

Vocabulary: dimensions, area, perimeter, scale, angle

MEASURING AND MAPPING

THE SCHOOL GARDEN

Description

Students measure and map the school garden. This lesson is an excellent opportunity for students to practice the skills of measurement and estimation using fractions and percentages. The lesson can stand alone, but is also part of a garden-planning series that also includes *Winter 2, Plant Timelines*; *Winter 3, Companion Plants*; and *Winter 4, Writing Instructions for a School Garden Bed*. In this lesson, students gather baseline data that they can use later to design a model school garden in the spring.

Guiding Question

How can we plan what to grow in a garden?

Big Idea

Careful planning can help make a garden healthier and more productive.



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Learning Objectives

At the end of this lesson, students will be able to measure a given plot of land in several ways. They will be able to estimate and calculate a two-dimensional space. Students will be able to draw to scale and create a realistic map of the school garden. Students will understand that different plants require different amounts of space to grow.

Materials

Tape measures or yardsticks.

Clipboards, paper, pencils.

Graph or squared paper (paper printed with squares to guide graphing or map-making), pencils, colored pencils, rulers and other map-making tools.

Optional: Large sheet of paper.

Seed packets for four vegetables that have different space requirements.

Optional: Volunteers to help with measuring and mapping.

Preparation

Ensure students' readiness: Students need how to be able to read a ruler to the nearest whole inch. They should also have some understanding of scale and maps.

Decide whether to conduct the lesson in groups or as a class. If you have volunteer help available, groups can be assigned to measure and map particular areas of the garden. If not, the class can work as a whole to measure and map the entire garden.

Optional: Recruit and train volunteers to help with measuring and mapping.

Gather materials.

Additional time: 2-3 hours. Can be divided: 60-90 minutes measuring the school garden, 60-90 minutes creating maps of the garden



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Lesson time: see additional time

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Introducing the Lesson

Activate prior knowledge. Remind students of any measuring or mapping studies that you have already completed, or start a discussion about measuring and mapping. You might ask questions such as these: *How tall are you? How do you know? Does someone in your home measure your height regularly? Do you know how far it is from your home to the school? How do you know? What about when you travel to places you don't know? How do you find your way around? Do you use a map? How did somebody make that map?*

Engage student interest. Ask students, *If someone asked how big your school garden is, how would you respond? How could you figure out the size of the garden?* When students suggest that the garden would need to be measured, tell them that they are going to get to go outside and do exactly that. Ask: *What if someone asked how to find something in the garden?* Guide students to discuss the need for a map of the school garden, and reveal that they can use their own measurements to make a helpful garden map.

Procedure

In the classroom

1. *Review measurement skills.* Remind students how to use measuring sticks or tape measures. Review how to multiply length and width to calculate the area of a quadrilateral (4-sided) shape.

2. *Plan for estimation.* Point out to students that some areas of the garden may be difficult to measure exactly. Brainstorm ways to estimate measurements. Guide students to realize that counting their own paces or strides can be a good way to estimate distances. Have students work in pairs to measure their strides along a tape measure or yardstick, so that they can use the length of their strides to estimate the dimensions of the garden.

3. *Prepare to visit the garden.* Review garden rules, emphasizing reminders not to step on plants while measuring the garden. Assign students to teams and volunteer helpers, if using. Hand out measuring tools and clipboards, paper, and pencils to record measurements.

In the garden

1. *Measure.* Choose one area of the garden, and model for the whole class how to measure the perimeter of the area. Then, either move as a class from area to area, measuring all of them and allowing all students the opportunity to participate in the measuring and recording tasks, or assign groups to measure particular areas. Observe and/or sketch the shapes of different garden beds, footpaths, and any other measurable features. Make estimates in areas that are difficult to measure. Guide students to notice the angles found in the layout of the garden.

Back in the classroom

1. *Prepare for mapping.* Challenge students to suggest a workable scale for making a model of the school garden space. Try to reach consensus before students start mapping.



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2. *Map*. If you are working as a class, have students guide you to draw and label a map of the entire garden. Have students work along with you, creating their own maps on squared paper. If students are working in teams, have each team use squared paper to create a map of its assigned garden area, then share their map with the class. (Optional) Combine the information from the teams' maps to create a map of the entire area on a large sheet of paper or, if you have one, a smart board.

3. *Map math*. Use your maps and measurements to solve math problems with practical applications in the garden, such as the following:

- Convert the units of linear measurements (for example, go from inches to feet, or centimeters to meters, or vice versa).
- Multiply the lengths and widths of quadrilateral garden beds to determine area.
- Determine the cubic amount of soil that would be needed to fill a quadrilateral bed to a certain depth.
- Use division to estimate how many of each vegetable could be grown in various areas of the garden; Use seed packets to determine the spacing requirements of two or three vegetables.
- Measure the size of various angles on your maps.
- Use angles to determine whether or not any triangular garden shapes are right triangles.

4. *Wrap-up*. Collect all student maps and save them (as well as your large map, if you made one) for use in later garden-planning lessons.

Assessing Student Knowledge

Conduct informal assessments of your students' knowledge by observing them as they engage in class discussion, measure the garden, and make their maps. Correct any misunderstandings as students are working. Check students' maps that you collect as another way to assess understanding.

Extensions

1. *Go to more places*. Ask students to do similar calculations and estimations in and around their classroom, school grounds, or at home.

2. *Go big*. Find aerial photos of Oregon cities, towns and rural areas using Google Maps. Make similar calculations to help students understand scale. Explore questions such as: How many school gardens would fit in the farm we see in this map?

Books & Resources

Books:

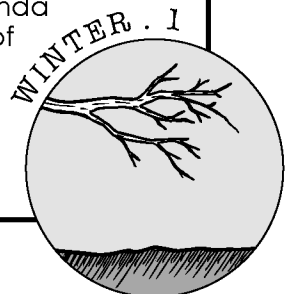
Estimating and Measuring, by Karen Ferrell, Cathy Weiskopf, and Linda Powley, Illustrated by Tom Kerr (2008, Barron's Educational Series) - Part of the "Adventures in Mathopolis" series.

Measuring in the Garden, by Tracey Steffora (2011, Heinemann-Raintree) - Part of the "Math Around Us" series.



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Measurement Mania: Games and Activities That Make Math Easy and Fun, by Lynette Long (2001, Wiley)
Using Division Facts in the Garden, by Linda Bussell (2008, Weekly Reader Early Learning Library)

Web Sites:

Length, Mass and Volume, on the Measurement Page at Johnnie's Math Site <http://jmathpage.com/JIMSMeasurementlengthmassvolume.html> - Animated games can help students review using a ruler and measuring lengths.

Measurement Games, PBS Kids <http://pbskids.org/games/measurement.html> - Especially the vegetable planting.

Taking America's Measure, National Institutes for Standards and Technology http://www.nist.gov/public_affairs/kids/morenist.htm



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OR. Dept. of Ed. Key Standards

Oregon Common Core State Standards for Mathematics:

- 4.MD.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.
- 4.MD.3 Apply the area and perimeter formulas for rectangles in real world and mathematical problems. *For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.*
- 4.G.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.



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