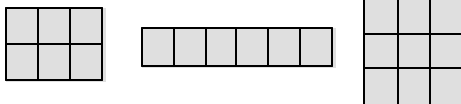
Paper and Pencil

D4.3 Ask the student to explain how he/she knows that the area of the shape shown has to be between 6 and 20 units. Ask also for an estimate.



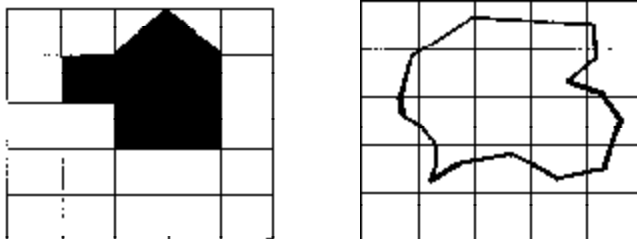
Interview

D4.4 Show 3 rectangles, such as

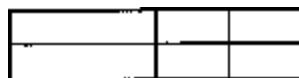


Ask the student which has the greatest area and to explain why.

D4.5 Ask why it is easier to find the area of the shape on the left than the one on the right.



D4.6 Ask the student why the area of the shape does not show 6 units.



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D5 solve problems involving kilometres

D6 use appropriate units for capacity and mass

The purpose of an interview is to uncover how students think about mathematics, so provide opportunities for contradictions in students' beliefs about mathematical concepts to emerge. (Mathematics Assessment, p. 29)

Suggestions for Teaching and Learning

D5 Students should know that 1 kilometre is 1000 metres. To fully appreciate how far 1000 metres is, it is important that they have a benchmark for the distance; for example, from the school to the town hall. Experiences with a trundle wheel are worthwhile.

Students should solve problems which are meaningful and of interest to them, involving kilometres.

It is important to include situations in which they can estimate a response, then check by doing. For example:

- Could you run 1 km without stopping?
- How many trips around the playground would you need to walk to cover 1 km?
- Are there enough students in your school to reach 1 km if they stood side by side, arms extended?
- How many of your classrooms placed end-to-end would make a kilometre?

Ask the students to predict how long it will take them to walk 1 kilometre. Then take the students on a 1 km walk, and check their estimates.

Students might like to design a table of other distances familiar to them (e.g. distances from homes to school) and predict how long it would take to walk, bike, etc.

D6 Students should recognize which capacity unit (mL or L) is appropriate in a given situation. Include situations in which something is measured in litres in one case and millilitres in another case. For example, a container of juice for a baby is measured in millilitres while a container of juice for a family could be measured in litres.

Have students check food containers to make a list of things measured in millilitres and another of things measured in litres.

Arrange a display of food containers, some with labels indicating millilitres and others with labels indicating litres.

Students should recognize which mass unit (gram or kilogram) is appropriate for measuring the mass of a specific item. It is helpful for students to investigate how everyday items are measured (e.g., food items). Include items which are small and dense as well as those which are large and porous.

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Suggestions for Assessment*Performance*

D6.1 Ask the student to estimate, then verify, how much water will pass through a given funnel in 10 seconds.

D6.2 Ask the student to estimate and then find the capacity of a cereal bowl.

D6.3 Ask the student to estimate the mass of a textbook and verify the estimate.

Paper and Pencil

D6.4 Have the student list five items that would be measured in grams rather than kilograms.

D6.5 Have the student draw a picture of an object that he/she believes to have a mass of about 5 kg.

Interview

D6.6 Ask the student to name three items normally measured in millilitres and three measured in litres.

D5.2 Tell the student that the tiger shark can travel about 50 km in an hour. Ask: About how far is 50 km from the school? About how long would it take you to walk that far?

Portfolio

D5.3 Provide a list of distances (in kilometres) to various places. Ask the student to plan a trip that does not exceed 500 km.

Resources

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ii) *estimate and determine measurements in everyday problem situations and develop a sense of the relative size of units*

SCO: By the end of grade 3, students will be expected to

D7 read digital and analog clocks to the nearest five minutes

D8 continue to solve a wide variety of measurement problems

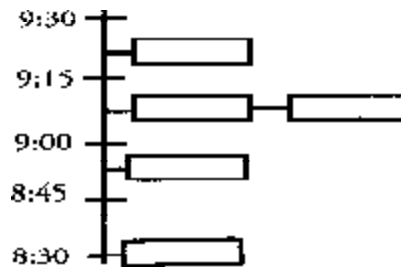
Suggestions for Teaching and Learning

D7 Students should read times on both digital and analog clocks to provide information about relevant situations, such as

- comparing start and finish times to determine how much time has passed
- focussing on times when special events are going to happen

To help them read time to the nearest five minutes, it is important that students are comfortable with skip counting by 5. This provides the opportunity for students to relate the numbers on a clock to the five times table. It is also helpful to use a clock that shows not only the numbers from 1 to 12, but also the minute amounts from 5 to 55 beside the numbers from 1 to 11.

- Have students track events throughout a specific day by means of a time line divided into 15-minute segments. Students should record the time of the activity or event and note it at the appropriate spot on a time line; for example:



D8 Students should continue to explore interesting, real-life measurement situations. It is important for students to recognize the approximate nature of measurement, in that we are limited by the precision of the measuring instrument. To encourage this, use approximate language (*about 12 cm long, a bit more than 1.5 litres, not quite a kg*).

Students could, for example:

- plan a class party and determine the number of 1 litre cans of juice they need to buy
- determine the size of the containers required to hold 1 kg of potatoes, macaroni, pattern blocks, etc.
- compare start and finish times of situations to determine how much time has elapsed (e.g., time between first bell and recess)
- track events throughout a specific day by means of a time line divided into 15-minute segments

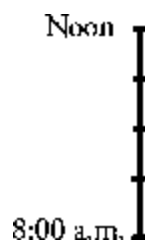
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Suggestions for Assessment

Performance

D7.1 Ask the student to move the hands of an analog clock to match the time shown on a digital clock.

D7.2 Ask the student to record the temperature on a chart at five different times during the morning.



Paper and Pencil

D7.3 Have the student make a list of the times when the minute hand and the hour hand are just about on numbers that are one apart.

D7.4 Have students work in pairs to set up a schedule in which every student will get 10 minutes on the computer, starting at 8:30 a.m. Ask them if all students can have time on the computer before noon and, if not, how long it will take to finish after lunch. At what time will the last one finish? (Remind them to leave time for recess.)

Interview

D7.5 Ask: What time might it be if the minute hand and hour hand are opposite one another?

Presentation

D8.1 Have students work in pairs to figure approximately how many children would have to lie down in a line to make a distance of 1 km. Ask them to record how they found their answers and to share it with the class. (Different line formations are likely to be presented, for example, head-to-toe, arms outstretched over their heads.)

Portfolio

D8.2 Tell the students that you have a map that takes only one page where 1 cm represents 1 km. Ask them if all of their community can fit on the map and have them provide a written rationale.

Resources