

Home Water Use Study

Overview

In this activity, students find out how much water their family uses in a week. They use that information to make stacked bar graphs that compare usage for different purposes. The process has 4 steps: 1) identify and locate the home fixtures and appliances that use water, 2) determine how fast water flows from each fixture or appliance, 3) put a record sheet at each appliance or fixture for all family members to record the duration of water usage, and 4) multiply each time by flow rate and add up the amounts each fixture uses. Students then make a stacked bar graph from a week's data. A teacher who used this lesson found that her 1999 class's families used an average of 1,308 gallons per family per week (gfw). Her 2000 class averaged 1,475 gfw. Her 2002 class averaged 894.2 gfw. You might see weekly family water use in this range.

The activity can take a few weeks. It works best if you help the class arrive at their own method for gathering data. For that reason, the data analyses, tallies, and record sheets with this activity are intended as guides for the teacher in leading the class to find their own methods for data gathering.

Background

One way that people affect water resources is to use them up. Urbanizing areas of North Carolina face possible shortages of water during the next few decades. The growing populations in these areas are too large for the ground and surface water supplies, especially during droughts. Additionally, the average American uses more water than the average citizen of any other country. Maybe your students' families are typical American families in this regard and maybe not. In this activity, students might find out. They might also see how their family could use less water if this resource became scarce.

Materials

Materials for the whole class

- Water Source Inventory transparency
- Water Flow Rate transparency
- Water Use Record Sheets transparency
- Water Use Tables transparency
- Water Use Stacked Bar Graph transparency

Materials for small groups (Groups of 2)

- Water Source Inventory Handout
- Water Flow Rate Handout
- Water Use Record Sheets handout
- Water Use Tables Handout
- Water Use Stacked Bar Graph Handout

Preparation

Have all handouts and transparencies ready.

Procedure

1. Talk to students about how they might go about learning how much water their family uses. How would they go about it? What steps would they take?
 - If students don't come up with it on their own, ask them to list all of the things in the house that use water.
 - Next, ask them how much water each thing uses each time it's used.
2. SAY: "We also need to know how much water is used throughout the house." Try to get the class to come up with ways, given what has been discussed, to represent the different uses for each household *and* for the whole class. For example, how would we know what proportion of water is used for flushing toilets?
3. Either have the class make up a water source inventory sheet (best option), or go over the Water Source Inventory transparency and give out the Water Source Inventory Handout (no inquiry).
4. Either have the class make up a technique for determining water flow rate (best option), or go over the Water Flow Rate transparency and give out the Water Flow Rate Handout (no inquiry).
5. Either ask the class to determine how they will record water use rate by fixture or appliance (best option), or go over the Water Flow Rate transparency and give out the Water Flow Rate Handout (no inquiry). Some combination of these options might work.
6. Either have the class devise a technique for recording water use at each fixture (best option), or go over the Water Use Record Sheets transparency and give out the Water Use Record Sheets handout (no inquiry).
7. Either have the class decide how they will assemble all of their water use records into data tables (best option), or go over the Water Use Tables transparency and give out the Water Use Tables handout (no inquiry).
8. Ask students to make a stacked bar graph showing water use in their households. To make the graphs comparable, ask them to use a scale of 1 cm = 50 gallons. Show the Water Use Stacked Bar Graph transparency and give out the Water Use Stacked Bar Graph Handout.

Water Source Inventory

How many do you have?

Water-Using Item	Number in your house
Toilets	
Bathroom sinks	
Showers	
Bathtubs	
Kitchen Sinks	
Ice cube maker (in refrigerator)	
Refrigerator door water	
Dishwashers	
Washing Machines	
Garden Hose Spigots	
Other (specify)	
Other (specify)	

Water Flow Rate

TOILETS, SINKS, BATHTUBS, SHOWERS, HOSES, etc.: How could you find out how fast water flows from a faucet or shower head? Think about:

1. How do we usually express how fast water flows?
 - in the American system, flow rate of a liquid is given in gallons per minute
 - in the metric system, the flow rate of a liquid is given in liters per second
1. What tools will you need?
2. What will you do, one step at a time?
3. Who will do what?

TOILETS:

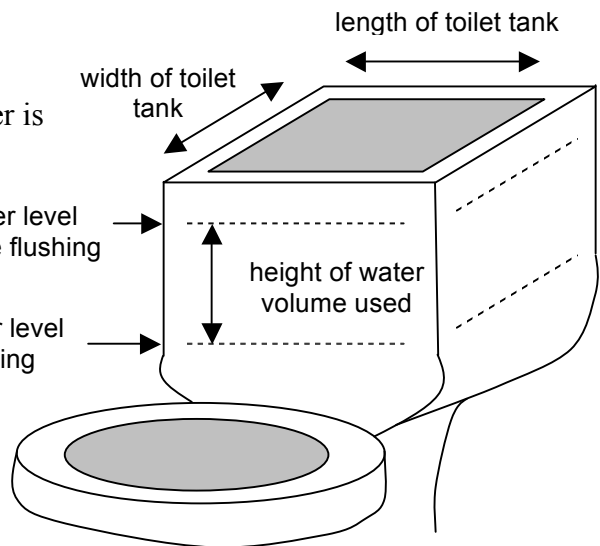
1. What happens when you push the handle? (look inside the back and find out)
2. What makes water empty out of the tank?
3. What makes water stop filling the toilet bowl?
4. What does the float do?
5. Here's one method to calculate how much water is used in one flush? Low flow toilets may use a different mechanism.

- Measure the inside width and length of the toilet tank in INCHES.

Record here. Length: _____

Width: _____

lowest water level after flushing



- Use a pencil to mark the water level in the tank before flushing and after flushing and measure the distance between the two lines.

height of water volume used: _____

- Convert your measurements to decimal numbers (e.g. 3/4 inch = 0.75 inch)

- Multiply length of toilet tank times width of toilet tank times height of water volume used.

length of toilet _____ x width of toilet _____ x height of volume used _____

Volume of water used = _____ cubic inches

- 1 gallon = 231 cubic inches. How many gallons were used?

Record your answer _____

If you have multiple toilets, use the following table to calculate the volume for each:

toilet location	length	width	height of volume used	volume in cubic inches	volume in gallons

WASHING MACHINES – Typically use about 40 gallons each use. Check the instruction manual if you have it.

DISHWASHERS – Typically use about 14 gallons each use. Check the instruction manual if you have it.

Flow Rates

SINKS — Use a small bucket, cooking pot, or other container, along with a second hand on a watch, to determine the flow rates of all sinks. **IMPORTANT:** Do this with the water turned on at a *medium* rate – not fastest or slowest, but in the middle.

Collect water flowing from the faucet for 10 seconds. Then, measure the water you have collected to the nearest quarter of a cup. Do three trials for each sink. Fill in the data in the table below. You have the # of cups/10 seconds. How do you find the # of cups/minute if flow remains constant? How many cups are in one gallon? What is the flow rate in gallons/minute?

sink location	cups per 10 seconds			gallons per minute			avg. gal. per minute
	trial 1	trial 2	trial 3	trial 1	trial 2	trial 3	

SHOWERS — Fill the table using the procedure for sinks, but use the flow rate that most shower takers in the family use (not necessarily the middle amount).

shower location	cups per 10 seconds			gallons per minute			avg. gal. per minute
	trial 1	trial 2	trial 3	trial 1	trial 2	trial 3	

TUBS — Cut the top off an empty gallon milk or water jug just below the neck. Make the hole just big enough to fit around the bath tub spigot. Find out how long it takes to fill the jug. Then find out how long it takes to fill the tub. Record the number of gallons it takes for one bath.

tub location	# seconds to fill a 1 gallon jug	# of seconds to fill the bath tub	gallons for one bath

HOSES — Fill the table using the procedure for sinks.

hose location	cups per 10 seconds			gallons per minute			avg. gal. per minute
	trial 1	trial 2	trial 3	trial 1	trial 2	trial 3	

REFRIGERATOR DOOR WATER

Do this by the number of glasses people drink (call each glass 1 cup).

ICE MAKERS

Melt 10 ice cubes and determine how much water is in an ice cube; then keep track of the number of ice cubes used in a week.

Check Sheet for placing water use record sheets

_____ Bathroom sinks – all that are in use

_____ Showers – all that are in use

_____ Tubs– all that are in use

_____ Toilets – all that are in use

_____ Kitchen sink

_____ Refrigerator water (if people get water from the refrigerator door)

_____ Ice cubes (for automatic ice cube makers only (on door or in freezer)

_____ Dishwasher

_____ Clothes washer

_____ Any other sinks (e.g. laundry, bar, garage)


_____ Hoses– all that are in use

_____ Other

BLANK WATER USE RECORD SHEETS


Cut these sheets along dotted lines and place at appropriate fixtures or appliances.

Sink (kitchen, bathroom, utility, or other) Record Sheet

Directions: make one hash mark for every 12 seconds the sink runs.  = 1 minute


Sink location	Day 1	Day 2	Day 3
	Day 4	Day 5	

Sink (kitchen, bathroom, utility, or other) Record Sheet

Directions: make one hash mark for every 12 seconds the sink runs.  = 1 minute

Sink location	Day 1	Day 2	Day 3
	Day 4	Day 5	

Sink (kitchen, bathroom, utility, or other) Record Sheet

Directions: make one hash mark for every 12 seconds the sink runs.  = 1 minute

Sink location	Day 1	Day 2	Day 3
	Day 4	Day 5	

Shower Record Sheet

Directions: make one hash mark for every 12 seconds the shower runs.

Shower location	Day 1	Day 2	Day 3
	Day 4	Day 5	

.....

Shower Record Sheet

Directions: make one hash mark for every 12 seconds the shower runs.

Shower location	Day 1	Day 2	Day 3
	Day 4	Day 5	

.....

Bathtub Record Sheet

Directions: make one hash mark for every bath taken.

Bathtub location	Day 1	Day 2	Day 3
# of gallons used per bath =	Day 4	Day 5	

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Bathtub Record Sheet

Directions: make one hash mark for every bath taken.

Bathtub location	Day 1	Day 2	Day 3
# of gallons used per bath =	Day 4	Day 5	

Toilet Flush Record Sheet

Directions: make one hash mark each time the toilet is flushed.

Toilet location	Day 1	Day 2	Day 3
# of gallons used per flush =	Day 4	Day 5	

Toilet Flush Record Sheet

Directions: make one hash mark each time the toilet is flushed.

Toilet location	Day 1	Day 2	Day 3
# of gallons used per flush =	Day 4	Day 5	

Toilet Flush Record Sheet

Directions: make one hash mark each time the toilet is flushed.

Toilet location	Day 1	Day 2	Day 3
# of gallons used per flush =	Day 4	Day 5	

Refrigerator Water Record Sheet

Directions: make one hash mark for each glass of water taken.

Refrigerator	Day 1	Day 2	Day 3
	Day 4	Day 5	

Ice Use Record Sheet (automatic ice makers only)

Directions: make one hash mark for each ice serving taken.

# of cups of water per avg. ice serving (e.g., melted ice cubes or crushed ice) =	Day 1	Day 2	Day 3
	Day 4	Day 5	

Dishwasher Record Sheet

Directions: make one hash mark for each time the dishwasher is run.

Use 14 gallons of water per operation of the dishwasher (unless otherwise specified)	Day 1	Day 2	Day 3
	Day 4	Day 5	

Clothes Washer Record Sheet

Directions: make one hash mark for each time clothes are washed.

Use 40 gallons of water per operation of the washing machine (unless otherwise specified)	Day 1	Day 2	Day 3
	Day 4	Day 5	

Hose Record Sheet

Directions: make one hash mark for each 5 minutes the hose is run.

Hose location	Day 1	Day 2	Day 3
	Day 4	Day 5	

Hose Record Sheet

Directions: make one hash mark for each 5 minutes the hose is run.

Hose location	Day 1	Day 2	Day 3
	Day 4	Day 5	

Water Use Tables

Use these data tables to calculate the total number of gallons used by each water source.

TOILETS	# of flushes	Gallons per flush	Gallons Used
Toilet 1			
Toilet 2			
Toilet 3			
Total gallons used by all toilets: _____			

SHOWERS	minutes run	Gallons per minute	Gallons Used
Shower 1			
Shower 2			
Shower 3			
Total gallons used by all showers: _____			

BATHTUBS	# baths	Gallons per bath	Gallons Used
Bathtub 1			
Bathtub 2			
Bathtub 3			
Total gallons used by all bathtubs: _____			

SINKS (write location)	minutes run	Gallons per minute	Gallons Used
Sink 1 _____			
Sink 2 _____			
Sink 3 _____			
Sink 4 _____			
Total gallons used by all sinks: _____			

DISHWASHER	# of uses	Gallons per use	Gallons Used
		14	
Total gallons used: _____			

WASHING MACHINE	# of uses	Gallons per use	Gallons Used
		40	
Total gallons used: _____			

HOSES	minutes run	Gallons per minute	Gallons Used
Hose 1			
Hose 2			
Hose 3			
Total gallons used: _____			

OTHER (describe)	minutes run	Gallons per minute	Gallons Used
Total gallons used: _____			

GRAND TOTAL OF ALL WATER USED FOR THE WEEK _____

Stacked Bar Graph Practice Sheet

Ann gathered the data shown below after a week of measuring her family's water use.

SOURCE	GALLONS USED
toilets	175
laundry	150
showers	250
bathtubs	150
sinks	85
hoses	40

Questions:

1. How many gallons of water did the family use for the week?
2. What *percent* of the family's water was used for toilets for the week?
3. What *fraction* of the family's water was used for sinks for the week?

Use the data given to make a stacked bar graph showing how Ann's family used water. Use a scale of 1 cm = 50 gallons. Make your graph on the back of this sheet. How many cm tall will the whole stacked bar graph be?

Stacked Bar Graph of Ann's Family's Water Use for 1 Week
(850 gallons total)

