

Lesson Plan: Clean Water for Everyone Today and Tomorrow with Good Food Choices
A lesson in four steps with assessment template and discussion questions and answers included

Grade Level and Subjects: Grades **K-2** science, social studies, health

Length: 1-2 class periods

Purpose: To visualize for young children how much water is used to do everyday tasks and how much water is needed to grow common food items. To graphically illustrate for children how some human activities and how food production causes water pollution. To instill in children that water is a precious resource and should not be wasted.

Objectives: As a result of this lesson's activities, students will be able to:

- Estimate and measure quantities of liquids using metric or English scales or by using containers of different relative sizes (e.g., liter bottles, trash cans, etc.)
- Provide analogies through words and pictures of water usage for various tasks with the use of small swimming pools, one-liter water bottles, gallon jugs, or devices of their own choosing/creation.
- Demonstrate using mud how common water pollutants (e.g., used motor oil, fertilizer applications to lawns or fields, manure spreading on cropland, discharged animal effluent into freshwater bodies, etc.), pollutes waterways.
- Identify water as a natural resource which may be polluted by natural and human-caused processes.
- Identify major sources of water pollution.
- Identify dietary choices as a major factor in determining how much water is consumed by each person on a daily basis.

National Science Content Standards Correspondence:*

NS.K-4.1 Science as Inquiry As a result of activities in grades K-4, all students should develop

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

NS.K-4.2 Physical Science As a result of their activities in grades K-4, all students should develop understanding of

- Properties of objects and materials
- Position and motion of objects

NS.K-4.3 Life Science As a result of their activities in grades K-4, all students should develop understanding of

- Organisms and environments

NS.K-4.5 Science and Technology As a result of activities in grades K-4, all students should develop

- Abilities of technological design
- Understandings about science and technology
- Abilities to distinguish between natural objects and objects made by humans

NS.K-4.6 Personal and Social Perspectives As a result of activities in grades K-4, all students should develop understanding of

- Personal health
- Characteristics and changes in populations
- Types of resources
- Changes in environments
- Science and technology in local challenges

*Education World (2008) *U.S. National Education Standards*. Retrieved September 18th, 2009
<http://www.education-world.com/standards/national/index.shtml>.

Materials Needed:

- Whiteboard and markers, overhead projector, or Smart Board
- One or more of the following: kiddie pool (borrowed from a parent); trash cans of known volume; gallon jugs (several); 1-liter water bottles (several)
- Duct tape
- Dirt and/or food dye

Prior Knowledge and Skills Needed:

- Water as a requirement in food production
- Water as a requirement in daily living
- Measuring and estimating quantities
- Making predictions

Assessment:

Students will be assessed through these means:

- Completion of student worksheet #1
- Participation in oral presentation of Activity #1 and #2 results

Vocabulary:

- **Water conservation:** using less water than before to do something (e.g., take a bath or shower, brush teeth, etc.)
- **Sources of water pollution:** things that makes water dirty or unsafe to drink or swim in (e.g., animal manure, motor oil, etc.)

Lesson Background:

Teachers may look at the United Nations' 2006 report titled *Livestock's Long Shadow* available at <http://www.fao.org/docrep/010/a0701e/a0701e00.htm>. Chapter IV deals with water pollution due to animal agriculture. Both national and global issues are discussed. The major conclusion of this Report is that livestock production is a leading source of environmental damage including climate change; water and air pollution; land degradation; and loss of biodiversity. The Report suggests that a human diet that is plant-based would prevent much of the environmental damage caused by animal agriculture, including the feedcrop production associated with it.

Procedure:

NOTE: The water and mud activities are best performed outside in warm weather, possibly as an Earth Day activity. Parent helpers are recommended. Older students could help as part of a service learning activity if school principal approves.

Alternatively, the activities may be done inside using hundreds of small plastic balls to fill up a kiddie pool or a large trash can instead of water. Tissue paper streamers may be used instead of mud in a waterless trough.

Lesson Step #1: Introduction and Topic Setting

The teacher introduces the subject by showing pictures or video clips of polluted water bodies. This can be followed by role playing a "water waster" by letting the water run in the schoolyard or

bathroom. Teacher leads a general discussion to be sure children can identify water pollution and know when water is being wasted. To lead into the activities, teacher proposes that food choices also can be responsible for water pollution and water wastage.

Lesson Step #2: Activity 1: Making Large Quantities of Water Concrete

1. Teacher presents the data tables given below on the board or overhead showing water used to do common tasks and water used to produce common foods. Teacher provides pictures as needed to facilitate understanding. Teacher asks during the presentation if it seems like a lot of water or not. Teacher compares and contrasts numbers using *more than*, *less than*, etc.
2. With teacher's help as needed, teams of students fill a kiddie pool, gallon jug containers, or water bottles with water to show relative or exact quantities of water needed to perform various household activities. *Note: Having a spare pool or trash can for water exchanges is suggested. Capacity of pool must be known to do this part with the pool accurately; however, a qualitative assessment is instructive, too.*
3. Teacher asks students for their reactions after each example. Teacher may ask *Which food took the most water to grow? Which food took the least water to grow?*
4. Steps 2 and 3 are repeated as time allows to illustrate how much water is used to grow common foods.
5. Students assist teacher in developing a chart showing pool/jug/water bottle analogies to complement the data charts shown at the beginning of class. For example, teachers may reproduce the 1-liter water bottle, gallon jug, or kiddie pool templates and place the appropriate number of copies of them next to each listing according to the table.
6. Alternatively, students illustrate the chart with pool, gallon size jugs, other containers, or water bottle icons that they draw and color themselves.

Lesson Step #3: Activity 2: How Pollution Travels in Water

1. Using recyclable one-liter water bottles slit in two and securely attached to each other, (with tops and bottoms removed), students construct a long trough (3-10 m long) into which a shallow water layer (3-6 cm) is placed. See diagram below.
2. Students add a small quantity of mud (wet dirt) or food dye at one end of the trough. Students agitate the trough by moving it gently from side to side and by adding water to it occasionally at one end.
3. Students describe how the mud or dye travels in the trough and how added water and movement affect the mud's/dye's movement. Teacher may ask lead questions such as *Does the mud/dye move at the same speed all the time? What makes it go faster or slower?*
4. With teacher's prompts, students name similarities and differences with how pollution moves in waterways. *Teacher may ask, does the solid part of the mud move faster or slower than the liquid part? What would happen if the trough was on a hill? What if it were a rainy or windy day?*

Lesson Step #4: Culminating activity: Teams of students present a picture to the class of each activity as they did it. The team states how some behaviors conserve water while others waste it and give one example of what they can do at home to conserve water. (*Answers based on Table 1 below.*) Students state how some food choices use more water than others. They suggest one way that they can use less water through their diet. (*Answers may include eating more vegetables, eating less meat, becoming a vegetarian, etc.*)

Water Facts:

Table 1. Water Consumed during Daily Activities (data taken from <http://www.epa.gov/reg5rcra/wptdiv/p2pages/water.pdf>)

Activity	Water consumed (gallons)
Flush toilet	5-7
Run dishwasher	15-25
Wash dishes by hand	20
Water a small lawn	35
Take a shower	25-50
Take a bath	50
Wash a small load in a washing machine	35
Brush teeth with water running	2-5

Table 2. Water Used to Produce some Common Items (Data taken from Hoekstra and Chapagain 2004; numbers are rounded off on table children use for activity.)

Product	Water Used (gallons)
1 glass of milk (200 ml)	50
1 glass of apple juice (200 ml)	47.5
1 glass of orange juice (200 ml)	42.5
1 bag of potato chips (200 g)	46.3
1 slice of bread (30 g)	10
1 egg (40 g)	33.8
1 slice of bread (30 g) with cheese (10 g)	22.5
1 hamburger (150 g)	600
1 potato (100 g)	6.3
1 tomato (70 g)	3.3
1 apple (100 g)	17.5
1 orange (100 g)	12.5
1 cotton T-shirt (medium sized, 500 g)	1,025
1 pair of shoes (bovine leather)	2,000
1 sheet of 8 ½ x 11 inch paper	2.5

Chapagain A, Hoekstra A (2004) Water Footprints of Nations Volume One: Main Report. *Value of Water Research Report Series No.16. Delft (The Netherlands): UNESCO – IHE Institute for Water Education.*
<http://www.waterfootprint.org/?page=files/Publications>

Chapter Four of *Livestock's Long Shadow* cites sources that on average, people consume 30-300 L of water per day for household uses while 3,000 L of water are used to grow their daily food.

RESOURCES:

<http://www.earthday.net>

There are several categories of well-developed environmental lesson plans for all grade levels. Topics include climate, sustainability, and organics and food. Site has an environmental jeopardy game that students will enjoy.

<http://eelink.net/pages/Lesson+Plans>

The North American Association for Environmental Education (NAAEE) has a multitude of lesson plans, teacher guides, and student resources at its site.

<http://www.ehponline.org/science-ed/2007/Food.pdf>

A lesson plan that shows interconnections between water use and food production and contains links to several helpful websites.

<http://www.epa.gov/kids/>

This site is written to appeal to children of all ages. There are many interactive features and many downloadable resources. With art, game, and science rooms, as well as pages devoted to environmental issues of all types, this site could make a good supplemental resource or lesson enhancement.

<http://www.footprintnetwork.org>

Provides an interactive quiz that students will enjoy to calculate the ecological footprint of cities, businesses, and individuals.

<http://kids.niehs.nih.gov/>

National Institute of Environmental Health Sciences (NIEHS) has an enormous website filled with useful resources for teachers and students in all grade levels. Certain pages are written at a child's level and cover many different topics related to environmental health.

<http://www.ryanswell.ca>

First grader Ryan Hreljac was inspired by a classroom lesson about children who don't have clean water around the world and began raising money to provide it. Now, over ten years later, his Ryan's Well Foundation is still very active. At this site, children and youth can learn about fundraising projects and ways to get involved so that everyone in the world can have clean water.

Clean Water for Everyone Today and Tomorrow with Good Food Choices Assessment:

Student Worksheet KINDERGARTEN

Name: _____ Date: _____

Directions: Answer the questions with pictures or numbers.

1. Look below at Table 1

Table 1. Water Consumed during Daily Activities

Activity	Water consumed (gallons)
Flush toilet	5-7
Run dishwasher	15-25
Wash dishes by hand	20
Water a small lawn	35
Take a shower	25-50
Take a bath	50
Wash a small load in a washing machine	35
Brush teeth with water running	2-5



Draw a picture below of gallon size jars to show how many gallons of water it takes to flush the toilet.

2. Look below at Table 2.

Table 2. Water Used to Produce some Common Items

Product	Water Used (gallons)
1 glass of milk (200 ml)	50
1 glass of apple juice (200 ml)	48
1 glass of orange juice (200 ml)	43
1 bag of potato chips (200 g)	46
1 slice of bread (30 g)	10
1 egg (40 g)	34
1 slice of bread (30 g) with cheese(10 g)	23
1 hamburger (150 g)	600
1 potato (100 g)	6
1 tomato (70 g)	3
1 apple (100 g)	18
1 orange (100 g)	13
1 cotton T-shirt (medium sized, 500 g)	1,025
1 pair of shoes (bovine leather)	2,000
1 sheet of 8 ½ x 11 inch paper	3

How many gallons of water does it take to make a hamburger? _____

3. Draw a picture below to show how pollution moves in a stream.

Clean Water for Everyone Today and Tomorrow with Good Food Choices Assessment:

Student Worksheet GRADES 1 and 2

Name: _____ Date: _____

Directions: Answer the questions in complete sentences.

1. Look below at Table 1.

Table 1. Water Consumed during Daily Activities

Activity	Water consumed (gallons)
Flush toilet	5-7
Run dishwasher	15-25
Wash dishes by hand	20
Water a small lawn	35
Take a shower	25-50
Take a bath	50
Wash a small load in a washing machine	35
Brush teeth with water running	2-5

Do you think it takes more or less water to brush teeth *without* the water running than it does to flush the toilet? Explain your answer in one or two sentences.

2. Look below at Table 2.

Table 2. Water Used to Produce some Common Items

Product	Water Used (gallons)
1 glass of milk (200 ml)	50
1 glass of apple juice (200 ml)	48
1 glass of orange juice (200 ml)	43
1 bag of potato chips (200 g)	46
1 slice of bread (30 g)	10
1 egg (40 g)	34
1 slice of bread (30 g) with cheese(10 g)	23
1 hamburger (150 g)	600
1 potato (100 g)	6
1 tomato (70 g)	3
1 apple (100 g)	18
1 orange (100 g)	13
1 cotton T-shirt (medium sized, 500 g)	1,025
1 pair of shoes (bovine leather)	2,000
1 sheet of 8 ½ x 11 inch paper	3

Based on what the table above says about a potato and a hamburger, do you predict that a baked potato takes more or less water to make than a hamburger? Explain your answer in one or two sentences.

3. Based on what you saw with the mud and food dyes, how do you think animal manure will move in a stream as compared to liquid weed killer? What can make them move faster or slower?
