



AFTERSCHOOL EXCHANGE ACTIVITY

WATER WHERE YOU WANT IT

PREPARATION

Grade Levels: 5-8

This activity would be most effective if presented in one 60-90 minute session.

Prerequisites

Before beginning this activity, preview the PLANET H2O series (<http://www.thirteen.org/h2o>) as well as the suggested Web sites. Try out the hands-on part of the activity before doing it with your group.

Materials Needed

Students will need:

- Handout #1: How Much Water Do I Use?
- Handout #2: Irrigation Simulation
- Handout #3: Wrap Up
- Pen or Pencil

Group Leader will need:

- A copy of the video PLANET H2O, [LINK TO <http://www.thirteen.org/h2o/>] or the ability to project the digitized clips on a TV or a projector
- 4 paint trays
- 1 small bag of potting soil
- 1 small bag of playground sand
- 1 small bag of gravel
- 1 small bag of peat
- 2 empty gallon milk containers, each filled with water
- 1 garden watering can
- 1 garden towel or small shovel
- 1 graduated cylinder or measuring cup (should hold at least 1 liter)
- 1 stopwatch or watch with a second hand

NOTE: If you do not have access to these materials, you can still do the experiment portion of the activity. Instead of paint trays, you can easily recycle other containers such as coffee tins, milk cartons or even old plastic food containers. If you have a green space, playground or park nearby you can use soil and sand you find outside to complete the experiment. (Sand from a playground, dirt from a park etc...) Just remember to put the soil back and clean up your area after you complete your experiment.

Academic Goals

Children will:

- understand that water on our planet is finite
- understand that an irrigation method can both conserve water and use it to maximize plant growth

Social Goals

Children will:

- work in pairs or teams to answer questions and report to the group
- cooperate in small groups to complete an activity
- develop their group speaking skills as they provide feedback on each other's work
- develop their listening skills, allowing peers to speak and share opinions

STEPS

Introduction

Part I

1. Ask the students if they've ever heard the saying, "Water, water everywhere, but not a drop to drink." Ask them if they know what that means. Accept all answers, but remind them that not all water is drinkable. Ask them for examples of water they cannot drink. (Answers: sea water, polluted water, glaciers, underground water.)

2. Tell the students that they'll be doing a study of water and water supplies both locally and nationally. If you can't show the clip from the Web, cue the video to the very beginning where the logo PLANET H2O is on the screen. Provide the group with a focus before you start the video by asking the students to watch the video segment and be prepared to share with the group what they think the people onscreen are talking about.

3. Play the video and pause it when the teenager on the screen says, "The government should put restrictions on it." Ask the group what they think the people are talking about. (Possible answers: water, air quality, food.) List their responses on the board. Do not give them the answer.

4. Provide the group with a new focus by asking them to watch the next video segment and listen to see if anyone guessed the topic the people in the video are talking about.

Resume the video and pause it once again when the young man says, "...do something differently." Ask the students once again what the people are talking about. (The correct answer is "water.") Check to see if anyone had the right answer and that it was written on the board.

5. Ask the students if they know the definition of the word conservation. Go over the definition as a large group. (Conservation means to preserve and protect something.)

Ask the students to watch the next video segment to see why water conservation is an issue in today's world.

6. Resume the video and play it until Sarah Paxton says, "... how wisely we use the water we have." Pause the video at this point and ask the students why the availability of water is an issue. (The demand for water is growing faster than the supply can be replenished.)

7. If you can't play clip #2 from the Web, cue the video at the point where the mustachioed man in the boat has just said, "... there are more demands on the water than there is water itself." Ask the group to watch closely and try to remember why the demand for water is growing.

Play the video and pause it after the woman says, "... the amount of water per person is growing." Ask the group why the demand for water is growing. (Answer: Population is growing too fast to keep up with the water supply.) Ask them to name some of the reasons that the demand for water is growing. (Possible responses might include: farming, golf courses, cities getting larger, population growing) Note: The video clip in this section is very short, 15 seconds.

Part II:

1. Ask everyone if they have any idea how much water they each use every day. (Accept all answers). Ask the students if they have any idea how much water they would use while taking a single shower. (Accept all responses.) Ask the students WHEN they use water during the course of the day, and list their responses on the board. Ask each person to list the different things they use water for each day. (Answers might include: bathing, drinking water, washing dishes, and others.)

2. Tell the group that they can make a pretty good estimate of their personal water usage using some guidelines provided by the United States Geological Survey (USGS). (Note to Leader: The USGS is an agency within the United States Department of the Interior. It is responsible for issues dealing with the natural resources in our country.) Distribute Handout #1: How Much Water Do I Use? For programs that have multiple computers and Internet access, this handout can be found in an interactive format at: <http://ga.water.usgs.gov/edu/sq3.html>.

3. Using yourself as a model, fill out Handout #1 based on your own water use habits. Show the students how to record the number of times you flush the toilet each day, or how long you take to wash your dishes. Instruct the students to complete the handout based on their own habits. Make sure that they use the information given for the amount of water used for each daily activity to calculate their own habits.

4. List the students' individual totals on the board. Discuss with the group which activities seem to take the most water. Ask them if they find any of the findings surprising. Ask the group if they can conserve water in their own personal usage. (Possibilities might include: Be sure to turn the water off while actually brushing teeth.

Make sure you have a “low flow” toilet. Only use the dishwasher or washing machine when there is a full load.)

Activity 1 (15 minutes)

1. If you can't play clip 3 from the Web, fast forward the video to the section on “Precision Farming.” Pause the video just after the narrator says, “They're very thirsty crops,” and the tractor holding a round bale of hay just appears on the screen.
2. Review with the group some of the things they learned in the Introductory Activity. (Water is a finite resource. Water is being used at a faster rate than it can be replenished in the environment. Individuals can reduce their own water consumption.)
3. Tell the group that they'll now be looking at a common use of water that has been around for thousands of years. Ask the students what they think that use might be. (Possible answers: drinking water, bathing, farming, or fishing.) Accept all answers and record them on the board.

Provide the students with a focus, and ask them to listen for the first time mankind tampered with their environment.

4. Play the video until the female narrator says that agriculture was the first reason man tampered with the environment. Pause the video at this point. Ask the students to recall what the first reason was. (Farming.) Ask them how primitive farmers watered their plants, and record their answers on the board. (Possible answers: by hand, by pump, with irrigation.) Accept all answers and record them on the board.
5. Before continuing the video, ask the group to listen for the name of the source of water for the farmers in this video, and how primitive farmers watered their crops.

Resume the video until the narrator mentions the Ogallala Aquifer. Ask the students what the source of water is for the farmers in the video, and how primitive farmers watered their crops. (The source of water is the Ogallala Aquifer. Primitive farmers relied on rain. Now farmers rely on irrigation.) Define the terms “aquifer” and “irrigation” for the class. (Note to Teacher: An aquifer is an underground bed or layer of earth, gravel, or porous stone that yields water. Irrigation is to supply dry land with water by means of ditches, pipes, or streams; to water artificially. Tell the class that they'll be learning about both aquifers and irrigation.)

6. Resume playing the video from this point, and pause it after the farmer says, “... the Ogallala Aquifer” and the map showing the extent of that aquifer is on the screen. Check for comprehension, and ask the students to summarize why Nebraska is such a great place to grow crops. (Good soil, adequate rainfall, and lots of groundwater.)

7. Tell the group that in the next part of the video they'll be learning about two methods of irrigation. Ask them to write down what the two types of irrigation are and how one is different from the other.

Resume playing the video and pause it after the boy says, "... center pivot irrigation." Ask the students to recall what the two types of irrigation are. (Answers: gravity flow irrigation and center point pivot irrigation.) Ask the students what they think gravity flow irrigation is, based on the name. (Gravity flow irrigation uses the force of gravity to move water to different parts of the farmer's field.)

8. Have the students see if their predictions are correct. Resume the video and pause it when the boy says, "... gravity pulls the water to the end of the field." Ask the students to think of some pros and cons of this method of irrigation. (Pros: inexpensive, uses a force of nature, effective. Cons: Pipes must be moved around and set up. It uses a lot of water.) Ask the group to watch the video and see if some of the pros and cons they mentioned are correct.

9. Resume the video and pause it when the farmer says, "...we've used more water from the aquifer" and the water pressure gauge is on the screen. Ask the class to summarize the pros and cons of gravity flow irrigation. (Pros: simple, reliable, effective, low cost. Cons: hard to put system in, more water is coming out of the aquifer than is going in, need to drill deeper, costlier.)

10. Ask the students if they can think of another way to get water to plants more efficiently. Ask the students to watch the video and listen for the name of the next method of irrigation, and how efficient it is.

Resume the video and pause it when the boy says, "... it doesn't waste as much water" and he is starting to climb the ladder at one of the pivot point sprinklers. Ask the students what the next method of irrigation is called. (Pivot point irrigation.) Ask students how efficient gravity flow irrigation is. (60% efficient.) Ask the students how efficient pivot point irrigation is. (85% efficient.) Stop the video at this point.

11. Ask the group if they can think of reasons when gravity flow irrigation might be a better choice than pivot point irrigation. (It conserves more water.)

Tell the group that they'll be investigating this question using a laboratory experiment.

Note: The video clip in the section above is just about 2 minutes and 30 seconds long.

Activity 2: Hands-on (20 minutes)

Procedure: To be done by the group leader prior to the session:

1. Lay a strip of rag cloth along the thicker edge of each paint tray.
2. Fill one paint tray level to the top with sand, another with potting soil,

another with gravel, and another with peat.

3. Lightly compress each soil, but don't overly compact it.
4. You'll be pouring water into the raised part of the paint tray, and you'll be collecting any drainage water at the lowered end.
5. Place the graduated cylinder or other catch device in a position to capture the water as it runs down the lowered end of the paint tray.

1. Distribute Handout #2 to your students, and ask them to collect data from the two following experiments.
2. To simulate gravity flow irrigation:
 1. Slowly pour a gallon of water directly from the milk container back and forth across the rag strip at the top of the paint tray containing sand.
 2. Have the students time the intervals from water application to the first dribble of drainage.
 3. Repeat for gravel, potting soil, and peat.
 4. Measure the amount of water drained from each of the types of soil.
 5. Record the drainage time and quantity of water drained from each soil type.
3. To simulate sprinkler irrigation:
 1. Using the paint tray as you did in the gravity flow irrigation simulation, pour or spray water from diffuser head of the hose or sprinkler can to simulate a pressurized spray system.
 2. Again, have the students time the interval between application and the first dribble of runoff, and measure the quantity of runoff.
 3. Record the drainage time and quantity of water drained from each soil type.

Wrap Up (15 minutes)

After the data has been collected from the experiments, ask the group to discuss their observations and things they noticed about the rate of water flow. (Responses might include: The gravel went very quickly. The sand seemed to go more slowly. There was very little flow from the peat.) Tell the group they'll be compiling their results while working in small groups. Distribute Handout #3. Read it aloud, and ask if the questions being asked are clear. When all questions have been addressed, divide students into small groups of two or three and set them to work.

Bring the students back together, and have each group report their findings. Record each group's findings on the board.

Follow-up Activities:

1. Create a water conservation awareness campaign in your community. Have the students make posters highlighting the amounts of water used in everyday activities (i.e. bathing, flushing, washing clothes and dishes) and suggesting ways to use less.
2. Participate in or co-organize a "clean-up" day or "green space" day with a local area park and/or community organization. Let your students try out their new-found understanding of irrigation techniques and have them plant flowers or shrubs in your neighborhood garden or park.

CREDITS

This AFTERSCHOOL EXCHANGE activity was adapted from a lesson created by Bob Berwick, Science Head at New Canaan Country School in New Canaan, Connecticut, based on the series PLANET H2O. (<http://www.thirteen.org/h2o/>)



Water Where You Want It

Handout #1 How Much Water Do I Use?

Activity	# Times per Day	# Gallons per time	Gallons per day
Baths			
Showers			
Shower Length			
Brushing Teeth			
Hand/Face Washing			
Face/Leg Shaving			
Dishwasher Loads			
Dishwashing by Hand			
Clothes Washer Loads			
Toilet Flushes			
Water Drunk			
TOTALS WATER	X	X	

Use the following data from the USGS for your chart:

Bath: 50 gallons

Shower: 2 gallons per minute

Teeth brushing: 1 gallon

Hands/face washing: 1 gallon

Face/leg shaving: 1 gallon

Dishwasher: 20 gallons/load

Dishwashing by hand: 5 gallons/load

Clothes washing (machine): 10 gallons/load

Toilet flush: 3 gallons

Glasses of water drunk: 8 oz. per glass (1/16th of a gallon)



Water Where You Want It

Handout #2

Irrigation Simulation

Gravity Flow Irrigation Simulation

Soil Type	Start Time For Water Pour	Time of First Drainage	Time That Water Stopped Flowing	Drainage Time	Volume of Water Collected
Sand					
Gravel					
Potting Soil					
Peat					

Sprinkler Irrigation Simulation

Soil Type	Start Time For Water Pour	Time of First Drainage	Time That Water Stopped Flowing	Drainage Time	Volume of Water Collected
Sand					
Gravel					
Potting Soil					
Peat					



Water Where You Want It

Handout #3

Wrap Up

Directions: In groups of two or three, draft answers to the following questions using data from your experiments to justify what you say.

1. What are two advantages and disadvantages of each type of irrigation system?
2. What kinds of crops would gravity feed irrigation be best for?
3. What kinds of crops would sprinkler irrigation be best for?
4. Which kind of irrigation conserves the most water in sandy soil?
5. Which kind of irrigation conserves the most water in gravel-like soil?
6. Which kind of irrigation conserves the most water in peat-like soil?
7. Which kind of irrigation conserves the most water in rich soil like potting soil?