Which Measurement Should I Use? — Grade Six

Ohio Standards Connections

Measurement

Benchmark E
Use problem solving techniques and technology as needed to solve problems involving length, weight, perimeter, area, volume, time and temperature.
(Grades 5 - 7)

Indicator 4
Determine which measure (perimeter, area, surface area, volume) matches the context for a problem situation; e.g., perimeter is the context for fencing a garden, surface area is the context for painting a room.
(Grade 6)

Benchmark F
Analyze and explain what happens to area and perimeter or surface area and volume when the dimensions of an object are changed.
(Grades 5 - 7)

Indicator 1
Understand and describe the difference between surface area and volume.
(Grade 6)

Mathematical Processes Standard

Benchmark A
Clarify problem-solving situation and identify potential solution processes; e.g., consider different strategies and approaches to a problem, restate problem from various perspectives.
(Grades 5 - 7)

Benchmark B
Apply and adapt problem-solving strategies to solve a variety of problems, including unfamiliar and non-routine problem situations.
(Grades 5 - 7)

Lesson Summary:
Students will be able to identify and categorize different problem situations or contexts with one of the four measurements (perimeter, area, surface area or volume) to solve the problem.

Estimated Duration: *120 minutes*

Commentary:
Surface area and volume

The concepts of surface area and volume can be very difficult for many students to understand. A key component of understanding surface area is recognizing when a situation involves an item with multiple faces to be covered. Likewise, understanding volume includes recognizing situations involving filling of a three-dimensional object. The process of determining the solution for either of these measurements will vary greatly for this age of student. Some students will be able to calculate the measurement while others will need to use physical material to determine the measurements.

Pre-Assessment:

This lesson does not have a formal pre-assessment. Instead, the assessment of the students' understanding of each measurement type and the skills to make connections to specific real world contexts or problem situations will take place throughout the lesson.

Most students should already have a working knowledge of how to find the perimeter, area and volume (capacity) of an object. The concepts of surface area and volume and the differences among the measurement types may need further development before some of the students are able to make the connections to a real world context.

Scoring Guidelines:

Students who demonstrate a lack of understanding or have misconceptions about perimeter, area, surface area and volume should be provided intervention throughout the lesson. The use of physical materials to develop missing concepts and differences among the measurement types should be part of the intervention.

Post-Assessment:

Each student should demonstrate that he/she is able to identify which measurement is required by a specific context or problem situation. Create a post-assessment using items developed by the students in step 7 of the instructional procedures. Suggestions: use 20 of the student-developed context or problem situations to create the assessment. Have each student take the generated list of contextual problems and identify the correct measurement needed.

Scoring Guidelines:

Each student should consistently identify the correct measurement for problem situations.

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Students who have difficulty in identifying the measurement that is being addressed should be given intervention and the concepts addressed through other examples and experiences.

Instructional Procedures:
Day One

1. Have students start the lesson by writing a response to the following question. (Students will be asked to revise their response at the end of the lesson. Therefore, the need to have the students revise their response at this time is not necessary.)

   How do you know what measurement (perimeter, area, surface area or volume) is needed for a "problem situation?"

2. Facilitate a whole-class discussion on the characteristics of each of the measurement types. Use the following questions to facilitate the discussion:

> **Teacher Tip:**
> Use physical materials to investigate any of the measurement types that students are not demonstrating an understanding.

- What are you doing when you find the perimeter? What unit of measure do you use when you write your answer? What would you call the perimeter if you are dealing with a circle?
- What are you doing when you find the area? What unit of measure do you use when you write your answer?
- What are you doing when you find the surface area? What unit of measure do you use when you write your answer? How are area and surface area alike? How may area and surface area differ?
- What are you doing when you find the volume? What unit of measure do you use when you write your answer? What is the difference between surface area and volume?

> **Commentary:**
> Use additional questioning with the students to lead them into making general statements for each of the questions above. These statements will then be used to guide the students thinking and understanding in the following tasks.

3. Organize the students into small groups. Have the groups create a list for each measurement type, describing context or problem situation where each type would be used or needed to find the solution. Students should individually record the list in their mathematics journal or notebook.
   - Start with examples:
     1. Perimeter: What is the length of fence that is needed to go around the garden?
     2. Area: How many tiles are needed to cover the floor of our

classroom?

3. Surface area: How much wrapping paper is needed to cover this package?
4. Volume: How much water is needed to fill this sports bottle? or How many cubes would it take to fill a shoe box?

Teacher Tip:
A tissue box filled with tissue could also be used as an example for how each measurement could be applied to a single item.

Perimeter:	How much ribbon is needed to go around the top of the tissue box?
Area:	How much room does the tissue box take up on the table? (Put the box on grid paper and trace around the box.)
Surface area:	How much cardboard is needed to make the tissue box? (Trace each side on grid paper or cut apart a tissue box to demonstrate this measurement.)
Volume:	How many tissues will the tissue box hold?

- Ask each student to identify at least two different contexts or problem situations for each measurement type. Allow students to start on this lesson in class, but to be completed as homework.

Commentary:
Provide the students with newspapers, magazines and other sources or objects that they could use to get ideas to represent each measurement.

Day Two

1. Organize students into new groups. Ask students to take turns describing a context or problem situation to the other members of the group. The other members are to identify the measurement type for the context or problem situation described by the student.

Commentary:
Use observation as a means to assess students as they share the different contexts or problem situations with their group. Record, intervene or ask the student to share contexts that are more difficult to associate with one

of the measurement types. Students may confuse measurement types. For example, students may believe they are looking for the perimeter of an object when the situation calls for a length that is not the perimeter. Confusion between area and surface area and between volume and surface area may also occur.

2. Students should add any new contexts or problem situations to their list.
3. Ask students to share contexts that were interesting or different with the rest of the class.
4. Have each student write one problem situation or context for each of the four measurement types, identifying the associated measurement type. Students should use a context or situation similar to those mentioned in their groups. Students are not to use the keywords of perimeter (circumference), area, surface area or volume. A sample problem situation or context students might suggest: The school is planning to resurface the outdoor basketball courts. How would you determine the amount of tar needed to cover the basketball courts?
5. Collect the student work. Use this set of problem situations and context to determine if additional practice or intervention is needed before a post-assessment is given.
6. Use the collected work to create a post-assessment for the students.

Differentiated Instructional Support:

Instruction is differentiated according to learner needs, to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s).

- Use grid paper for finding the area or surface area (depending on the size of box, this will only be an estimate of the area).
- For surface area trace around each side of the box, finding the area of each side. This will help the students make the connection between surface area and area.
- Use cubes to find the volume.
- Have students pick a topic like sports or cars and find as many contexts that use the four measures related to the topic chosen.
- Have student find items that are sold in different measurement units, such are linear units (inches, meters, yards), square units (square feet, square centimeters), and cubic units (cubic inches, cubic centimeters).
- Have students make the connection between cubic measurements like cubic millimeters to milliliters.

Technology Connections:

- Students can use authoring software to create tutorials describing the difference between surface area and volume.
- Use geometry software to investigate perimeter, area, surface area and volume of objects.

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Materials/Resources Needed:

For the students: Chart paper, markers, inch or centimeter grid paper, small box, cubes or blocks, tape measure, ruler.

Key Vocabulary:

- perimeter
- area
- surface area
- volume
- circumference
- measurement units