Engineering Activity 2: Close to Home: Water Where We Are From

Educator Preview

Activity Snapshot

Learners consider who uses water in their community and how, and they make water samples.

Timing | 45 minutes

Get Ready & Team Up	10 min.
Water in Our Community	10 min.
Water Samples	15 min.
Reflect	10 min.
Total	**45 min.**
Level Up Activities	5–20 min. each

Prep Snapshot*

Prep Time 15 min.

- Set up Materials Table.
- Print handouts.

**See Materials & Preparation for full info.*

21st Century Skills

Connection

- Critical Thinking

Habits of Mind

- Consider problems in context.

Guiding Question

Who uses water in our community, and how do they use it?

Learners Will Do

Identify multiple groups that use water and the kind of water each needs.

Learners Will Know

Different types of water can be used in different ways.

Connecting Across Activities

Activity 1: Sharing Experiences	Activity 2: Water Where We Are From	Activity 3: Investigating Water Quality
Last time, learners shared experiences with, and stories about, water.	**Today**, learners consider who uses water in their community and how, and they make water samples.	**Next time**, learners will measure the water quality of the samples they have made.

Activity Resources

Access videos and digital resources using the link or QR code below. More information for teaching this curriculum is available in the Educator Guide Introduction, pgs. iii–xxvi. Access more PLANETS units, research, and pathways at https://planets-stem.org/.

weblink: https://hov.to/e3c34ea8

Materials and Preparation

Materials

For the whole group

- *Our Ideas* poster (on paper or a shared digital document) in Prep & Setup Guide (PDF) Examples & Template
- 1 permanent marker
- 1 roll of masking tape
- 1 roll of paper towels
- 2 pairs of scissors
- 4 tablespoons
- 4 teaspoons
- 4 rulers
- 5 sheets of cardstock

For each learner

- 3 index cards
- Engineering Notebook (PDF)

For the Materials Table

- 1 bottle of scented liquid
- 1 bottle of soap
- 1 bottle of white vinegar
- 1 spool of thread
- 1 Tbsp of detergent
- 1 tube of toothpaste, travel size
- 1 vial of food coloring, yellow
- 2 sticks modeling clay
- 4 Tbsp of soil
- 4 tea bags, black tea
- coffee grounds
- natural materials (such as soil, sticks, grass, sand)

Teaching Tip

For the scented liquid, choose from the following options: diffuser oils, scented teas, extracts, essential oils, or other scented liquids that differ from hand soap and detergent that align with your program's budget and learners sensory sensitivities.

For each group of 4

- 1 craft stick
- 1 container, 1/2 gallon, filled with water
- Engineering Activity 2 Water Sample Recipes Handout, pgs. 35–37

Activity 2 Materials Preparation (15 min.)

Ahead of Time

1. Watch the video Engineering How to Part 1 (0:00–0:53) to learn about what happens in this activity.
2. Make one copy of Engineering Activity 2 Water in Our Community Handout, pgs. 33–34, for each group.
3. Make one copy of Engineering Activity 2 Water Sample Recipes Handout, pgs. 35–37, for each group.
4. Review the "In-Use Example" in the Prep & Setup Guide (PDF) to help you think about what to add to the *Our Ideas* poster during the discussions in this activity. Add the questions "Who uses water in our community?" and "How do they use water?" so learners can refer to them throughout the activity.
5. Download and prepare to share the Engineering Activity 2 Extreme Environments slides (PPTX). If you cannot project them, print them instead.

In Your Space

6. Place the *Our Ideas* poster in a visible place in your learning setting or prepare to share it digitally.

Teaching Tip

Lead this activity in a room with a sink for easy setup.

7. Arrange the materials (contaminants) listed above on the Materials Table for learners to access throughout the activity. Place the teaspoons, tablespoons, and scissors on the Materials Table for learners to share. Label each material with its name (for example, on an index card) to support learners identifying and talking about the materials.
8. Set up a device with a projector and internet access, then test the video Recycling Water on Space Station (1:32, optional).

Activity Guide

Get Ready & Team Up (10 min.)

1. Ask: **If you did the last activity, what did you do and why?** *(We told stories about why water is important, which helped us understand why it's important to solve problems about water.)* Draw learners' attention to their work on the *Our Ideas* poster about how water is important for humans and other living things.

2. Say: **Since water is so important, as engineers, our ultimate goal will be to design a technology to reuse water in a place where water is hard to get. The International Space Station is one place where it is important to reuse water. Let's watch a video about it.** Show the video Recycling Water on Space Station (1:32).

3. Say: **As engineers, we are going to answer the same big question as the engineers who designed the International Space Station: How can we reuse water in a place where water is hard to get?** Write the question on the *Our Ideas* poster. Ask: **What smaller questions will we need to answer in order to answer this question?** Allow learners to think of questions in pairs, then share them with the whole group. Record their questions on the *Our Ideas* poster in related categories. Possible categories of questions include:
   - **Environments**: Where is water hard to get? Who uses the water? How do people use water in different places? (answered in Activity 2)
   - **Measurement**: How can we tell if water is safe to reuse? How can we measure contamination in water? What can we measure and what can't we measure? (answered in Activity 3)
   - **Filtering**: How can we clean water? How can we remove contaminants from water? Can we turn contaminated water back into clean water? (answered in Activity 4)
   - **Reuse**: How clean does the water need to be for reuse? How can groups in the community reuse water? How many times can water be reused?

Support Learner Differences

If new learners are joining you, lead an inclusion activity (pgs, xx-xxi) and use other engagement strategies as necessary (pgs, viii–xviii).

Teaching Tips

- If you cannot show the video, tell learners that, because water is so hard to get in space, astronauts on the International Space Station recycle the water in their urine.
- Each activity in this pathway has a suggested Guiding Question. As much as possible, replace these questions with similar ones from the list of questions learners have thought of. Using learners' questions will increase their engagement. There will likely be questions you do not answer in the pathway. When you can, mention these questions and have learners think about ways to answer them in the future.

4. Point out questions about users of water and say: **Today, we'll be investigating our questions about how different groups use water and what they use it for.** Share the Guiding Question or a similar question from the *Our Ideas* poster with learners aloud and in writing (using multiple languages as needed): **Who uses water in our community, and how do they use it?**

5. Organize learners into groups of four.

Water in Our Community (10 min.)

6. Give each group a copy of *Engineering Activity 2 Water in Our Community Handout*, pgs. 33–34. Give each learner 3 index cards. Say: **You are going to be thinking about different groups in a community you belong to that use water. You have about five minutes to follow the instructions on the sheet.**

7. After about five minutes, say: **Now, you will take all your index cards that name groups and add them to the *Our Ideas* poster.** Have one learner from each group bring up those index cards and tape them to the poster around the question "Who uses water in our community?"

8. Say: **Now, you will take the rest of your index cards and add them to the poster in two categories: uses that need clean water and uses that do not.** Near the question "How do they use water?", write "Needs Clean Water" and "Does Not Need Clean Water." Have one learner from each group bring up the rest of the index cards and tape them to the poster in the appropriate categories.

Support Learner Differences

Although this activity uses the term *community*, learners can think about places they are from or have a connection to but do not currently live. Make sure to inform them of this option. If appropriate, you can use different terms, such as *homeland* or *home community*.

Support Thinking

- Following the instructions on Engineering Activity 2 Water in Our Community Handout, pgs. 33–34, learners will be identifying groups in the community that use water and what they use water for. Provide examples as needed to prompt learner thinking. For example, farmers use water to irrigate crops and water livestock, gardeners use it for plants, and wild animals and plants use it to live and as a habitat. Many people use water for laundry, sinks and showers, toilets, cooking, and drinking. (Make clear that learners should not actually drink any of the water they work with in this activity.)
- Learners may draw connections between water in their communities and social, environmental, and health issues, such as pollution, disease, and the availability of running water. Find ways to encourage conversation around these topics as appropriate.

Support Learner Differences

As needed, allow learners to choose other methods of sharing their ideas, such as audio recordings or Braille. Post index cards with filenames on them so the record can be referenced later.

Water Samples (15 min.)

9. Give each group a copy of *Engineering Activity 2 Water Sample Recipes Handout*, pgs. 35–37. Say: **One of the problems people face is that, once clean water is used for something, it is no longer clean. To learn about this problem, we're going to make water samples that are like water after it has been used. You have about ten minutes to follow the instructions on the sheet.**

10. Give each group one container of water, and draw learners' attention to the substances on the Materials Table. Give groups 10 minutes to create their water samples.

11. After learners make their water samples, have groups pair up and share their samples. Ask: **What do you notice about your water samples? What is similar? What is different? What substances do you think these materials represent? Are you surprised by any of them?** As learners share, capture the vocabulary they use, such as *dirt*, *murky*, *soap*, *yellow*, *contaminated*, and add these words to the *Our Ideas* poster.

Teaching Tip

Encourage different small groups to choose different samples so that the group as a whole has a variety of samples to compare.

Support Learner Differences

Give learners time to examine the materials on the Materials Table before they begin making their samples.

12. Say: **Things that make water dirty are called *contaminants*. The substances you added, like toothpaste, dirt, and soap, are all examples of contaminants. Water with contaminants in it is called *contaminated*.** Add the words *contaminants* and *contaminated* to the *Our Ideas* poster. Let learners discuss in groups words that they know related to these words. If appropriate, they can make up sounds or movements to help remember the words.

13. Ask: **Why can contaminants in water be a problem?** Have learners discuss in their groups. *(Contaminants can make water unsafe to drink; they can make people and animals sick; they can make it so the water can't clean things.)* As needed, share examples of problems caused by contaminated water. Discuss how different types of contamination can cause different problems. For example, fertilizer in water may make it unsafe to drink, but it can make plants grow better. Salty water might make some animals and plants sick, but other organisms can only survive in salt water.

Reflect (10 min.)

14. Revisit the Guiding Question on the *Our Ideas* poster: **Who uses water in our community, and how do they use it?** Say: **Now that we've thought about different groups and the ways they use water, we can understand the problem: water is important, but it gets contaminated when it is used. Your challenge is to learn more about how to reuse contaminated water, then engineer a water reuse system for a particular community.** Remind learners of the words *contaminant* and *contaminated*.

15. Display the *Engineering Activity 2 Extreme Environments* slides and move through them as you read the following list. **There will be four communities you can choose to help:**
    - An off-the-grid farmhouse in the Southwest United States
    - Astronauts on a future exploration of Mars
    - Scientists on a research ship at sea
    - Astronauts on the International Space Station
16. Say: **Next time, we will think about how to make water samples less contaminated.**
17. Using the permanent marker and masking tape, have learners label the water samples they made (Farm Field, Bathroom Sink, Laundry, Shower, or Toilet) and save them for use in the next activity.

Support Thinking

Show the video Water Reuse in Extreme Environments: Human Technology to emphasize how people can design ways to reuse water in places where water is scarce.

Level Up!

- Refer to the *Engineering Design Process* poster. Ask: **What phases of the Engineering Design Process did you use today?** *(We framed the question of groups that use water and investigated how they use it and how it becomes contaminated.)* (5 min.)
- Ask this story prompt question: **Can you tell a story about contaminated water, either that you've experienced directly or learned about?** *(Possible responses include finding contaminated water, witnessing the effects of contaminated water, and helping to clean contaminated water.)* Have learners share with a partner (note that the sharing can take forms other than speaking aloud). Consider returning to learners' ideas at the start of the next activity. (20 min.)
- Tell learners, if anyone asks them what they did today, they can tell them "We explored who in our community uses water and how." (5 min.)

Support Learner Differences

It is possible that stories about contaminated water may bring up trauma related to the lack of access to clean safe water (e.g., the water crisis in Flint, Michigan; lack of running water in certain Indigenous communities). If you notice this, ask the learner privately what they might need at that moment. If they do not know, you can offer some ideas from the Arizona Adverse Childhood Experiences Consortium Resource Library

After the Activity

1. Clean up:
   - Keep the *Our Ideas* poster for use in Activity 3.
   - Save the water samples for use in Activity 3. Decide if you need to make more.
2. Plan for Engineering Activity 3. See the Activity 3 Preparation on pg. 42.
3. Take time to reflect on the following educator prompt. **How did focusing on communities support learner engagement?**

Water in Extreme Environments Additional Resources

Resources include All Downloads, All Videos, Family Connections, and more.

weblink: https://hov.to/7cb5c428

Water in Our Community

Groups That Use Water

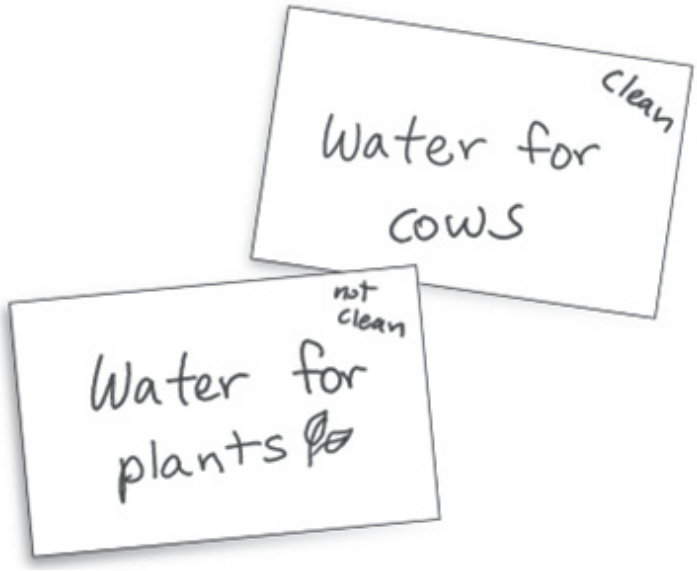
1. Think about groups in a community you belong to that use water. Write the name of one of these groups on an index card.

Ways of Using Water

2. Think about the group you chose. Write two ways that group uses water on your other two index cards.

Does It Need to Be Clean?

3. Think about the ways of using water you chose. Is it ok for the water to be contaminated? What types of contamination (if any) are ok? Indicate this in the corner of each index card.



Water Sample Recipes

As a group, choose one of the water samples listed below and make it.

Farm Field Water Sample

- 1/2 container of water
- 1/2 tsp scented liquid
- 1 Tbsp loose soil
- 2 Tbsp vinegar

Add scented liquid to water and mix. Then mix the other ingredients and add them to the water.

Bathroom Sink Water Sample

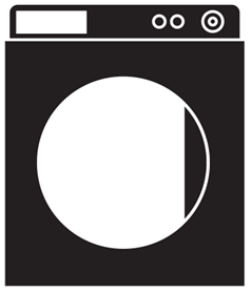
- 1/2 gallon container of water
- 1/2 tsp scented liquid
- 1 tsp soap
- 2 pea-sized blobs of toothpaste

Add scented liquid to water and mix. Then mix the other ingredients and add them to the water.

Laundry Water Sample

- 1/2 gallon container of water
- 1/2 tsp scented liquid
- 1 tsp tea leaves
- 1 Tbsp detergent
- 2 tsp soil

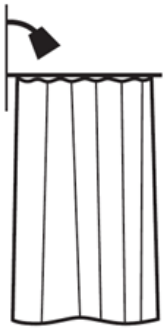
Add scented liquid to water and mix. Then mix the other ingredients and add them to the water.



Shower Water Sample

- 1/2 gallon container of water
- 1/2 tsp scented liquid
- 1 tsp soap
- 1 tsp soil
- 2 Tbsp vinegar
- 30 pieces of thread, approx. 3–5" long

Add scented liquid to water and mix. Then mix the other ingredients and add them to the water.



Toilet Water Sample

- 1/2 gallon container of water
- 1/2 tsp scented liquid
- 1 tsp soap
- 1 tsp tea leaves
- 1 Tbsp soil
- 2 drops yellow food coloring

Add scented liquid to water and mix. Then mix the other ingredients and add them to the water.