Post-festival Lesson 6.1 - A Drop in the Bucket Lesson Plan

Investigative Question:

- How much water on Earth is available for our use?
  - What is potable water?
  - Does everyone have access to potable water?

Summary: Based on percentages of water in various locations on Earth, students measure water using beakers or measuring cups to see what proportion of one liter represents potable water.

Reference: adapted from **"**A Drop in the Bucket", *Foundations of Water Education*, 2024, pg. 31-40.

Time Frame: 45 minutes (can be done quicker as class demo if needed)

Cross Cutting Concepts Demonstrated:

- Scale, Proportion, & Quantity
- Patterns
- Cause & Effect
- Systems & System Models

Science and Engineering Practices Integrated:

- develop and use models
- engage in argument from evidence
- ask questions & define problems
- use math & computational thinking

Materials Needed:

- 1 Liter of water per group (or for class, if doing class demo)
- Small measuring cup of at least 30 mL per group
- Globe or world map
- 100 mL measuring cup or container per group
- 10 mL measuring cup or container per group
- Eye dropper (optional) per group
- Metal Bucket or small bowl per group

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Activity Warm up:

Feel free to use slides provided to introduce lesson.

- **What is potable water?** How is it different or the same as freshwater? (Potable water is suitable to drink by humans. Not all freshwater is potable).
- How did students use water today?
    - Student can discuss in pairs or as a group
- Divide students into small groups
- Pass out one liter of water and measuring cups to each group.
- The liter of water represents 100% of water on Earth. Students will estimate how much of the liter of water represents potable water by pouring their estimations into a measuring cup of their choice.
- How much did each group estimate and why? Discuss differences and similarities.

Lesson Sequence:

Investigation: Students need to pour their estimation amount back into the liter container before continuing this activity. They will now see how close their estimations were.

1. **Where is most of the water on Earth located?** (Refer to a globe or map)
2. What percentage of water on Earth do students think **is in the Ocean?** (97%). The rest is freshwater. What percentage of water on Earth **is freshwater?** (3%).
3. Students should pour 30 mL (or 3%) of the water into a smaller measuring cup.
4. Ask students to put the 970 mL aside because salt water cannot be used for consumption (without expensive and specialized treatment – called desalinization).
5. **Is all freshwater potable water?** Why or why not? No some of it is not clean enough to be consumed safely. Some is not available in the form we need it.
6. What is at Earth's poles? Estimate **what percentage of Earth's freshwater is stored in its frozen state**. (80% of freshwater is frozen in ice caps and glaciers).
7. Students should pour 6 mL (0.6% of the total water on Earth) of water into a smaller measuring cup and place the rest (24 mL) aside as it cannot be used because it is frozen.
    a. Water is melting due to global warming but is not readily available to use as freshwater.
8. The water in the smaller container (around 0.6% of the total) represents **non-frozen freshwater**. Where is the water found? (In lakes, rivers and underground).
9. Only about 25% (1.5 mL) of this water is **surface water**; the rest is underground. Pour 1.5 mL into another smaller cup to represent the fresh surface water and set the rest (4.5 mL) aside.

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10. Use an eyedropper or a pencil, pen or finger to remove a **single drop of water** (0.03 mL) from the dish. Release this one drop into a small metal bucket or small bowl.
11. **This drop in the bucket represents clean, freshwater that is not polluted or otherwise unavailable for use, about 0.003% of the total!** This precious drop must be managed properly.
12. Discuss the results. At this point many students will conclude that a very small amount of water is available to humans.
    a. Don't panic! The 0.0003% of available water is actually a large amount of water per person.

Wrap-Up:

- What is potable water? (water suitable to drink by humans)
- Where is most of the water on Earth located? (oceans)
- Where is the majority of freshwater located? (frozen in the icecaps)
- How much potable water is available for us to use? (0.003%)
- How can we manage and conserve water for everyone in the future?

Justice & Equity

Clean water is not available equally between countries or within a country. In the U.S., many Native American communities do not have access to potable water.

Digital Resources:

U.S. Geological Survey. Water Use in the United States – information on how different states use water and what their average water use

- https://www.usgs.gov/mission-areas/water-resources/science/water-use-united-states#overview
- https://www.usgs.gov/staff-profiles/national-water-use-science

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Copy Page – Background Reading

Earth is often called the Blue Planet because it is covered in water. However, not all of this water is available or safe to drink. All living things, including humans, need water to survive. We especially need clean water to drink. **Freshwater** is clean water that doesn't have too much salt or other things dissolved in it. **Potable** water is freshwater that is safe to drink.

Most of Earth's water is in the oceans. Ocean water is not potable (safe to drink) because it contains salt. Only a small amount of Earth's water is freshwater. Out of that freshwater, only a tiny fraction is actually easy to get to and safe to drink.

Did you know, most of the freshwater on Earth is frozen in ice caps and **glaciers**? This means that there is a small amount of water that is available for us to use. Even though it's a small amount of all the water on Earth, it's still a lot of water **per capita**—meaning for each person. If we shared all the clean, freshwater equally among the approximately 8 billion people on Earth, each person would have about 5.3 million liters (1.4 million gallons) of water. And freshwater is constantly being replenished through the water cycle so it is a **renewable resource** for us.

Water towers like this hold clean water for drinking until needed by people in the town.

Does everyone have equal access to water? No, everyone does not have equal access to clean water. Some places, like rainforests, have plenty of water, while others, like deserts, have very little. People in different locations have learned to adapt and live with the amount of water available to them.

Even within communities, water is not always shared fairly. Poorer communities often have less access to clean water or have water that is not safe to drink. In Flint, Michigan, some communities had water that was contaminated by old lead pipes, while wealthier communities did not.

So while Earth is mostly covered in water, only a small percentage of that water is actually clean and safe for us to drink. It is important that we take care of our water resources and work towards providing equal access to clean water for everyone.

Career Connections

WATER CONSERVATION SPECIALIST • WATER RECYCLING (WATER TREATMENT PLANT OPERATORS, ENGINEERS) • WATER RESOURCES PLANNING • ENVIRONMENTAL LAW