

A Drop in the Bucket

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Subject/Grade: 8th Science



1-2 Sentence Lesson Summary

In this Lesson students will explore how water is a precious resource, by estimating and calculating the percentage of available freshwater on Earth, students learn water is a resource that must be used and managed carefully.

Driving Question that Students Will Understand

Should a community be able to plant lawns and use water as freely as they like to please themselves?

Water Industry Connection (e.g., an industry-related career, skill, or challenge; addresses **reducing water pollutants, conserving water resources, and/or inspiring watershed stewardship**)

In summation, considering each and every activity that we participated in this week, I have been given tools from our Valley Water Zoom Day, particularly from Justin Burke's Water Conservation Presentation discussion and resources to connect students to water resource management. In learning about and understanding the significance of water industry challenges I will share the lessons from this week's real-world examples, success stories and challenges. In focusing on the potential positive impact, students can make in their academic studies and careers and see that people who work in the water industry are stewards of our most valuable resource, water. Ignited's Water Stewardship Week has given me a broader perspective in advocating about water resources so that I can help my students learn about their choices, both present and future, concerning water resources. To do this, students need to understand the challenges and opportunities presented this week to develop a passion for social and environmental justice.

Learning Goals: Make sure to address how your lesson will:

- Involve your students in a [Community Environmental Action](#)
- Develop Critical Thinking Skills (e.g. CERs, Student Inquiry)

This lesson extends an existing Climate Change Unit that is taught to expand and include Water Resources as an option to consider as students are selecting their trauma-informed-practice [Sustainability Action Plan](#). The Sustainability Action Plan is a project that gives students power in addressing our climate crisis, students select a cause and take action.

This lesson gives students insight to the challenges of supplying freshwater resources and gives students the opportunity to explore the impact that water resources and water use have on sustainability and their Ecological Footprint. Students are given alternatives as they choose the actions that they will complete to satisfy the requirements of their Sustainability Action Plan.

After doing the activity in this single lesson, students will be able to...

- explain why fresh water is a renewable resource.
- calculate the percentage of fresh water available for human use.
- Complete a service learning project to reduce each student's Ecological Footprint.

Students will then use this information to be informed as they choose their year-long Sustainability Action Plan Project which can also be outlined in the [Community Environmental Action Project by Ignited](#).

Instructional Outline: This should be the bulk of your writing. Bullets of what the students will do throughout the lesson to reach the learning goals you have set.

Hook/Intro... The Earth is covered mainly by water, but only a small amount is available for human consumption.

During... Learning that water is a renewable, yet limited, resource helps students appreciate the need to use water resources wisely. Students collaborate to finish [this handout](#).

Procedure

▼ Warm Up

- Tell students they are going to estimate the proportion of potable water on Earth and compare it to the rest of the water on the planet. Have students work in small groups.
- Instruct them to draw a large circle with a marker on a white sheet of paper. Offer them two sheets of different-colored construction paper. One color represents available fresh water; the other represents the rest of the water on the planet.
- Tell students that they will be tearing the two sheets of paper into a total of 100 small pieces. Ask them to estimate how many pieces will represent potable water and how many pieces will indicate the rest of the water on the planet.
- Instruct each group to arrange the 100 pieces within the circle so that these pieces reflect their estimates.
- Have groups record the number of pieces representing “potable” and “remaining” water

The Activity

NOTE: For simplicity, measurements have been retained in metric. To convert to standard measurements, refer to the Metric Conversion Table in the Appendix or use an Internet conversion site.

1. Show the class a liter (1,000 ml) of water and tell them it represents all the water on Earth.
2. Ask where students believe most of the water on Earth is located. (Refer to a globe or map.)
3. Ask students to estimate how many milliliters of water they think would represent all of the freshwater on Earth. Pour 30 ml of the water into a 100-ml graduated cylinder. This represents Earth’s fresh water, about three percent of the total. Put salt into the remaining 970 ml to simulate salt water found in oceans, unsuitable for human consumption.
4. Ask students what is at Earth’s poles. Have students estimate what percentage of Earth’s freshwater is stored in its frozen state. Almost 80 percent of Earth’s freshwater is frozen in ice caps and glaciers. Remind students that the North Pole is frozen sea ice while the South Pole is Antarctica (a continent) covered in an ice sheet. Pour 6 ml of fresh water into a small dish or cylinder and place the rest (24 ml) in a nearby freezer or ice bucket. The water in the dish (around 0.6 percent of the total) represents non-frozen fresh water. Only about 1.5 ml of this water is surface water; the rest is underground.
5. Use an eyedropper or a glass stirring rod to remove a single drop of water (0.03 ml). Release this one drop into a small metal bucket. Make sure the students are very quiet so they can hear the sound of the drop hitting the bottom of the bucket. This represents clean, fresh water that is not polluted or otherwise unavailable for use, about .003 percent of the total! This precious drop must be managed properly.
6. Discuss the results of the demonstration. At this point many students will conclude that a very small amount of water is available to humans. However, this single drop is actually a large volume of water on a global scale. Have students use the Water Availability Table to calculate the actual amounts.

▼ Wrap Up

- Referring to the Warm Up, remind students of their earlier guesses at how much water on Earth is available to humans and compare the actual percentage of Earth’s water available. Have students explain their reasoning for their initial estimates. How would they adjust their proportions? (Onehalf of one of the pieces of paper represents potentially available water [0.5 percent]. Only one small corner of this half [.003 percent] is actually potable water.)
- Discuss with students the complexity of what the single “drop” of available freshwater on Earth represents. Ask them who uses this water and for what. For example, thermoelectric power has accounted for the largest percentage of U.S. water withdrawals since the U.S. Geological Survey’s 1965 water use summary.



Name: _____

Date: _____

Water Availability Table Quantity to be divided among people on Earth	Amount Available liters/person	% of total water
All the water on Earth	202.9 billion	100%
Only the fresh water (calculate 3% of the amount available)		3%
Only the non-frozen fresh water (calculate 20% of the remaining amount available)		0.6%
Available fresh water that is not polluted, trapped in soil, too far below ground, etc. (calculate 0.5% of the remaining amount available)		.003%

Every five years, the United States Geological Survey (USGS) compiles data to understand how much water was used by diverse water users in the United States. This information assists water managers in planning for present and future water needs by understanding how water resources are used throughout the nation.

In 2005, the USGS estimated the following:

- Total withdrawals were 410,000 million gallons per day
- Fresh water withdrawals were 85 percent of the total
- Surface water supplied 80 percent of all withdrawal

DIRECTIONS: On a separate sheet of paper, use the information in the chart below to represent water use in the United States in 2005 in a way that is graphically interesting. For example, create a pie chart, bar graph or other graphic. To see how the USGS represented this information, follow this link <http://pubs.usgs.gov/fs/2009/3098/pdf/2009-3098.pdf> and review their bulletin, "Summary of Estimated Water Use in the United States in 2005."

Water User	% of Water Use	Number of gallons used (million gallons per day or Mgal/day)
Public Supply	11	44,200
Domestic	1	25,600
Irrigation	31	128,000
Livestock	1	2,140
Aquaculture	2	8,780
Industrial	4	18,200
Mining	1	2,020
Thermoelectric Power*	49	201,000

*Very large volumes of water are needed for cooling thermoelectric power plants. For more information about thermoelectric power and water use, refer to the full USGS "Summary of Estimated Water Use in the United States in 2005" report cited above.

Reflection...Students will summarize their learning in a reflection then follow with a CER for the activity assessment.

Standards: Common Core, NGSS, CTE, GoalBook or another state or national list.

SCIENCE AND ENGINEERING PRACTICE Engaging in Argument from Evidence Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-ESS3-4)

Disciplinary Core Idea(s) ESS3.C: Human Impacts on Earth Systems Typically as human populations and per capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.(MS-ESS3-4)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-4)

Assessment: How will you check your students' understanding? Check out these [creative assessments](#) if helpful.

Students will write a [CER](#) for this activity and present their CER in a [Flipgrid video](#).

- a. Students write a scientific analytical paragraph explaining data and drawing conclusions

Materials/Resources

- Two colors of construction paper
- Sheets of white paper
- Markers

The Activity

- Water
- Globe or world map
- 1,000-ml beaker
- 100-ml graduated cylinders
- Small dish
- Salt
- Freezer or an ice bucket
- Eyedropper or glass stirring rod
- Small metal bucket
- Copies of What's in a Drop?

References: [Project Wet \(https://portal.projectwet.org/\)](https://portal.projectwet.org/)