"Add It Up" Lesson Plan
Part 1—School Usage

Objectives and Activity Description

Students will learn the term wastewater and will discuss daily activities that use water. Students will be able to measure the amount of water used by the average individual, as well as the amount of water used by their class in a single day of school. They will compare the average use of one classmate to the use of the entire class and will make bar graphs displaying the results. The lesson will conclude with a classroom discussion in which students brainstorm and share ideas regarding the effects of water usage on the environment. Sanitation District No. 1, Northern Kentucky's primary wastewater utility, will be introduced.

Core Content

MA-07-1.1.3 Students will convert among whole numbers, fractions, decimals, percents and π, and will compare and order these numbers.

MA-07-1.3.1 Students will add, subtract, multiply and divide whole numbers, fractions and decimals to solve real-world problems and apply order of operations (including positive whole number exponents) to simplify numerical expressions.

MA-07-4.1.1 Students will analyze and make inferences from data displays (drawings, tables/charts, pictographs, bar graphs, circle graphs, line plots, Venn diagrams, line graphs, stem-and-leaf plots, scatter plots).

PL-07-3.1.4 Students will describe consumer actions (reuse, reduce, recycle) and explain how these actions impact the environment (e.g., conserving resources, reducing pollution, reducing solid waste, conserving energy).

PL-07-3.1.5 Students will identify and describe resources and services provided by community agencies: Public health department, Fire department, Police department, Family resource center

Supplies

Tally Sheets (hang in bathrooms and by sinks and water fountains)
Information and Instructions Sheet
Water Usage Guide
Step-by-step formulas worksheets
Pens/Pencils (in bathrooms and by sinks and water fountains)

Stopwatch (place near water fountain)
One-gallon container (to catch water)
Calculator (by discretion of teacher)
Graphing/Grid Paper

Procedure

The Day Before the Classroom Lesson

1. One day before this lesson, inform the students that there are water usage logs in the restrooms, by the sinks and by the drinking fountain. Each time they flush the toilet or wash their hands, they will put a tally mark on the corresponding sheet.

2. When they drink from the drinking fountain, they will use a stopwatch to time the number of seconds the water runs. The student should then write the number of seconds on the corresponding sheet. See the "Step-by-Step Formulas" sheet to calculate usage for water fountains.

"Add It Up" Lesson Plan
Part 1—School Usage

Procedure

The Day of the Classroom Lesson

3. On the day of the lesson, first, brainstorm with students how they use water on a daily basis (toilet, shower, drinking, cooking, tooth brushing, etc.) Pass out the worksheets they will need for today's lesson.

4. Display the completed tally sheets at the front of the classroom. As a group, add the tally marks to come up with classroom totals for each category (drinking fountain, sink, toilet.) Write the totals on the board.

5. To determine water usage for the drinking fountain, multiply the total number of seconds spent drinking by the number of gallons per second. The product is the total usage for the day. The "Step-by-Step Formulas" worksheets lay out the formulas. Students fill in the blanks.

6. For toilet-flushing and hand-washing, multiply the total number of uses by the number of gallons of water required for each use. The product equals the total number of gallons of water per day used by your classroom. Refer to the Water Usage Guide for conversions.

7. Add the totals for each category to get the total amount of water in gallons used by your students in a given day.

8. Divide the total number of gallons used per student, per day by the number of students in your class. This number is the average amount of water used at school per student, per day in gallons.

9. Now calculate how many gallons of water each student and the entire class use for each category over the course of a school year (approximately 180 days.) To find these totals, multiply the gallons used per day by 180 days (for both the student totals and the class totals.)

10. Divide the students into groups. Each group should analyze their findings and develop a bar graph on their graphing paper to compare water usage categories. Be sure to remind them that each bar graph should have labeled x and y-axis with values indicated. Graphs must also include a title. Some ideas for what to graph:

- Number of hand washings, toilet flushes, drinking fountain uses
- Number of gallons used for each activity
- Classroom usage vs. individual usage for each category
- Daily usage vs. school year usage for individuals
- Daily usage vs. school year usage for the class
- You may also propose your own graph

11. Have each group present their graph(s) to the class. The class should discuss and make inferences about each bar graph.

12. Review and wrap up!

Assessment

Students complete worksheets with 85% accuracy.

Tally Sheet—Girls Bathroom

Each time you flush the toilet, make a tally mark in the space below:

_____

Each time you wash your hands, make a tally mark in the space below:

Tally Sheet—Boys Bathroom

Each time you flush the toilet, make a tally mark in the space below:

_____

Each time you wash your hands, make a tally mark in the space below:

Tally Sheet—Water Fountain

Each time you use the water fountain, time the use with a stop watch and then record the number of seconds the water ran.

Introduction and Instructions

Introduction—What is wastewater?

Water quality is a key component to the environmental and public health of our community. The proper collection and treatment of wastewater is an essential piece to meeting high-quality water standards. Sanitation District No. 1 (SD1) provides wastewater service to Northern Kentucky. The term "wastewater" refers to water that leaves any residential, commercial or industrial establishment after being used. SD1 collects and treats (cleans) not only your wastewater (the water that goes down your drain and toilet), but also the wastewater in 33 communities in Boone, Campbell and Kenton counties, a population of over 320,000!

Once wastewater leaves a home or business, it is collected in sanitary or combined sewers. SD1 owns, operates and maintains approximately 1,600 miles of sewer pipes. If you stretched out the pipes from end to end they would run from Northern Kentucky to Texas.) The system of pipes transports the wastewater to a treatment plant where it is treated. SD1 operates two major wastewater treatment plants (that you can visit), eight small treatment plants, 141 pump stations and 15 flood pump stations. After treatment, the wastewater (now called effluent) is discharged to a body of water nearby.

On average, each person uses about 100 gallons of water per day. This average is based on all daily activities that use water.

Question for discussion: How do you use water each day?

Instructions

For this lesson, you will look at three activities most students conduct throughout the course of a school day: hand washing, toilet flushing and using the drinking fountain. You will calculate how much water your class uses for each of these three activities on an average day. You will also calculate individual averages, classroom sums for all activities and school year totals.

The "Step-by-step Formulas" sheets will walk you through your calculations. Be sure to fill in all blanks. You will then make bar graphs in groups to display your results and will present your graph(s) to the class.

Before you get started on your "Step-by-step Formulas" worksheets, take a look at the Water Usage Guide. You will need the estimated number of gallons used for the activities to complete your formulas.

Step-by-step Formulas

Add the marks on the tally sheets completed by your class to find the basic totals.

Basic Totals

Add number of seconds water fountain was used.   Total: _____ seconds

Add number of hand washings.   Total: _____ washes

Add number of times toilet was flushed.   Total: _____ flushes

Record number of students in class.   Total: _____ students

Water Fountains

Calculating Water Usage for Water Fountains:

Hold a 1 gallon jug under the stream of water coming from the fountain for 30 seconds. Record the approximate amount of water caught in gallons. Divide the number of gallons by 30 seconds. This number is the approximate number of gallons per second used by your school's water fountain.

# of gallons of water caught in 30 seconds ÷ 30 seconds = approximate number of gallons per second used by water fountain

_____ gallons/30 seconds ÷ 30 seconds = _____ gallons/second

Classroom Usage:

Multiply the total number of seconds students spent drinking by the number of gallons per second to find the total number of gallons of water used by your students in one day.

Total # of seconds spent drinking x approximate number of gallons per second used by water fountain = total # of gallons used by your class in one day

_____seconds x _____ gallons/second = _____ gallons/day

Individual Usage:

Divide total classroom usage for the day by the number of students in your class to find the average number of gallons used by each student in a given day.

Total classroom usage for the day ÷ number of students in the class = Average individual student's usage

_____ gallons ÷ _____ students = _____ gallons/day

Hand Washing

According to the "How Much Water Do You Use Each Day?" worksheet, every time you wash your hands you use about 2 gallons of water! Use this estimation to complete the following formulas:

Classroom Usage:
Multiply 2 gallons of water by the total number of times students washed their hands to find the total number of gallons of water used by your students in one day.

2 gallons x total # of times students washed their hands = total # of gallons used by your class in one day

_____ gallons x _____ hand washes = _____ gallons/day

Individual Usage:
Divide total classroom usage for the day by the number of students in your class
to find the average number of gallons used by each student in a given day.

Total classroom usage for the day ÷ number of students in the class = Average individual student's usage

_____ gallons x _____ students = _____ gallons/day

Toilet Flushing

According to the "How Much Water Do You Use Each Day?" worksheet, every time you flush the toilet you use about 5 gallons of water! Use this estimation to complete the following formulas:

***Check with your school to see if you have low-flow toilets. Low-flow toilets only use about 2 gallons of water per flush. If your school uses these toilets, cross out the 5 gallon estimate below and write in 2 gallons.

Classroom Usage:
Multiply 5 gallons of water by the total number of times students flushed the toilet to find the total number of gallons of water used by your students in one day.

5 gallons x total # of times students flushed the toilet = total # of gallons used by your class in one day

_____ gallons x _____ flushes = _____ gallons/day

Individual Usage:
Divide total classroom usage for the day by the number of students in your class to find the average number of gallons used by each student in a given day.

Total classroom usage for the day ÷ number of students in the class = Average individual student's usage

_____ gallons x _____ students = _____ gallons/day

Statistics for a School Year

Now calculate how many gallons of water each student and the entire class use in an entire school year (approximately 180 days.) To find this total, multiply the gallons used per day by 180 days (for both the student total and the class total.)

Water Fountains

Classroom Usage:

_____ gallons/day x _____ 180 days = _____ gallons/school year

Individual Usage:

_____ gallons/day x _____ 180 days = _____ gallons/school year

Hand Washing

Classroom Usage:

_____ gallons/day x _____ 180 days = _____ gallons/school year

Individual Usage:

_____ gallons/day x _____ 180 days = _____ gallons/school year

Toilet Flushing

Classroom Usage:

_____ gallons/day x _____ 180 days = _____ gallons/school year

Individual Usage:

_____ gallons/day x _____ 180 days = _____ gallons/school year

Overall Totals

Fill in the blanks below to determine the total number of gallons of water used by the individual and the class in one day, and then in one school year.

Totals for one day

	Classroom Usage (add column below)	Individual Usage (add column below)
Water Fountains	_____ gallons/day	_____ gallons/day
Hand Washing	_____ gallons/day	_____ gallons/day
Toilet Flushing	_____ gallons/day	_____ gallons/day
	_____ TOTAL	_____ TOTAL

Totals for one school day (180 days)

	Classroom Usage (add column below)	Individual Usage (add column below)
Water Fountains	_____ gallons/school year	_____ gallons/ school year
Hand Washing	_____ gallons/school year	_____ gallons/ school year
Toilet Flushing	_____ gallons/school year	_____ gallons/ school year
	_____ TOTAL	_____ TOTAL

Totals for one school day (180 days)

Your teacher will divide the class into groups. Each group should analyze their findings and develop a bar graph on their graphing paper. The graph will compare water usage categories. Each bar graph should have labeled x and y-axis with values indicated. Graphs must also include a title. Some ideas for what to graph:

- Number of hand washings, toilet flushes, drinking fountain uses
- Number of gallons used for each activity
- Classroom usage vs. individual usage for each category
- Daily usage vs. school year usage for individuals
- Daily usage vs. school year usage for the class
- You may also propose your own graph

When finished, your group will present your graph(s) to the class. The class will then discuss and make inferences about each bar graph.