Lessons from the Bay

Going for Water

If persons today had to haul their own water instead of rely on plumbing, would they use as much?

Objectives

Students will

- compare the experience of hauling one's own water, as described in Robert Frost's poem "Going for Water," to the modern convenience of electric plumbing
- predict the amount of water a student uses in a day and the amount of time it would take to haul that volume by hand
- predict and then measure the weight in pounds of a variety of standard volumes
- measure the time to the nearest minute that it takes each student to carry the water 50 yards
- calculate the average (mean) amount of time needed to haul water 50 yards.

Background

Before electricity and plumbing were widely available to homes, people had to haul their own water from a hand-powered pump, well, or nearby body of freshwater. This work was physically strenuous and time-consuming, so people naturally found ways to conserve water. Today, most homes have plumbing that uses electricity to pump water from a municipal water source or a private well. Because we get our water today with little effort, we use and waste much more.

Wasting Water

When water is used wastefully, problems occur at both ends of the plumbing: at the water source and at the destination of the water after its use.

Related Standards of Learning

Science:
3.1.a; 3.1.h; 3.9a; 3.9.d; 3.9.e; 4.1.c; 4.9.a; 5.1.c; 5.1.b; 5.1.g; 5.1.h; 6.1.b; 6.1.h; 6.7

Mathematics:
3.1.c; 3.4; 3.6; 3.9; 3.11.a; 3.12; 3.19; 4.4.b; 4.4.a; 4.4.c; 4.6.a; 4.6.b; 4.7; 4.8.a; 4.8.b; 5.4; 5.4; 5.5.a; 5.8.d; 5.8.e; 5.10; 5.16.c; 6.6.a; 6.7; 5.16.d

English:
3.1; 3.2; 3.3; 3.5; 3.6; 4.1; 4.2; 4.4; 4.6; 5.1; 5.4.a; 5.4.c; 5.4.e; 5.5; 6.1; 6.2; 6.4; 6.5

History and Social Science:
VS.1.b; VS.1.d; VS.1.e; VS.1.h; USI.1.b; USI.1.e; USII.9

Time Required

Three 45-minute sessions

Materials

- *containers, labeled with volumes: cup, pint, quart, half gallon, gallon, 5 gallons*
- *bathroom scale*
- *balance*
- *30-gallon, water-filled trashcan*
- *5 yardsticks*
- *2 traffic cones*

For each group:

- *dictionary*
- *stopwatch*
- *gallon bucket*

For each student:

- *"Going for Water," by Robert Frost (see Resources)*
- *Study Guide for Robert Frost's "Going for Water" (handout, page 161)*
- *Going for Water Lab Sheet (handout, page 165)*
- *calculator*
- *sticky note*
- *clipboard (optional)*

Problems at the Source

Water Source	Problems Caused by Wasting Water
Municipal water reservoir (lake or river)	Large demand can deplete the supply, especially during droughts.
Private well (groundwater)	Large demand can deplete the supply, especially during droughts. In some places, the lack of water pressure under the ground can cause the ground to cave in.

Problems at the Destination

Destination	Problems Caused by Wasting Water
Municipal water treatment plant (which empties into a lake or river)	Treatment plants are designed to treat a limited volume of water. When the plant is overwhelmed with a high volume, some untreated water overflows directly into the lake or river.
Private septic system (tank and drain field)	Large volumes of water put a strain on a septic system so that solids do not have enough time to settle out and the beneficial bacteria cannot effectively treat the wastewater. Then untreated water flows to the drain field and can contaminate groundwater or come to the surface and run off into surface water bodies.

Procedures

Session 1 (45 minutes)

Conduct this session in the classroom.

1. Divide the class into groups of 3–5 students each, and give each student a copy of the Study Guide for Robert Frost's "Going for Water."
2. Before the groups begin, examine the study guide together. Point out that there are three sections that the students will complete within their group and that the last section will be done when the class as a whole discusses the poem at the end of the session. Explain that students should read a poem multiple times in order to understand the words, imagery, and mood of the poem. Some questions are best answered before reading the poem; some, while reading the poem; and others, after reading the poem.
3. Have students read Robert Frost's "Going for Water" (see Resources) and complete the first three sections of the study guide.
4. When the groups are ready, share answers to check for understanding. Then discuss and complete the fourth section of the study guide ("To be discussed with the whole class").

Session 2 (45 minutes)

Conduct this session in the schoolyard.

1. Give each student the "Going for Water" Lab Sheet and a clipboard (if available). The class will also need one calculator and all the other listed materials except dictionaries.
2. Explain that in this experiment, the students will determine how much time it would take to haul all the water needed for a day's use. To begin, students must weigh different volumes of water in order to choose the optimal sized container in which to carry their water.
3. Show students an empty quart container, and have them predict how much that volume of water will weigh. Choose three volunteers. Have the first volunteer fill the quart container with water. Have the second stand on the bathroom scale—first holding the quart of water, then without the water. (When standing on the scale with the water, one must hold the container close to the body to get an accurate measurement.) Have the third volunteer find the difference between the two weights; the answer will be the weight of the water. Students can record the actual weight of a quart of water.
4. Repeat step 3 with the other volume containers in the order they are listed on the lab sheet: 5 gallons, cup, gallon, half gallon, and pint. (Let the students use the bathroom scale when weighing the cup of water; they should discover that the balance is needed to weigh such a light container.) As the students proceed through the list, encourage them to use the data they have gathered so far to try to make increasingly accurate predictions.
5. Have students list the volumes in order from least to greatest on their lab sheets and look for patterns to reinforce knowledge of measurement. (Weights should double from each of the first five volumes to the next.)
6. Discuss which would be the best volume of water to haul (i.e., one that is large enough to be a significant portion of a day's worth of water but not too heavy to carry 50 yards.) Hopefully students will choose the gallon!
7. Position the 30-gallon trashcan, fill it with water, and place a traffic cone beside it. Choose six students to help measure the 50 yards from the trashcan. Hand out the five yardsticks to the first five students. Instruct them to begin at the traffic cone and lay their yardsticks end-to-end in a straight line. Ask the rest of the class to call out the number of yards measured with each laying of

a yardstick ("*Three yards!*"). Direct the sixth helper to put a finger down at the end of the fifth yardstick to mark the spot while the yardsticks are moved. Then have the five pick up their yardsticks and put them down again, this time starting from where the sixth helper has his or her finger (and the class called out "*Five yards!*"). Continue until 25 yards have been measured, and place the other traffic cone there to mark it. Ask students how many yards there are in a path beginning at the first cone proceeding to the second cone and back to the first (*25 + 25 = 50 yards*).

8. Organize the students into the same groups from Session 1, and give each group a stopwatch and a gallon bucket. Direct students within each group to take turns timing each other as they carry containers of water from the trashcan to the traffic cone and back. Explain to students that in order to achieve a realistic sample, they must walk—not run—because running would not be practical when making several trips to haul a day's worth of water. Remind them to record their time to the nearest minute on their lab sheets.

Session 3 (45 minutes)

Conduct this session in the classroom.

1. Make sure each student has a calculator, a sticky note, and a copy of the lab sheet.
2. Have each student write on the sticky note the number of minutes it took to carry the water 50 yards. Direct all the students to stand and form a line ordered from least amount of time to greatest. Once they are in line, have them attach the sticky notes to a bulletin board in that order.
3. Discuss the data, and ask students questions such as the following:
   - *What was the least amount of time? The greatest?* You might subtract these times to find the *range*.
   - *What was the most common amount of time?* This is the *mode*.
   - *Do you observe any outliers (i.e., times that vary significantly from the rest)? Why do you think they occurred? Should they be discounted or kept with the rest of the data?* (It depends on why they occurred.)
   - *How could we determine the average time?* Explain that the average is found by adding all the times and then dividing by the number of times (students). This number will be near the middle of all the recorded times. (If students are not familiar with averages, you could ask three students of varying heights to stand next to each other to demonstrate the concept.)
4. Instruct the students now to find the average using their calculators. Go around the classroom and have each student share how many minutes it took to carry the water. As each student reports, all the students will enter that time on their calculators and add it to the previous sum of reported times. Once the total sum is found, have students divide it by the total number of students who reported their data. Students then record this average on their lab sheets.
5. Next, instruct students to indicate on the second page of the lab sheet how many times per day they might perform the listed water-use activities. As the chart indicates, for each activity, students then multiply the number in the "Times done per day" column by the number of "Gallons required." Then, to find how much water a student might use in a day, students total the numbers in the right-hand column. Discuss with students how this total compares to the predictions they made in Session 1 of the lesson.
6. Finally, have the students multiply their "Total gallons used per day" number by the class average time to haul one gallon. This product will be the time needed to haul all their water for a day's use.

   Discuss with students their feelings about spending that much time carrying water:

   - *What after school activities and pastimes might have to be sacrificed?*
   - *Did people spend as much time carrying water before electricity?*
   - *What would be a way to reduce time spent carrying water?* (Use less water.)
7. Explain that today with electricity, people often use more water than is actually needed, and, therefore, water is wasted. Discuss the problems that are caused by wasting water (see "Wasting Water" in the lesson Background).

   Ask students to think of ways that they can conserve water, such as

   - turning water off while soaping up in the shower or while brushing teeth
   - installing low-flow shower heads
   - running dishwashers and washing machines only when fully loaded
   - watering plants with a soaker hose in morning or evening when evaporation rates are low.

Classroom Assessment Suggestions

- *Group discussion of the poem "Going for Water," and answers on the Study Guide*
- *Predicted water weights: the predictions should become closer to actual as you go down the list if students are applying what they learn as each new volume is weighed.*
- *Correct ordering of volumes from least to greatest*
- *Accurate measurement of time, using stopwatches*
- *Correct calculations of average time, number of gallons used in a day, and time needed to haul that much water*

Extensions for Students

- *Read "Raven Brings Freshwater" (see Resources) and write a legend about Freshwater.*
- *Read rain poetry and stories (see Resources).*
- *At home, time showers and calculate number of gallons used.*
- *Calculate how many gallons per minute run from a faucet by letting it run for one minute into a large pot and then measuring this water, using the appropriate volume containers.*
- *If you are on municipal water at your school, ask the principal for a copy of the school's water bill. Note how many gallons were used in a month and the cost for the water. Start a water conservation campaign in school, making posters to advertise it. Then look at the next month's bill to see if any water was saved.*

Resources

Chesapeake Bay Foundation. "The Solution to Pollution May not be Dilution." *Watershed Action for Virginia's Environment (WAVE).* (See <http://www.cbf.org/site/PageServer?pagename=edu_educators_curriculum_va_index>, or contact the Virginia Office: Capitol Place, 1108 E. Main Street, Suite 1600, Richmond, VA 23219; phone 804-780-1392.)

"Easy Street," "Long Haul." Project WET. Bozeman: The Watercourse, 1995. (See <http://www.projectwet.org/watercourse>.)

Evans, Lezlie, and Cynthia Jabar. *Rain Song.* New York: Scholastic, 1995. ISBN 0439135109.

"Every Drop Counts." *Environmental Education Activity Guide.* Project Learning Tree. Washington: American Forest Foundation, 1995. (See <http://www.plt.org/prek-8-activity-38---every-drop-counts>.)

Frost, Robert. "Going for Water." *A Boy's Will.* New York: Henry Holt, 1915. ISBN 1587340151. (Also available at <http://www.americanpoems.com/poets/robertfrost/>.)

Hess, Karen. *Come On, Rain!* New York: Scholastic, 2000. ISBN 0590331264.

Hughes, Langston. "April Rain Song." *The Weary Blues*. New York: Knopf, 1926. (Also available on p. 20 of *Sing a Song of Popcorn: Every Child's Book of Poems*, by Beatrice Shenk De Regniers, et al. New York: Scholastic, 1988. ISBN 059043974X.)

Longfellow, Henry Wadsworth. "Rain in Summer." (Available at <http://www.americanpoems.com/poets/longfellow/>.)

Martin, Fran. "Raven Brings Fresh Water." (Available in *From Sea to Shining Sea: a treasury of American folklore and folksongs*. Ed. Amy Cohn and Molly Bang. New York: Scholastic, 1993. ISBN 0590428683.)

McGovern, Ann, ed. *Arrow Book of Poetry*. New York: Scholastic, 1965. ISBN 0590336711. (Includes Eve Merriam's "Summer Rain," p. 60.)