Red Butte Garden
THE UNIVERSITY OF UTAH

Conserving Water In the Desert

Lesson 5: Water Collection – A World View

Enduring Understanding

Water is essential to the existence of all living organisms, so it is important to find efficient, sustainable ways for humans to access it for daily use.

Essential Question

What are the ways humans around the world access water necessary for daily use and which system is most efficient?

Background Information

All living organisms depend on water for survival: animals, plants and humans. In fact, human bodies are approximately seventy-five percent water that must be replenished as the body continually loses its water.

With your students, explore the difference in the ability of developed nations to create and build more complex water collection systems than underdeveloped nations. What would be the effect on the economy of one, as opposed to the other; how would this affect the quality of water, quality of life, leisure time, pursuit of other activities such as education, etc.

Review Lesson # 3 – Water Sources and Distribution: The Earth is 75% water, yet just a small percentage of that water is available for human use and consumption.

Developed countries such as the United States rely on water treatment systems that pipe fresh, potable water into homes for drinking, cooking, bathing and other household uses. We rarely think of the systems and the people working to provide clean and safe water to our homes, yet the infrastructure is complex and expensive. Information on water treatment systems can be found at this website:

http://watereducation.utah.gov/WaterInUtah/Municipal/default.asp

The Magic School Bus at the Waterworks in the bin literature also has a good explanation of how water is made safe for drinking in a community.

Lesson Plan

Materials

- BB book *Our World of Water*
- BB book *One Well: The Story of Water on Earth*
- BB book *The Magic School Bus At the Waterworks*
- BB bag of PVC pipe and elbow connectors
- BB 6 two-foot long PVC pipes
- BB 4 one-gallon buckets
- BB Funnel
- Stopwatch
- Measuring Tape
- Water
- 4 five-gallon buckets

Procedure

Warm-up

Read *Our World of Water* and *One Well: The Story of Water on Earth*.

Discuss the different systems for delivering potable water to a community in the books. Also, review the information on water treatment plants and discuss the possible economic costs associated with building the infrastructure. Discuss which system students think will deliver the water most efficiently and quickly.

Activity – Water Collection – A World View

Students will have a competition to engineer the most efficient system for water delivery to their "home" or "community". Students will be divided into two teams, one for each: (1) Piped system, (2) Carrying water by buckets.

- Divide the students into two teams. Tell them each team will be moving water 12 feet – one team with a piped system and the other by buckets. One team will also be creating mathematical formulas to extend the data collected for moving the water 12 feet, to moving it one mile, three miles and five miles.
- Instruct the first team to build the most efficient piped system possible with the materials provided in the bin.
- Instruct the second team to create mathematical formulas to extend the data collected for 12 feet, to one mile, three miles, and five miles. They can also determine how they will work as a team to transport the water (relay, fire line)
- Have students fill out the Student Worksheet Water Collection – A World View (Prediction section).
- See the Student Worksheet for additional details on the race set-up. Have students line up their respective systems and prepare to begin.
- When students are finished with the three trials and have completed their averages, have all students complete the mathematical computations chart. Then have them complete the Reasoning and Communicating Your Findings sections on the Student Worksheet.
- Lead a whole group discussion about the activity and the information presented in the books, *Our World of Water* and *One Well*.

Discussion Questions:

- How did the data compare in the different systems you tested?
- What made carrying buckets efficient?
- How did you work with your team members to increase efficiency?
- What makes the piped system efficient?
- What is the best way for an undeveloped country without the pipe systems (infrastructure) in place to deliver water to the citizens?

(In many countries, children and women are designated water harvesters. What is positive/negative about that separation of workload? What amount of the day would you estimate is used just for collecting water?

RED BUTTE GARDEN
BOTANY BINS

Name: _____ Date: _____

Student STEM Practices Worksheet

Lesson 5: Water Collection – A World View, 3rd – 8th grade

Objectives
Your team will have a competition with a second team to determine the most efficient system for water delivery to your "home" or "community".

Setting up the race:

- Measure out a distance of twelve feet and mark a racing lane with a Start and Finish for each of two teams.
- Place a 5-gallon bucket filled with water at the starting end of each team's racing lane. Place an empty bucket at each of the finish lines.
- Water will be moved by each team from the full 5-gallon bucket to the end of the 12-foot lane and poured into the empty 5-gallon bucket.
- One team will work together to create a pipe system to transport the water. Place the completed pipe system and a 1-gallon bucket in one of the lanes.
- The second team should place the other two 1-gallon buckets in the other lane. While the other team is building a piped system, this team will create a mathematical formula to determine how long it would take for each system to move the water one mile, three miles and five miles. Write these formulas on the chart and share with both teams.
- Using a stopwatch, select a student for each team to mark the time it takes for the water to be transported from Start to Finish. Record race results in the table provided below.
- You will be completing three trials and then you will average the results. Both teams are required to finish the race and all three trials for data gathering purposes.
- Using the mathematical factors calculated by one of the teams, determine the time it would take to move the water one mile, three miles and five miles. Record on the chart.

1. Gathering Data: Make predictions about which delivery system will be the most efficient before you begin.

Questions I have: _____

_____

My Predictions: _____

Competition Trial Data

	1st trial	2nd trial	3rd trial	Average
Piped System				
Buckets				

Mathematical Formulas to Calculate Longer Distances

	Moving Water 1 Mile	Moving Water 3 Miles	Moving Water 5 Miles
Formula			
Calculations			

2. Reasoning: Analyze your data and explain what happened. You may draw a picture.

Which system was more efficient and why?
Could you adjust either system to make it more efficient?

3. Communicating Your Findings: You may draw a picture.

Describe a place where each one of the watering systems is being used.
What makes one system more efficient than the other?
What is the best way for underdeveloped countries without infrastructure to deliver water to their citizens?

Extension

Activity: What is a water well?

A water well is created to access ground water for human use; uses can include agriculture, recreation, and home use. At the most basic, a well is a hole in the ground that is created to access groundwater.

Groundwater:

- Aquifers: Groundwater is found in what is known as an aquifer. Aquifers can be confined or unconfined:
  - A confined aquifer is one where the water inside is put under pressure between two impermeable layers of rock. When a well taps a confined aquifer, the water often comes out of the well from the pressure and doesn't require a pump. This is called an artesian well.
  - An unconfined aquifer is found where water has saturated the ground above an impermeable layer of rock; mechanical assistance (pump) is required to retrieve the water since it is not under pressure; this is known as a water table well.
- Spring: A place in the water table where water flows naturally out of the ground, up to the surface, is called a spring. Water can easily be collected and used from a spring.

The ways that people access these sources of groundwater vary greatly from place to place, culture to culture. Most people who live in developed countries access water from a municipal water system or well that is connected by pipes directly to taps in homes and businesses in their community. Just a turn of the tap allows water to flow directly indoors for daily use. In less developed parts of the world, people often use communal wells to access water. In these areas, it is necessary for water to be collected on a daily basis.

How to assemble a Water Well Model:
http://www.education.com/activity/article/dig_a_well/

Materials

- BB coffee can
- BB cardboard tube (paper towel tube or pvc pipe)
- BB baster (optional – to move water out of the well)
- BB food coloring (optional)
- gravel
- sand

For additional information, visit these websites:

http://water.usgs.gov/edu/qa-home-artesian.html
http://water.usgs.gov/edu/earthgwwells.html

Project Wet Curriculum

How Our Bodies Utilize Water: Aqua Bodies, page 5.

The Long Haul, page 273.