4-H Water Wizards

Guided Inquiry Water Education for grades 4-6

Developed by
Marianne Bird and Trisha Dixon

Virtual Adaptation by
Marianne Bird, Nicole Marshall-Wheeler, and Steven Worker

UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources
4-H Youth Development Program

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In response to the coronavirus pandemic in 2020, a team of afterschool program staff, science teachers, 4-H staff and academics worked to adapt the curriculum for virtual and small-group delivery. Members of the 4-H Water Wizards Virtual Task Force included:

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Table of Contents

Welcome to 4-H Water Wizards

Guided Inquiry Water Education for Grades 4-6

4-H Water Wizards offers hands-on, minds-on activities designed not only to educate elementary school students about water and its importance, but to engage young learners as scientists themselves. The project balances the student's need for critical information about water with discovery through the process of doing science.

Project Overview

The University of California Cooperative Extension developed 4-H Water Wizards for implementation in afterschool programs where it was extensively piloted and refined. Classroom teachers have also implemented the curriculum, and the service-learning component makes it an especially adaptable as a project in 4-H Clubs. Whether delivered in formal (schools) or informal (afterschool or 4-H) learning settings, 4-H Water Wizards has proven easy to deliver and engaging for students.

4-H Water Wizards consists of 11 different sessions, some done over two days, but most of which can be completed in an hour. Activities fall into three areas:

> *Water and the Environment*: The first four sessions explore how water moves through the environment including activities about the water cycle, watersheds, water pollution, and water conservation.
>
> *Water Properties*: The middle four sessions encourage experimentation as youth explore water taste, salinity, density, and hardness.
>
> *Service-Learning Project*: The last three sessions guide youth in understanding the importance of making a difference in their community and creating and implementing a plan to address a water issue of their choosing.

4-H Water Wizards addresses two related issues: the need for high-quality science education programming both in and after school, and the desire to foster a citizenry that understands and can make informed decisions about water. Water is a valuable and limited natural resource that is critical to communities, agriculture, and the environment. It is often the center of policy debate as communities contend with floods, drought, pollution, loss of ecosystems and how to allot this sometimes-scarce commodity. Yet water issues are also personal ones as individuals ponder conservation and how to keep waterways clean. Education is the first step in helping children appreciate and understand water and its role in their community.

Project Delivery

Originally designed for in-person delivery to class-size groups of children, the project has been revised for virtual or in-person delivery to small groups. Science education happens best in-person. However, with the proper planning and technology, on-line science experiences can still be rich experiences.

Curriculum Layout

Each session contains:

- **Time Needed**: How much time is needed for the activity(ies).
- **Next Generation Science Standards (NGSS)**: The K-12 science content standards the session addresses. A full summary of the NGSS covered in this curriculum are listed in an appendix.
- **Vocabulary and Concepts**: Definitions of words and concepts presented in the session. Definitions are also found in the Water Glossary at the end of the unit.
- **Materials**: A list of all materials needed for the session, both for students and for educators.
- **Overview**: A brief description of the session's content and its relevance.
- **Purpose**: The learning outcomes for participants.
- **Background Information**: Provides basic information about the session topic to help the educator feel prepared to lead the activity. It is not meant to be lecture material presented to youth, but rather foundational information for the facilitator.
- **Introduction**: A brief description of each activity.
- **Session Outline**: Roadmap outlining session components and approximate times.
- **Getting Ready**: The preparation required prior to leading the session.
- **Experiencing**: One or more interactive segments where participants explore the session topic.
- **Sharing, Processing and Generalizing**: Questions that help the learner process the experience, facilitate reflection, and encourage concept application.
- **Application Suggestions**: Ideas for out-of-classroom activities that allow students to apply what they've learned in the session.
- **Educator Tips**: Helpful hints to facilitate session preparation, delivery, and safety.
- **Handouts**: Printed material to be duplicated for each student. These materials may be printed as a whole and combined into a "Student Lab Book" for each participant or printed and handed out for each session.
- **Educator Aids**: Charts or other materials the facilitator will use in processing data and discussion ideas for the whole group.

Each session has two options for delivery.

> ***Virtual Delivery*** allows students to participate in the session remotely and requires access to online platforms like Zoom. Students will need a set of their own materials at home. In almost all instances, the educator facilitates group participation just as they would in-person, with occasional demonstrations where necessary.
>
> ***In-Person Delivery*** is designed for small cohorts of children and considers social distancing and other health precautions. Students work independently with their own set of supplies, which the educator will have and distribute. This curriculum can be used in traditional education settings as allowed.

While teamwork—an important component of science education—is missing in both delivery options when doing experiments and building models, students participate in group discussions as they question, explore ideas, and problem solve together.

Materials

Most of the materials needed for the sessions are available at grocery or dollar stores, but some sessions require more specialized materials. Hydrometers can be purchased at many aquarium stores or found on-line.

The video *The Water Cycle* is available through the California Department of Water Resources, which also provides a variety of free and low-cost water education materials to educators. Session three uses an Enviroscape® model to show how pollutants enter the water system. Information for purchasing an Enviroscape® is found at www.enviroscapes.com. These models may be available to borrow from local water districts or other groups who conduct water education in the community. Know it will take time to purchase and assemble materials, especially if items are packaged for distribution to students learning from home.

> To simplify information, trade names of products have been used. No endorsement of products or services are granted or implied by the University of California, 4-H, the US government, or any of its organizational units or employees.

Recommendations for Virtual Delivery

4-H Water Wizards in the virtual format is designed to allow interaction between instructor and student and youth themselves. Things to consider when working in a virtual environment include:

- **Familiarize yourself with technology:** The 4-H Water Wizards curriculum does not specify any online learning software. In 2020, popular connectivity platforms included Zoom, Google Hangouts, and Skype for Business, yet platforms come and go. When selecting a virtual learning platform, make sure it includes (a) digital whiteboard or the ability to share screen so you can share posters and record notes; (b) break-out rooms; and (c) ability to share video. Young people often have vast experience in digital tools, media, and websites. Tap into their expertise and invite them to offer options and, together as a group, select digital tools to enhance the learning experience.
- **Prepare:** Before engaging with students, make sure you are fully prepared to facilitate the educational experience. Understand the session, its objectives and concepts. Make sure your video equipment captures what you want or need the students to see. Check web-based links and pull up Google documents, if the session requires them. If possible, have a second adult help manage the logistics of the session.
- **Focus on relationships**. Youth-adult relationships are an essential part of learning. Youth need positive, sustained, and trusting relationships with caring, competent, and committed adults, in a traditional in-person program or in an online program. Educators should be present in three ways: (a) socially by creating connections with youth and becoming aware of their interests and abilities; (b) practically, though facilitating the learning experience; and (c) cognitively to support each young person as they develop knowledge and skills.
- **Recognize missteps happen**: Inevitably, things will not go as planned. Perhaps students don't have supplies or learners (and perhaps yourself) experience connectivity issues. It's okay! Be flexible and recognize we're all learning in this virtual space. Stay positive and adapt as you go.

Consider a Field Trip

A trip to a water-related place can solidify what students learn in 4-H Water Wizards. Water education centers, water agencies, treatment plants, dams, wetlands, creeks, and habitats dependent upon water are scattered throughout our communities. Plan a field trip or invite a speaker if you can't' get away.

Doing—Not Talking—Science

The learn-by-doing philosophy 4-H embraces encourages children to build their own knowledge through activities, discussion, and reflection. Allowing learners to discover through exploration is not easy for many adults: the temptation is to tell information. Yet developing deductive reasoning skills requires asking questions, hypothesizing, experimenting, analyzing, concluding. For those facilitating the process, it requires trust that learners will discover on their own.

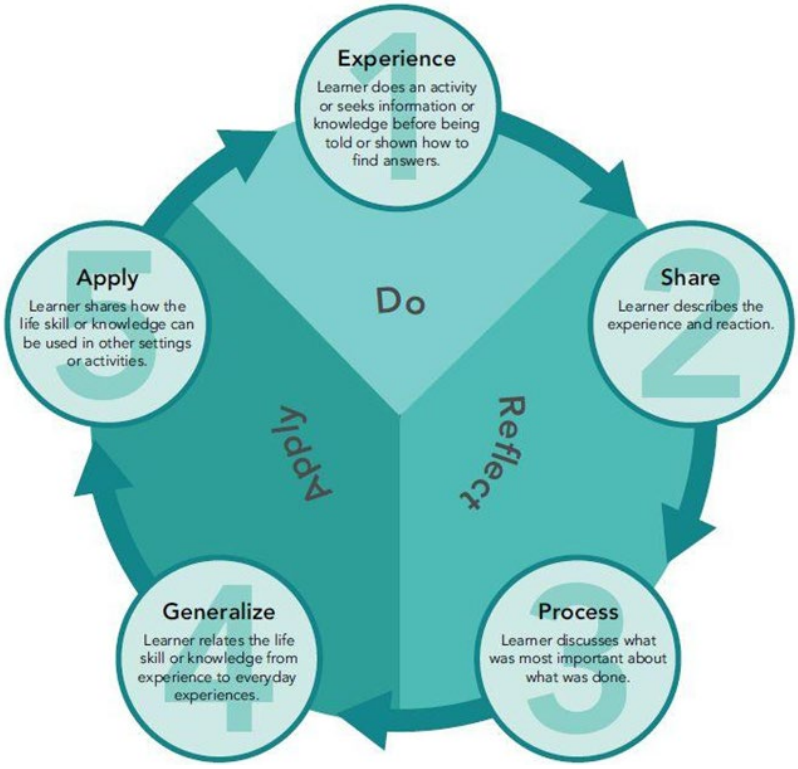
4-H Water Wizards builds in opportunities for children to be scientists: constructing models, experimenting, collecting and comparing data, and sharing findings through graphs and pictures and words. Each session outlines the Next Generation Science Standards—the practices, core ideas and crosscutting concepts central to building science knowledge and skills—that youth will experience through the activity.

Experiential Learning Cycle

Experiential learning is a cyclical process where learners have opportunities to construct meaning through experiences. The Experiential Learning Model (Kolb, 1984) includes a concrete hands-on experience; a reflection phase where students share and process the experience, and the opportunity for youth to generalize and apply new skills and knowledge.

The Experiential Learning Cycle guide 4-H Water Wizards and are imbedded in the curriculum.

- **Experiencing**: This includes introductory questions and prompts to get students thinking about the topic they're about to explore, then the procedures and instructions for a hands-on activity.
- **Sharing, Processing, Generalizing**: Students question, share, and compare their observations. Often, some of the sharing and processing takes place during the "experiencing" phase, however it is important for the group to reflect after the activity. During this phase, ensure students have discovered or been introduced to the session's primary learning objectives and concepts.
- **Application**: The true test of learners' understanding is when they can apply new knowledge and skills to authentic situations. Hands-on activities serve as vehicles for learning new concepts and skills to apply to real-world situations. It is important to provide students specific opportunities where they will use what they learned.



Summary

Water is an excellent topic to spark curiosity, encourage investigation, and apply learning. Water surrounds us and is a substance on which everyone relies. Its presence in our lives naturally draws us to wonder and think deeper as we begin to explore its properties. It is a topic that appears regularly in the news, allowing students to connect what they're learning to a broader context. It's exciting to watch learners—not only young people who participate in the project, but also the adults trained to deliver it—develop their own questions or experience the "Ah-ha!" moment, when they tie an activity to their own life experience.

Most importantly, allow students to ask and explore their own questions. Trite as it may sound, science really is a journey, not a destination. Have fun, and enjoy the journey!

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Upper Saddle River, NJ: Prentice Hall.

Session 1: The Water Cycle – Nature's Recycling System

What is the water cycle?

Overview

Activities in this session will help students understand that there is no new water and how water cycles in our world. Water is in perpetual motion: With heat, water evaporates and becomes a gas. As it rises and cools the gas becomes a solid and falls back to the earth as rain or snow. Finally, water accumulates in lakes, rivers, and oceans where the cycle begins again. Students come to appreciate that water is limited and the importance of conservation.

In Activity 1, students will explore what they know about water, watch a short video on the water cycle, and create a picture or poster of how water travels through the water cycle. Through an experiment in Activity 2, the group investigates evaporation and what enhances it. They will observe evaporation's role in making rain in the water cycle.

Next Generation Science Standards

Describe ways the geosphere, biosphere, hydrosphere, and atmosphere interact.

Practices: Analyzing and interpreting data; Obtaining, evaluating, and communicating information

Disciplinary Core Idea: Earth systems interact in multiple ways to affect Earth's surface

Crosscutting Concept: Energy and matter: Flows, cycles, and conservation

Purpose

Students will:

- Understand how nature recycles water
- Learn terms that relate to the water cycle
- Explore one of the water cycle terms: evaporation

Time Needed

Activity 1: 55-60 minutes

Activity 2: 55-60 minutes (done over two days)
***Day 1*:** 35 minutes
***Day 2*:** 20 minutes

Materials

For Educators

1. Link to video or DVD: The Water Cycle from the California Department of Water Resources
2. Water Knowledge Chart (for virtual delivery)
3. Flip chart and markers (for in-person delivery)
4. Sponge (for in-person delivery)
5. Access to water (for in-person delivery)

For Students

1. Blank paper
2. Crayons or colorful felt-tip markers
3. Sponge
4. Three plastic cups
5. Ruler
6. Permanent marker
7. Plastic wrap
8. Rubber band
9. Measuring cups
10. Access to water

Background Information (for educator only)

The definition of recycling is “To put or pass through a cycle again; to use again, especially to reprocess” (www.thefreedictionary.com/recycle). Nothing fits that definition better than the water cycle. The water (hydrologic) cycle is a perpetual motion – a natural process of water molecules recycling from the land, the air, and back to the land.

The sun’s energy warms water, which is transferred as vapor from oceans, lakes, and land into the atmosphere. This is the evaporation stage of the cycle.

Once in the atmosphere, the vapor forms clouds, the condensation stage of the cycle. Water molecules attach themselves to dust in the air. Eventually the water vapor in the air becomes heavy and falls to the earth as rain or snow. This is called precipitation. Whether the water ends up as a raindrop, snow crystal, or hail, is dependent upon the season, location, and climate. Not all the water will reach the earth. Some will evaporate on the way down and then return to the atmosphere to start the process over again.

On the ground, water gathers as snow and ice, in surface water, and in the soil. This is called the accumulation phase of the cycle. Most of the water infiltrates into the soil. Excess water travels across the land’s surface into various bodies of water like creeks, rivers, and lakes. Then the process returning the water back into the atmosphere begins again.

Water can be a gas, a liquid, or a solid. As water travel through the water cycle it changes states. When water molecules are heated, they become a gas and rise into the atmosphere. The air around us contains water, even if we can’t see it. When water freezes it becomes a solid like snow and ice.

Though relatively small in the scheme of the water cycle, living things also play a part. When people and animals breathe, they release water vapor. This is called respiration. We also drink and release water. Plants, too, take in water through their roots, and release water as vapor through their leaves in the process of photosynthesis. This is called transpiration.

Another term associated with the water cycle is infiltration. Infiltration is the process by which water seeps into the earth where it accumulates as groundwater. Groundwater is stored in natural aquifers or continues to move through the earth to the ocean.

This is how nature recycles water. Water changes form and is used, stored, and reused. There is no new water.

Vocabulary and Concepts

Accumulate: To pile up, gather, collect.

Atmosphere: The layer of air surrounding the earth.

Aquifer: A layer of permeable rock, sand, or gravel through which groundwater flows, containing enough water to supply wells and springs.

Condensation: The conversion of a vapor or gas to a liquid.

Evaporation: To remove moisture; to change a liquid or a solid into vapor.

Hydrology: The study of water, its properties, laws, and distribution.

Infiltrate: To pass through a substance by filtration, or to make a liquid or gas pass through a substance by filtration.

Molecules: The smallest parts of an element or compound that can still exist and keep the characteristics of that element or compound.

Precipitation: Rain, hail, sleet, and snow.

Respiration: The process by which a living organism or cell takes in oxygen from the air or water, utilizes it and gives off products of oxidation such as water vapor and carbon dioxide.

Transpiration: The passage of water through a plant from the roots, through the vascular system in the leaves, to the atmosphere.

Vapor: A gas, such as mist, fog, steam, and or clouds.

Virtual Delivery

Activity 1: Exploring the Water Cycle

Introduction

Students begin their exploration about water by brainstorming what they know and what they'd like to know about water. They view a video and become familiar with parts of the water cycle. They then work to create a water cycle poster.

Session Outline

Activity 1	Time
Welcome and opening questions	5 minutes
Experiencing	
• Brainstorming session: Water Knowledge Chart	10 minutes
• Watch video: The Water Cycle	15 minutes
Sharing, Processing, Generalizing	
• Create a water cycle poster	25 minutes
Assign and explain at home evaporation experiment with sponge	5 minutes

Getting Ready

1. A few days in advance, package materials for students to pick-up. Or share the materials list and ask students to gather the materials at home. Make sure to include the necessary pages from the Student Lab Book.
2. Pull up the Water Knowledge Chart located at the end of this session.
3. Load the video: The Water Cycle, from either DVD or online.
4. Be prepared to share your screen with the students.

Experiencing

1. Gather students together. Tell them that for the next several weeks they will be exploring something that they use every day, probably without thinking much about it. In fact, all living things use it. Do they have an idea of what this is?
2. **Brainstorming What We Know:** Ask the students to brainstorm what they already know about water. Sharing your screen, record their responses on the Water Knowledge Chart under the "What we know about water" title.
3. **Brainstorming What We Want to Know:** After students have shared their knowledge about water, ask them what they don't know about water that they'd like to know. What questions do they have about water? Record these on the other side of the Water Knowledge Chart under the "What we want to know about water" heading.

Educator Tip: *Students may need some questions to prompt their thoughts about water. You may want to have some ready like, "Where does water come from?" or "How do we use water?" When students share an answer or an idea, repeat what they say to assure all students hear what is said.*

4. Tell the students that today they're going to begin their exploration of water by learning about the water cycle. Tell them that they'll watch a video about the water cycle and afterwards will work to create a water cycle poster.
5. **Video:** Play the DVD or linked video online, The Water Cycle, from the California Department of Water Resources.
6. When the video is over, ask the students to share something new about water that they didn't know before. Why should we care about water?

Sharing, Processing, Generalizing

1. **Creating the Water Cycle Poster:** Have each student get out a piece of paper and crayons or markers. Allow 15-20 minutes for the students to create their posters.
2. At the end of the poster-making session, ask each student to share their water cycle posters. What did they choose to include? Ask students how the posters are similar. How are they different? Use this as an opportunity to check for understanding.

Assign Sponge Experiment

1. Tell students that in the next activity they are going to take a closer look at a part of the cycle called *evaporation*. Ask the students what they know about evaporation.
2. **Explain Evaporation Assignment**. Tell students that before the next Activity, students will have a short assignment. Have students wet their sponge, then go outside to a sunny stretch of sidewalk or street. Have students swipe the wet sponge across the sidewalk and watch as the wet spot disappears.
3. **Debrief:** Students will debrief this experiment at the beginning of the next Activity.

Educator Tip: *The sponge evaporation experiment works best in a sunny location.*

Application Suggestions

Have students consider where they see different aspects of the water cycle in their own lives. Condensation can be found in half-full water bottles left in a hot car. Accumulation can be seen in puddles in the street after it rains. Evaporation can be found in steam coming off a hot pot of water. Precipitation can be seen when it rains.

Students can experience "respiration," the process by which living organisms take in oxygen from the air and give off water vapor. Have students exhale in- to a clear, plastic cup and see and feel the moisture left on the inside of the cup.

Educator Tip: *Save the "Water Knowledge Chart" for future reference.*

Activity 2: Investigating Evaporation

Introduction

Students work to conduct an experiment exploring water evaporation. By placing cups filled with an identical amount of water in different locations, they can see how sun and heat affect evaporation. They will also see, via a covered cup, how water condenses and forms rain.

Session Outline

Activity 2	Time
Experiencing (on own before live session)	
• Evaporation experiment with sponge – on own	5 minutes
Introduction of topic: Evaporation	
• Debrief sponge evaporation experiment	10 minutes
Experiencing	
• Discuss evaporation experiment with cups	10 minutes
• Set cups up for experiment	10 minutes
Sharing, Processing, Generalizing (Day 2)	
• Revisit cup evaporation experiment	5 minutes
• Facilitate discussion about cup observations	15 minutes

Getting Ready

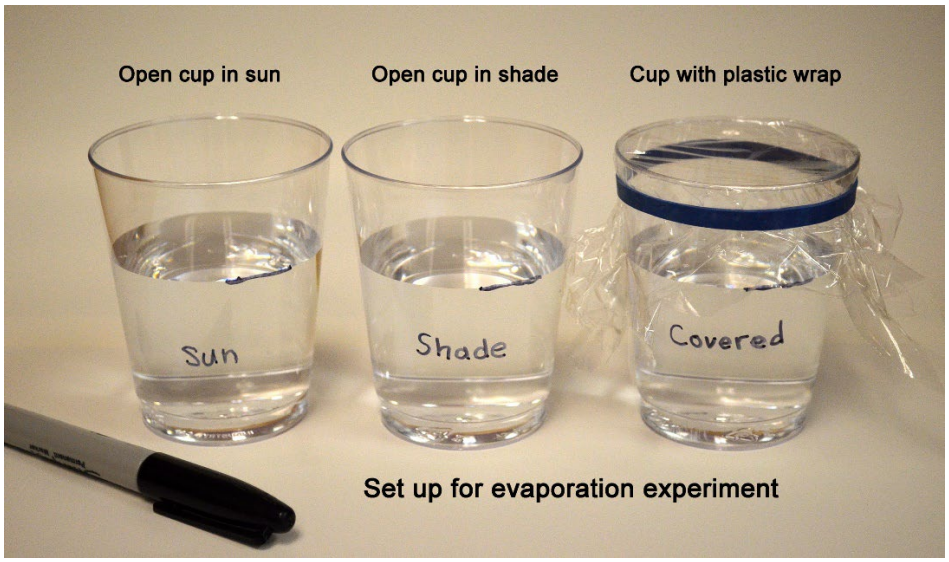
1. Gather all supplies.

Experiencing

Day One

1. Ask students what they remember about the water cycle from the first activity and from their wet sponge experiment.
2. **Debrief Sponge Evaporation Demonstration:** Ask students the following questions:
    a. What happened when you swiped the wet sponge across the ground?
    b. Why?
    c. How do you know?
3. Ask the students to share their own examples of water evaporating. Where have they seen evidence that evaporation happens?
4. **Evaporation Experiment with Cups:** Tell the group that they are going to conduct another experiment to explore evaporation.
5. Gather the group to prepare them for the cup evaporation experiment.
6. Have each student gather three cups and a ruler, a permanent marker, a rubber band, and some plastic wrap (enough to cover one of the cups).

7. Have them label one cup sun, one cup shade, and the last cup covered. See example picture below.



8. Ask the students to partly fill their plastic cups with water so that they have the same amount of water in each cup.

Educator Tip: *Students may choose any amount of water to partially fill their cups, but the amount must be consistent for each cup. Encourage students to use the measuring cup as a tool.*

9. Mark the water levels with the permanent marker.
10. With the ruler, have students measure the water level in each cup and record on the Evaporation Experiment page in their 4-H Water Wizards Student Lab Book.
11. Ask students to seal their cup labeled “covered” with plastic wrap. Secure with a rubber band.
12. Place the sealed cup and the cup labeled sun in a sunny place. Place the cup labeled shade someplace out of the sun.

Educator Tip: *Find a place to set the cups where they will not be disturbed and where they’ll have good sunlight. Remember, the sun moves throughout the day!*

Suggest students put their cups in the following places: Shade cups may want to go on top of the refrigerator, in a corner of the kitchen counter, or a completely shaded place outside. Sun and covered cups may go in sunny windowsills or on covered porches which get lots of sun.

13. Have students discuss and predict what will happen to the different cups of water. Ask students to write their predictions on the Evaporation Experiment page in their 4-H Water Wizards handbook. Make sure they also write an explanation as to why they made their prediction. Be sure to leave enough time for your students to do this as it is an important step in the process.
14. Leave the cups out at least a day (overnight). A few days is even better.

Sharing, Processing, Generalizing

Day Two

1. If possible, have students set up their workstation near their sun and covered cups.
2. Revisit the first day's work by asking students to explain what they did with their cups. What are they investigating?
3. Have students carefully bring all three of their cups to their workstation.

Educator Tip: *The reason for moving the shade cup to the sun cups is so as not to disturb condensation which may be in the covered cup.*

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4. Ask the students to make observations of the three cups. Using rulers, have them measure the water levels, recording their answers on their Evaporation Experiment page in their 4-H Water Wizards lab books. If the water level has changed on the cup, ask them to draw a line on the cups to mark the current water level.
5. Have the students compare what happened to their cups with what happened to other students' cups. Explore the following questions with the group:

    a. What do you notice?

    b. How do your observations compare with your predictions written in your lab book?

    c. Describe the differences in how fast the water in the sun cup, shade cup, and covered cup disappeared.

    d. Where do you think the water went?

6. Ask students if the water level changed in the cups with plastic wrap on their tops. What is happening in the cup? How does this laboratory situation compare with rain?
7. Ask the students to write in their lab books about whether their experiment was successful, being sure to state why they felt it was or wasn't.

Educator Tip: *Each student should keep all predictions and responses in their lab book.*

Application Suggestions

Have students consider where they see evidence of evaporation and condensation in their everyday lives. Observe how puddles form on the street or playground and then how they get smaller or disappear after sunny days. What happens to half-filled water bottles when left in the sun?

In-Person Delivery

Activity 1: Exploring the Water Cycle

Introduction

Students begin their exploration about water by brainstorming what they know and what they'd like to know about water. They view a video and become familiar with parts of the water cycle. They then work to create a water cycle poster.

Session Outline

Activity 1	Time
Welcome and opening questions	5 minutes
Experiencing	
• Brainstorming session	10 minutes
• Watch video: The Water Cycle	15 minutes
Sharing, Processing, Generalizing	
• Create a water cycle poster	25 minutes

Getting Ready

1. Prepare and post a flip chart or large paper with two columns labeled "What we know about water" and "What we want to know about water."
2. Load the video: The Water Cycle, from either DVD or online, prepare to play on TV or LCD projector and make sure it works.
3. Gather art supplies for poster making.

Experiencing

1. Gather students together. Tell them that for the next several weeks they will be exploring something that they use every day, probably without thinking much about it. In fact, all living things use it. Do they have an idea of what this is?
2. **Brainstorming What We Know:** Ask the students to brainstorm what they already know about water. Record their responses on the flip chart paper under the "What we know about water" title.
3. **Brainstorming What We Want to Know:** After students have shared their knowledge about water, ask them what they don't know about water that they'd like to know. What questions do they have about water? Record these on the other side of the flip chart paper under the "What we want to know about water" heading.

Educator Tip: *Students may need some questions to prompt their thoughts about water. You may want to have some ready like, "Where does water come from?" or "How do we use water?" When students share an answer or an idea, repeat what they say to assure all students hear what is said.*

4. Tell the students that today they're going to begin their exploration of water by learning about the water cycle. Tell them that they'll watch a video about the water cycle and afterwards will work to create a water cycle poster.
5. **Video:** Play the DVD or linked video online, The Water Cycle, from the California Department of Water Resources.
6. When the video is over, ask the students to share something new about water that they didn't know before. Why should we care about water?

Sharing, Processing, Generalizing

1. **Creating the Water Cycle Poster:** Give each student a poster-sized piece of paper. Tell them that they are to discuss amongst themselves what they'd like to include on their water cycle poster. Provide art supplies and allow 20-25 minutes for the students to create their posters.
2. At the end of the poster-making session, ask students to share their water cycle posters. What did they choose to include? Ask students how the posters are similar. How are they different? Use this as an opportunity to check for understanding.

Application Suggestions

Have students consider where they see different aspects of the water cycle in their own lives. Condensation can be found on half-full water bottles left in a hot car. Accumulation can be seen in puddles in the street after it rains. Evaporation can be found in steam coming off a hot pot of water. Precipitation can be seen when it rains.

Students can experience "respiration," the process by which living organisms take in oxygen from the air and give off water vapor. Have students exhale into a clear, plastic cup and see and feel the moisture left on the inside of the cup.

Educator Tip: *Save the "What we know /want to know about water" sheet for future reference.*

Activity 2: Investigating Evaporation

Introduction

Students work to conduct an experiment exploring water evaporation. By placing cups filled with an identical amount of water in different locations, they can see how sun and heat affect evaporation. They will also see, via a covered cup, how water condenses and forms rain.

Session Outline

Activity 2	Time
Introduction of topic: Evaporation	5 minutes
Experiencing	
• Evaporation demonstration with wet sponge	10 minutes
• Discuss evaporation experiment with cups	10 minutes
• Set cups up for experiment	10 minutes
Sharing, Processing, Generalizing (Day 2)	
• Revisit evaporation experiment	5 minutes
• Facilitate discussion about cup observations	15 minutes

Getting Ready

1. Gather all supplies.
2. Wet the sponge to use in the evaporation demonstration.

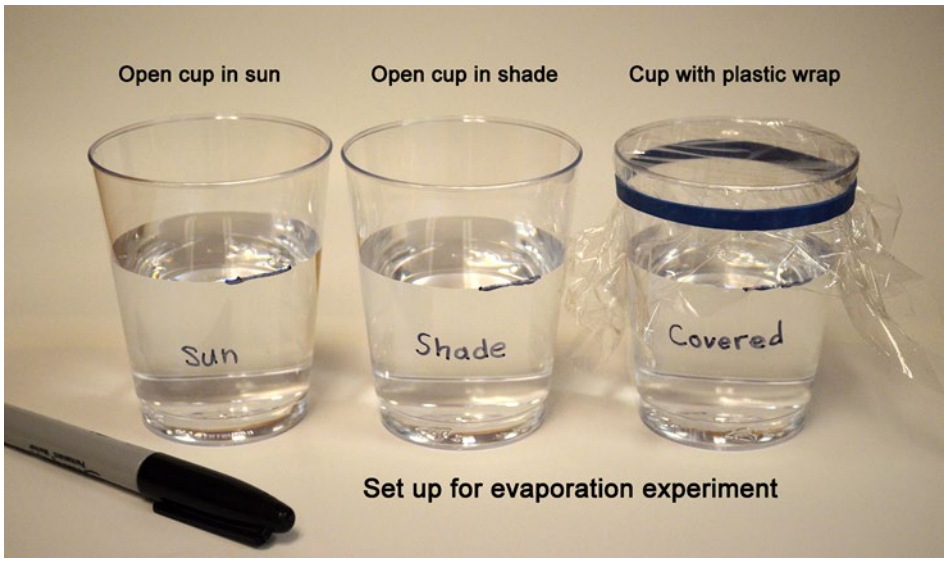
Educator Tip: *This activity works best on a sunny day.*

Experiencing

Day One

1. Ask students what they remember about the water cycle from the last activity.
2. **Evaporation Demonstration:** Tell students that they are going to take a closer look at a part of the cycle called evaporation. Ask the students what they know about evaporation.
3. Take the group outside to a sunny spot on the sidewalk or blacktop. Ask your students to observe while you swipe the wet sponge across the pavement. Wait until the swipe mark disappears. Ask students the following questions:
    a. What happened?
    b. Why?
    c. How do you know?
4. Ask the students to share their own examples of water evaporating. Where have they seen evidence that evaporation happens?
5. Tell the group that they are going to conduct an experiment to explore evaporation.

6. Take the group back inside to prepare their experiment.
7. **Evaporation Experiment:** Give each student three cups and a ruler, a permanent marker, a rubber band, and some plastic wrap (enough to cover one of the cups).
8. Ask the students to write their names on each cup. Have them label one cup sun, one cup shade, and the last cup covered. See example photo below.



9. Using the measuring cup, ask the students to partly fill their plastic cups with water so that they have the same amount of water in each cup.

Educator Tip: *Students may choose any amount of water to partially fill their cups, but the amount must be consistent for each cup. Encourage students to use the measuring cup as a tool.*

10. Mark the water levels with the permanent marker.
11. With the ruler, have students measure the water level in each cup and record on the Evaporation Experiment page in their 4-H Water Wizards Student Lab Book.
12. Ask students to seal their cup labeled “covered” with plastic wrap. Secure with a rubber band.
13. Place the sealed cup and the cup labeled sun in a sunny place. Place the cup labeled shade someplace out of the sun.

Educator Tip: *Find a place to set the cups where they will not be disturbed and where they’ll have good sunlight. Remember, the sun moves throughout the day!*

14. Have students discuss and predict what will happen to the different cups of water. Ask students write their predictions on their Evaporation Experiment lab book page. Make sure they also write an explanation as to why they made their prediction. Be sure to leave enough time for your students to do this as it is an important step in the process.
15. Leave the cups out at least a day (overnight). A few days is even better.

Sharing, Processing, Generalizing

Day Two

1. **Revisit Evaporation Experiment:** Revisit yesterday's work by asking students to explain what they did. What are they investigating?

2. Have the students revisit the site where their cups labeled shade were left. Ask them to bring their cups to where their sun and covered are.

Educator Tip: *The reason for moving the shade cup to the sun cups is so as not to disturb condensation which may be in the covered cup.*

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3. Ask the students to make observations of the three cups. Using rulers, have them measure the water levels, recording their answers on their Evaporation Experiment page in their lab books. If the water level has changed on the cup, ask them to draw a line to mark the current water level.

4. Have the students compare what happened to their cups with what happened to others' sets of cups.

5. Explore the following questions with the group:

   a. What do you notice?

   b. How do your observations compare with your predictions written in your lab book?

   c. Describe the differences in how fast the water in the sun cup, shade cup, and covered cup disappeared.

   d. Where do you think the water went?

6. Ask students if the water level changed in the cups with plastic wrap on their tops. What is happening in the cup? How does this laboratory situation compare with rain?

7. Ask the students to write in their lab books about whether their experiment was successful, being sure to state why they felt it was or wasn't.

Educator Tip: *Each student should keep all predictions and responses in their lab book.*

Application Suggestions

Have students consider where they see evaporation and condensation in their everyday lives. Observe how puddles form on the street or playground and then how they get smaller or disappear after sunny days. What happens to half-filled water bottles when left in the sun?

Session 1: Educator Aid

Water Knowledge Chart

What We Know About Water	What We Want to Know About Water

Session 1: Student Lab Book Page

Water Evaporation Experiment Data Sheet

Procedure:

1. Label the cups Sun, Shade, and Covered.
2. Using a measuring cup, partly fill the plastic cups with water so that there is the same amount of water in each cup.
3. Mark the water level on each cup with a permanent marker.
4. Cover the cup labeled Covered with plastic wrap and secure with a rubber band.
5. Place the cup labeled Sun and the cup labeled Covered in a place which receives a lot of sun light throughout the day. Place the cup labeled Shade somewhere out of the sun where it won't be disturbed.
6. After a day or two, mark the water level on each cup. Record any observations.

Predictions:

What do you think will happen to each of the three cups?

Data Collection:

Draw a picture of the three cups at the end of the experiment.

Date	**Sun Cup** **Where placed:**	**Shade Cup** **Where placed:**	**Covered Cup** **Where placed:**
	Beginning measurement:	Beginning measurement:	Beginning measurement:
	Ending measurement:	Ending measurement:	Ending measurement:

Observations: (Describe what happened)

Conclusion:

Water Cycle Poster

Session 2: Watersheds: Where We Live

What is a Watershed?

Overview

Students will learn that a watershed is a land area that drains water to a stream, river, lake, or ocean. Watersheds describe how water travels over the earth's surface. Students will experience that water flows from higher to lower elevations and that water is collected for storage. Students build a model simulating mountains, valleys, and water collection points. Students predict how water will travel and where it will accumulate on their models. Students then simulate a rainstorm to see where the water flows.

Purpose

Students will:

- Identify a watershed
- Understand the accumulation phase of the water cycle
- Observe how water flows from higher elevations to lower elevations in a watershed

Time Needed

- 45 minutes

Materials

Next Generation Science Standards

Describe the amounts of salt water and fresh water to provide evidence about the distribution of water on Earth.

Practices

Developing and using models

Planning and carrying out investigations

Disciplinary Core Idea

The roles of water in Earth's surface processes

Crosscutting Concepts

Scale, proportion, and quantity

For Educators	For Students
• Activity Instructions • Watershed poster	• Flat pan or meat tray with lip • Cardstock, 2 sheets-11 x 17 • Masking tape, 1 roll • Water-based/soluble marker or water-color marker (like Mr. Sketch) • Pen or pencil • Spray bottle • Optional: Book (to lift one end of model), ~1 inch thick

Background Information (for educator only)

A watershed is an area of land that drains and stores water. We all live in a watershed. Animals and plants live there with us.

In a watershed, water drains through streams, rivers, lakes, and oceans. Watersheds take many forms: some contain hills and mountains, some are relatively flat, some are in urban environments, others in natural settings. In all instances, a watershed is how water travels and where it's collected.

Water collects in a watershed in different forms. In the mountains, it may collect as snow in the cold months, to later melt and become runoff filling streams and creeks. These smaller waterways join to become larger waterways as rivers, eventually ending in the ocean. Large watersheds can contain many smaller watersheds. Changes in the smaller Watersheds - like dams, drought, or landslides - can affect the river systems downstream. Mountain ridges divide individual watersheds. All the area from which water flows into a river is that river's watershed. Water can also be stored in natural lakes and man-made reservoirs. Sometimes water is stored underground in natural aquifers. All of these are components of watersheds.

Water collection, storage, and control are important issues in California. As a limited resource in a large and populous state with a big agricultural industry, water is quite valuable and must be managed in such a way to meet many needs. There is a need to store water, to keep it clean, and to assure we have enough water year-round.

Protecting communities from flooding—a major event in a watershed—is also important. Floods occur when the volume of water exceeds the ability of a water body (stream, river, or lake) to contain the water within its banks. Any stream, river or lake can flood. Dams help to control both flooding and water storage.

Vocabulary and Concepts

Aquifer: A layer of permeable rock, sand, or gravel through which groundwater flows, containing enough water to supply wells and springs.

Aqueduct: Human made canals that carry water from its source (rivers, lakes, and other bodies of water) to their place of use (towns, cities, agricultural fields).

Drainage basin: An area of land that is drained by a river.

Earth's topography: The surface features of a region including hills, valleys, rivers, lakes, canals, bridges, roads, cities, etc.

Flood: Any relatively high flow of water that overflows natural or artificial banks of a stream, river, lake, or body of water.

Flood plain: A strip of relatively flat land bordering a stream, river, or lake that can accommodate the overflow of flood waters.

Ground water: Water found in pores or cracks in sand, gravel, and fractured rock beneath the land surface.

Precipitation: Rain, hail, sleet, and snow.

Reservoir: A place where large amounts of water are collected and stored for use.

Runoff: Water that drains or flows off surfaces to collect elsewhere.

Watershed: The land area that drains water to a stream, river, lake, or ocean.

Virtual Delivery

Introduction

Students revisit the accumulation phase of the water cycle by building a model watershed. Students each create a watershed consisting of land features (mountains and valleys) using cardstock covered with plastic wrap. They predict where they think the water will go when their model is sprayed. They simulate a rainstorm and observe how water travels and where it accumulates and compare it to their predictions.

Session Outline

Activity	Time
Welcome and review watershed poster together	**5 minutes**
Experiencing	
• **Create a simulated watershed**	**15 minutes**
• **Predict where the water will flow**	**5 minutes**
• **Simulated rainstorm**	**10 minutes**
Sharing, Processing, Generalizing	**10 minutes**

Getting Ready

1. Distribute a digital watershed poster to students in advance.
2. A few days in advance, package materials for students to pick-up. Or share the materials list with them and ask students to gather the materials at home.

Experiencing

1. Welcome students to the virtual room. Ask students what they remember from the previous session (where water comes from and how nature recycles it).
2. Share the watershed poster on screen. Ask students to discuss what they see. Ask where they see evidence of the water cycle.

Educator Tip: *If students don't mention it, remind them about the four parts of the water cycle: Evaporation, Condensation, Precipitation, and Accumulation.*

3. Announce that they are going to take a closer look at another part of the water cycle—**accumulation**—which is how water travels over land and where it ends up. Each student is going to design and build a model watershed. Explain that they are going to create landforms and simulate a rainstorm.

4. **Creating the Watershed Model:** Ask students to make mountains in their watersheds by crumpling sheets of cardstock separately and placing them next to each other at one end of the tray. Let them know they may want to use tape to keep the paper in place, if needed.

Educator Tip: *The cardstock should be stiff enough so that the water will run down it and accumulate in puddles representing lakes or other bodies of water.*

5. Invite students to share and describe their models, one-at-a-time, with each other in the virtual room. What do the peaks represent? What do the depressions (low points) represent?
6. Once students have the mountains arranged in their watershed model, ask students to color on the "mountain peaks" with a dark-colored water-based/soluble marker (like Mr. Sketch). Ask them what this might represent on the top of the mountains.
7. Ask students to put a small book under one end of the tray that has their "mountains" so that the tray slightly tilts.

Educator Tip: *While a book is not necessary, placing one at one end of the model will enhance water flow through the watershed.*

8. **Predictions:** Using a pen or pencil, have the students draw where they believe the water will flow in their models and where water will collect. Have them draw where they would build their house.
9. **Simulated Rain:** One at a time, ask each student to move their camera so everyone can see their model. Ask the student to make it "rain" on their watershed model. Have each student spray several pumps of water, using the spray bottle. Repeat for other students.

Educator Tip: *Ask students to involve an adult in the simulated rain portion. Remind students to adjust the spray bottle so that water is a mist and not a stream. The water should gradually accumulate on the model and begin to travel downward.*

10. After sharing, processing, and generalizing, ask students to set their watershed models someplace safe as they'll be using them in the next session.

Sharing, Processing, Generalizing

1. Gather students in the virtual room again.
2. Ask students what they observed when they made it rain on their watershed. What happened? How did the water travel? Where did it accumulate? In what ways did their predictions match what happened?
3. Have the students count the number of small watersheds that drain into larger watersheds on their model. How many watersheds are above the lake that forms at the lower end of the model?
4. Compare the models. How are they alike? How are they different?
5. What would happen if there was too much water all at once and it did not have enough time to absorb into the soil? Has anyone ever experienced this happening? Have you heard of anything like this happening on the news?
6. What are the possible consequences of a flood? (Give your students time to think and come up with lots of answers.)
7. Share the watershed poster again. Ask students if they see examples of ways humans try to control or deal with flooding.

Educator Tip: *When examining the watershed poster, have students look carefully to find all the ways flooding can be controlled. These include: Dams (big and small), timbers left on the slopes to stop or slow running water causing erosion, artificial lakes, retaining walls, wetlands (left to contain and absorb water in high water seasons), undeveloped land (where flooding can't hurt anything), farmland that is located near rivers. (If there is flooding the loss to property is minimal.)*

Application Suggestions

Observe the natural water cycle occurring in your neighborhood after it rains. Look for puddles in your driveway or in the street. Where does the water go? Where does the water accumulate?

In-Person Delivery

Introduction

Students revisit the accumulation phase of the water cycle by building a model watershed. Students each create a watershed consisting of land features (mountains and valleys) using cardstock covered with plastic wrap. They predict where they think the water will go when their model is sprayed. They simulate a rainstorm and observe how water travels and where it accumulates and compare it to their predictions.

Session Outline

Activity	Time
Welcome and review watershed poster together	**5 minutes**
Experiencing	
• **Create a simulated watershed**	**15 minutes**
• **Predict where the water will flow**	**5 minutes**
• **Simulated rainstorm**	**10 minutes**
Sharing, Processing, Generalizing	**10 minutes**

Getting Ready

1. Tape the watershed poster to the wall a day or two ahead of time. The day of the activity, share the watershed poster so that the students can gather around to see the detail of the poster.
2. Fill the spray bottles with water.
3. No sharing of materials, so create separate packages for each student.

Experiencing

1. Gather students together. Ask students what they remember from the previous session (where water comes from and how nature recycles it).
2. Share the watershed poster. Ask students to discuss what they see. Ask where they see evidence of the water cycle.

Educator Tip: *If students don't mention it, remind them about the four parts of the water cycle: Evaporation, Condensation, Precipitation, and Accumulation.*

3. Announce that they are going to take a closer look at another part of the water cycle—**accumulation**—which is how water travels over land and where it ends up. Each student is going to design and build a model watershed. Explain that they're going to create landforms and simulate a rainstorm.



4. **Creating the Watershed Model:** Ask students to make mountains in their watersheds by crumpling sheets of cardstock separately and placing them next to each other at one end of the tray. Let them know they may want to use tape to keep the paper in place, if needed.

Educator Tip: *The cardstock should be stiff enough so that the water will run down it and accumulate in puddles representing lakes or other bodies of water.*

5. Invite students to describe their models: what do the peaks represent? What do the depressions (low points) represent?
6. Once student have the mountains arranged in their watershed model, ask students to color on the "mountain peaks" with a dark-colored water-based/soluble marker (like Mr. Sketch). Ask them what this might represent on the top of the mountains (snow).
7. Ask students to put a small book under one end of the tray that has their "mountains" so that the tray slightly tilts.

Educator Tip: *While a book is not necessary, placing one at one end of the model will enhance water flow through the watershed.*

8. **Predictions:** Using the markers, have the students draw where they believe the water will flow in their models and where water will collect. Have them draw where they would build their house.
9. **Simulated Rain:** Ask the students to make it "rain" on their watershed model. Have each student spray several pumps of water, using the spray bottle.

Educator Tip: *Adjust the spray bottle so that water is a mist and not a stream. The water should gradually accumulate on the model and begin to travel downward.*

Sharing, Processing, Generalizing

1. Ask students what they observed when they made it rain on their watershed. What happened? How did the water travel? Where did it accumulate? In what ways did their predictions match what happened?

2. Have the students count the number of small watersheds that drain into larger watersheds on their model. How many watersheds are above the lake that forms at the lower end of the model?
3. Have the students examine other students' models. How are they alike? How are they different?
4. What would happen if there was too much water all at once and it did not have enough time to absorb into the soil? Has anyone ever experienced this happening? Have you heard of anything like this happening on the news?
5. What are the possible consequences of a flood? (Give your students time to think and come up with lots of answers.)
6. Gather students again around the Watershed poster. Ask students if they see examples of ways humans try to control or deal with flooding.

Educator Tip: *When examining the watershed poster, have students look carefully to find all the ways flooding can be controlled. These include: Dams (big and small), timbers left on the slopes to stop or slow running water causing erosion, artificial lakes, retaining walls, wetlands (left to contain and absorb water in high water seasons), undeveloped land (where flooding can't hurt anything), farmland that is located near rivers. (If there is flooding the loss to property is minimal.)*

Application Suggestions

Observe the natural water cycle occurring in your neighborhood after it rains. Look for puddles in your driveway or in the street. Where does the water go? Where does the water accumulate?

Session 2: Educator Aid

The Watershed Poster

Poster from: California Department of Water Resources and State Water Contractors.

www.water.ca.gov

Session 3: My Community Watershed—Keeping Our Waterways Clean

How does pollution enter a watershed?

Overview

The health of our environment depends on clean water. Keeping our water supply clean and safe is a growing concern. We may think of polluters as being "others" — especially factories or industry — but all of us contribute to the problem. All of us are also the answer!

In this activity, students will begin to investigate what water pollution is and some of its major sources. They will explore watersheds in an urban community and how runoff carries pollutants to rivers and lakes. They will discuss what they can do to help keep our water clean.

Next Generation Science Standards

Conduct an investigation to demonstrate how pollution is created and travels through a watershed.

Practices: Constructing explanations; Engaging in argument from evidence

Disciplinary Core Idea: As human populations increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Crosscutting Concept: Cause and effect

Purpose

Students will:

- Explore the different watersheds in an urban community
- Understand how contaminants enter the water system
- Identify ways to keep their community's water cleaner

Time Needed

- 45-55 minutes

Materials

For Educators

- EnviroScape® model
- Pollutants, consisting of: three small containers of:
  - Cocoa
  - Chocolate sprinkles (cake decoration)
  - Colored sprinkles (cake decoration)

  Flavored drink mix or powered gelatin of different colors:
  - Red
  - Green
  - Yellow
- 1 or 2 spray bottles with water
- Copy of *An Afternoon in (Your Community)*

For Students

- Model watershed that they built in Session 2
- Spray bottle with water
- Small container of instant cocoa mix

To simplify information, trade names of products have been used. No endorsement of products or services are granted or implied by the University of California, 4-H, the US government, or any of its organizational units or employees.

Background Information (for educator only)

Watersheds don't just include natural places; they exist in our man-made environment. Runoff from neighborhoods, agricultural areas, and cities make up the urban watershed. Just like in the natural environment, water collects and runs to ditches, creeks, and streams. In an urban setting, it is carried through storm drains, too.

Where we live, our water is polluted from many sources. Automobiles, gardening products, animals, boats, industry, and construction are just a few of the many ways in which contaminants enter our water. Often unseen and unthought-of, pollutants enter our water without people being aware of it.

Sometimes we can identify where pollutants enter the water, like through discharge from a pipe or a storm water drain. This is called point source pollution. Often identifying where pollution happens is not so obvious. Non-point pollution happens when rainwater or snowmelt washes over streets, suburban yards, neighborhood parks, and plowed fields. This polluted runoff finds its way into rivers, lakes, wetlands and infiltrates the soil to contaminate ground water. Non-point pollution comes from many small, scattered sources and is difficult to identify and prevent.

While wastewater from sinks and toilets in our homes is cleaned at a water treatment plant before being released back into the environment, other water enters our community watershed without being treated. Runoff that moves through storm drains and gutters empties directly into waterways.

Vocabulary and Concepts

Debris: Scattered pieces left behind after something has been broken down or destroyed.

Infiltrate: To pass through a substance by filtration, or to make a liquid or gas pass through a substance by filtration.

Non-point source pollution: Pollution that comes from many sources indirectly through run-off into water sources.

Point source pollution: Pollution that flows from pipes or comes from specific places such as industrial plants, sewage treatment plants, or storm water drains.

Seep: *v.* To pass, flow or ooze gradually through a porous substance, *n.* a small pool or spring where liquid from the ground escapes to the surface.

All of us contribute, in various ways, to non-point water pollution. How we wash and maintain our cars, fertilize our lawns, use pesticides, and dispose of animal waste has a direct impact on water quality. These pollutants wash into storm drains and runoff ditches to eventually find their way into rivers and lakes. This makes an impact on the entire ecosystem. Choices we make every day affect the quality of our water.

Virtual Delivery

Introduction

Students will explore what they think pollution is and where it comes from. They are introduced to the idea of urban watersheds. Students will identify potential pollutants, see the educator place them on the EnviroScape® model and observe how they enter waterways.

Session Outline

Activity	Time
Welcome and reflections on Watershed Where We Live	5 minutes
Experiencing	
• Introductory questions	10 minutes
• Personal watershed model activity	10 minutes
• Story and EnviroScape® model	20 minutes
Sharing, Processing, Generalizing	10 minutes

Getting Ready

Educator Tip: *This session is best delivered with a partner if done virtually. One person can read the story, the other can apply the pollutants.*

1. Read the lesson through to fully understand what students are to take away from this session.
2. Personalize the story, *An Afternoon in (your community's name)*, with locations and names that would be familiar to students.
3. Set up the EnviroScape® model before beginning the session, making sure that your laptop camera captures the model. Students will need to see the demonstration.
4. Around the EnviroScape® model set out the spray bottles, small containers of colored gelatin or drink mix, cake decorating sprinkles, and cocoa. You will be placing the "pollutants" on the model and the students will witness what happens when you make it "rain."
5. As students come online, remind them that they'll need the following materials for today's session:
    - The watershed model that they constructed last week
    - Their water spray bottle
    - The brown cocoa mixes

Experiencing

1. Welcome students to Session 3 of 4-H Water Wizards. Ask students what they remember about watersheds from the last session. Share that today they will be further investigating watersheds as it relates to pollution.

2. **Introductory Questions:** Allow students to share what they know about pollution. Ask:
    a. What do you think of when you hear the word "pollution?"
    b. Where does it come from?

3. **Personal Watershed Model:** Ask students to place their model watershed in front of them. Instruct them to take just a few pinches of the cocoa mix and sprinkle it on their model. Ask them what the brown powder might represent (soil or perhaps something on or in the soil).
    a. Tell the students to make it "rain" on their watershed model and to watch what happens.
    b. What did they observe?

4. Tell students that they are going to explore how water travels in their community environment. Using your laptop camera, show them the EnviroScape® model.

Educator Tip: *Depending the set up with your laptop and the EnviroScape®, you may need to shift the laptop so that camera show the different parts of the model—farms, houses, golf course, etc.*

5. **Story and EnviroScape® Model:** Tell students that this EnviroScape® model could be their community. Ask them what they see represented on the model and tie these elements to specific places where they live. Items on the model to note:
    - *Residential area* – Ask your students where they live.
    - *Industry* – Are there any big companies or factories in the community? Ask the children to name as many as they can and add any you may know.
    - *Farmland* – Are there farms in their community? What crops are grown on local farms?
    - *Golf course* – Does anyone in the class play golf or know of people who do?
    - *Waterways* – Ask the students to name rivers or creeks that flow through their community.
    - *Construction site* – Ask students to identify all the types of construction that is going on around their homes

6. Prepare for the story. Explain that you have some "pollutants" that we'll be using today, and show the students what each one is and represents:
    - Cocoa – soil
    - Chocolate sprinkles – animal waste
    - Colored sprinkles – trash
    - Red powder – pesticides
    - Green powder – fertilizers
    - Yellow powder – oil and gas

7. Explain to the students that as we read a story, you'll place a little bit of the pollutant onto the appropriate area of the EnviroScape®.

8. Read the story, *An Afternoon in (your community's name)*. Pause where appropriate and apply pollutants as described in the story.

9. As the story concludes, take a spray bottles and make it "rain" on the model. Stop when the water run-off from your urban watershed gets murky and dirty.

Educator Tip: *Set the spray bottle in the "mist" position. A light "rain" is what you're creating.*

Sharing, Processing, Generalizing

1. Ask students what they observed during the rainstorm they created on the model. What happened?

2. Besides the items that were used on the model, ask the students if they can think of other things that might find their way into our water as pollutants.

3. Ask students if they know where the water in their homes comes from. Do they know where the wastewater from their home goes? Do they know where the runoff water from streets and gutters goes?

4. Ask why it is important to keep our watersheds pollution free.

5. What are some of the ways we can reduce water pollution? As a youth in our community, what are things you can do to help keep our waters clean?

6. After doing this activity, do students have any questions?

7. Let students know that later in the 4-H Water Wizards they will plan and do a community service project dealing with a water issue. They will choose an issue that is important to them. Tell them to keep this in mind as we continue with the project.

Application Suggestions

Have students identify products in their homes that their family uses that may end up in waterways. When students meet next, ask what products they found. Are there ways that they can think of to help protect waterways when these items are used?

In-Person Delivery

Introduction

Students will explore what they think pollution is and where it comes from. They are introduced to the idea of urban watersheds. Students will identify potential pollutants, place them on the EnviroScape® model and see how they enter waterways.

Session Outline

Activity	Time
Welcome and reflections on Watershed Where We Live	5 minutes
Experiencing	
• Introductory questions	10 minutes
• Story and EnviroScape® model	20 minutes
Sharing, Processing, Generalizing	10 minutes

Getting Ready

1. Read the lesson through to fully understand what students are to take away from this session.
2. Personalize the story, *An Afternoon in (your community's name)*, with locations and names that would be familiar to students.
3. Set up the EnviroScape® model before beginning the session. This includes placing the houses, cars, and other small pieces in the model so that students won't touch them. Make sure students are not interfering with the model until the session begins.
4. Around the EnviroScape® model set out the spray bottles, small containers of colored gelatin or drink mix, cake decorating sprinkles, and cocoa. Each child will be given a separate "pollutant" to place on the model. One or two students can be given water bottles instead of pollutants. Students will witness what happens to the pollutants when it "rains."

Educator Tip: *Be certain to wipe the small containers and the spray bottles with sanitizing wipes both before and after the activity.*

Experiencing

1. Welcome students to Session 3 of 4-H Water Wizards. Ask students what they remember about watersheds from the last session. Share that today they will be further investigating watersheds as it relates to pollution.

2. **Introductory Questions:** Allow students to share what they know about pollution. Ask:

a. What do you think of when you hear the word “pollution?”
b. Where does it come from?

3. **Story and EnviroScape® Model:** Tell students that they are going to explore how water travels in their community environment. Using safe distance practice, show students the EnviroScape® model.

Educator Tip: *If there are too many students to safely gather around the EnviroScape®, split the students into two teams so that each may have a chance to identify elements displayed on the model.*

4. Ask a few students, using the spray bottles, to make it rain on the model. Tell students to watch what happens when the mist collects on the ground. Ask for their observations.

5. Tell students that this model could be their community. Ask them what they see represented on the model and tie these elements to specific places where they live. Items on the model to note:
    - *Residential area* – Ask your students where they live.
    - *Industry* – Are there any big companies or factories in the community? Ask the children to name as many as they can and add any you may know.
    - *Farmland* – Are there farms in their community? What crops are grown on local farms?
    - *Golf course* – Does anyone in the class play golf or know of people who do?
    - *Waterways* – Ask the students to name rivers or creeks that flow through their community.
    - *Construction site* – Ask students to identify all the types of construction that is going on around their homes.

6. Prepare for the story. Distribute the pollutants and water bottles. As you give each student one of the small containers of colored powder or cake decorating sprinkles, explain to the group what the container represents:
    - Cocoa – soil
    - Chocolate sprinkles – animal waste
    - Colored sprinkles – trash
    - Red powder – pesticides
    - Green powder – fertilizers
    - Yellow powder – oil and gas

7. Explain to the students that you are going to read a story. Tell students that when they hear their substance (e.g., soil, fertilizer, oil) mentioned in the story, they are to apply a little bit (a pinch or two) of their substance onto the appropriate area of the EnviroScape®.

Educator Tip: *Have the students apply their pollutants moderately, neither too much nor too little.*

8. Read the story, *An Afternoon in (your community's name)*, in a slow, unhurried voice. Pause where appropriate to assure students apply their substances.

9. As the story concludes, ask students holding the spray bottles to make it rain. Tell them that this is a big storm. Stop when the water run-off from your urban watershed gets murky and dirty.

Educator Tip: *Set the spray bottle in the "mist" position. A light "rain" is what you're creating.*

Sharing, Processing, Generalizing

1. Ask students what they observed during the rainstorm they created on the model. What happened?

2. Besides the items that were used on the model, ask the students if they can think of other things that might find their way into our water as pollutants.

3. Ask students if they know where the water in their homes comes from. Do they know where the wastewater from their home goes? Do they know where the runoff water from streets and gutters goes?

4. Ask why it is important to keep our watersheds pollution free.

5. What are some of the ways we can reduce water pollution? As a youth in our community, what are things you can do to help keep our waters clean?

6. After doing this activity, do students have any questions?

7. Let students know that later in the 4-H Water Wizards they will plan and do a community service project dealing with a water issue. They will choose an issue that is important to them. Tell them to keep this in mind as we continue with the project.

Application Suggestions

Have students identify products in their homes that their family uses that may end up in waterways. When students meet next, ask what products they found. Are there ways that they can think of to help protect waterways when these items are used?

Session 3: Educator Aid

The Story

This story is designed for you to insert names and places that personalize it for your community. Before reading the story, please identify and insert (where noted in red) the following places and characters.

- Name of your community (town/city)
- Youth's name (youth #1)
- Youth's name (youth #2)
- Uncle's name (Man's name)
- Family name (i.e., Smith, Lee, Hernandez)
- Name of prominent company
- Name of lake or water source
- Name of local auto shop or garage
- Name of agriculture crop grown in your area

Students should apply substances at points in the story noted in ***bold italic.***

An Afternoon in (insert name of your community)

(Youth #1 name) and (Youth #2 name), siblings who live in (name of your town/city), were sitting on the front porch steps of their home. Their uncle (Man's name), a local landscape contractor, was inside with their mom and dad. He was delivering ***fertilizer*** for their lawn.

They heard a call from inside the house.

"Youth 1 and Youth 2, will you get your wagon and take it to the back of Uncle (Man's name) car," Mr. (Family name), their dad, asked. "I need to unload the fertilizer." (Youth 1) and (Youth 2) said, "Okay Dad, we are on our way".

When (Youth 1) and (Youth 2) reached the back of their Uncle's car, (Youth 1) exclaimed, "Boy what a huge sack of fertilizer." Uncle (Man's name) replied, "It's left over from my job fertilizing the golf course. It takes a lot of ***fertilizer to make a golf course green*** and beautiful." Their dad nodded. "I want my new lawn to look as beautiful as a golf course, so we will put all this on my lawn and see what happens."

The phone inside rang and Mom called out, "Honey, your boss from (name of company) is on the phone." Dad went inside to take the call. When he came back, he no longer looked as pleased as he was a moment ago.

"Kids, I have to go to work. A pipe blew at the plant and ***oil is leaking*** into the drainage system. I need to go and look. Afterwards, I will go over to Granddad's for a short visit. Do you two want to come along?"

"No dad, if it is okay with you and mom, (Youth 2) and I want to ride out to (name of lake or water source) for a bit today," (Youth 1) replied.

"If it is alright with your mom, it is okay with me," Dad said. "But before you go, could you please pick up the ***dog poop*** on the front lawn?" Then he hurried to leave, wanting to get back home and work in the yard.

(Youth 2) turned to (Youth 1) and said, "I'll pick up the dog poop, and you go to get our bikes from behind the garage." (Youth 1) ran off to get the bikes. (Youth 2), shovel in hand, went to work picking up the **dog droppings**. Shoveling up the poop, (Youth 2) wondered what to do with the droppings. I'll just pile them in the gutter, (Youth 2) thought. I'll have this job done in no time at all.

(Youth 1), meanwhile, had returned with the bikes. "(Youth 2), the chains are full of dirt and the bikes are hard to pedal. We will have to clean them. We just need to get a small amount of gasoline in a shallow pan to wash the bike chains in, and then wipe them with oil. We can do it right here in the driveway." Together they quickly removed the chains from their bikes and prepared to clean them. Oops! As (Youth 2) tipped the gas can, some of ***the gas spilled*** onto the driveway. "Now for the oil," (Youth 1) said, squeezing the oil can to coat the chains. "Oh darn, now I have made an ***oil mess***, too."

Careful not to get their feet in the spills, the children replaced the bike chains and discussed how to clean the mess up. "I think we should get the hose and wash the **oil and gas** spills into the street," said (Youth 2). "Good idea," returned (Youth 1), "What will we do with the dirty gas left in the pan?"

(Youth 2) smiled. "I know, let's take it up the street to the new construction site. There is lots of ***bare soil*** there and we can pour the ***gas*** into the dirt." (Youth 1) nodded in agreement saying, "That is a great idea."

Their tasks completed, (Youth 1) and (Youth 2) went into the house to ask their mom for permission to bike to (name of lake or water source). When Mom heard their request to go to (name of lake or water source), she smiled. "That will be good exercise for you both. Be careful of cars. I am going to go across town to (name of local auto repair shop or garage) and get the oil leak fixed in my car. It has been ***leaking oil*** for a couple of weeks and I have been too busy to get it fixed."

(Youth 1) and (Youth 2) jumped on their bikes, glad to be free and finally on their way to the (name of lake or water sources). As they peddled down the street, a truck sped by, ***papers blowing*** out from the truck bed. (Youth 2) called out to (Youth 1), "Look! That truck is 'raining' papers. What a litter bug!"

Meanwhile, Mr. (Family name) had finished supervising the repairs at the plant and was on his way to visit his parents at the farm. Turning up the drive to the farmhouse, he noticed milk cows fenced in a small pasture close to the house. The air was fragrant with the smell of ***manure***. He knew he was back on the farm.

It was quiet at the farm and, hearing a sound of snipping coming from behind the house, he went to the back yard where he found his mom working in the rose garden.

"What are you doing, Mom?" he asked. Looking up, his mother smiled and replied, "I'm clipping the roses and ***spraying pesticide*** to kill those darn aphids that are sucking my plants dry. Your dad is ***out in the fields plowing*** and preparing the fields for planting. Sorry he won't be able to visit."

"That's okay mom," Mr. (Family name) replied, "I just wanted to come borrow the pesticide sprayer and the fertilizer spreader. I want to work on my lawn today. His mom smiled and replied, "Help yourself from the farm shed. Your father ***fertilized*** and ***sprayed pesticides*** on the (name of local crop) field last week. He won't need the little you will take for your yard and garden."

Mr. (Family name) glanced up and noticed that storm clouds were building. "Mom, I'll collect the things I came for and be on my way. I'd like to be home before it rains. (Youth 1) and (Youth 2) are out on their bikes and I want to be sure that they get home safely."

Session 4: Water Use and Conservation

How Much Water Do We Use?

Overview

Water is a limited and important resource. In many ways, water is California's "new gold." It's sought for its value. For years, political discussions have focused on water rights and distribution. Yet for many people, water is taken for granted and is used without limit. An important part of being a good steward of our planet is the wise use of water.

Purpose

Students will:

- Increase awareness of the amount of water used in individual households.
- Design a study to determine how much water families use.

Time Needed

- **Day 1:** 45 minutes **Day 2:** 60 mintues

Next Generation Science Standards

Conduct an investigation to understand home water usage.

Practices: Planning and carrying out an investigation; Obtaining, evaluating, and communicating information

Disciplinary Core Idea: As human populations increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Crosscutting Concept: Cause and effect

Materials

For Educators	For Students
1. Flip Chart (for in-person delivery) 2. Markers (for in-person deliver) 3. Water Use Ideas (for virtual delivery) 4. Class Water Usage Graph	1. Water Usage Chart 2. Student Tally Sheet 3. Graph paper or copy of Class Water Usage Chart – at least 2 sheets 4. Calculator 5. Pencils

Background Information (for educator only)

Water is managed to meet the needs of three different user groups. One of those groups, of course, is people who rely on water for basic needs like drinking, bathing, and cooking. People also use water in more discretionary ways, for example in caring for landscaping, cleaning, and leisure activities.

Agriculture also requires water for food production. In California, a state where agriculture is a large part of the economy, most of our cropland is irrigated. A great amount of water is used for this purpose.

The third group that relies on water is wildlife. Animals and plants depend upon the environment to meet their needs, and water is a key factor in determining where they can live. As water is diverted from streams, rivers, and lakes to help meet other needs, habitat is affected. Some habitats are very sensitive. The delta is an example of such an environment. As water is taken from our major rivers, the salinity level of the lower delta increases thus threatening wildlife dependent on this environment.

Water availability is unpredictable from year to year. In years when rainfall and snowpack is plentiful, there is enough water to meet everyone's needs. However, in drought years, there's not enough water to go around. Sometimes water is rationed. There are political debates about how water should be allotted to the different users as municipalities, farmers and environmentalists express concern for their interests.

Home usage of water is part of this equation. We use water everyday, usually without thinking about it as a valuable resource. Increasing awareness of how we choose to use water helps individuals to make wise choices and can reduce water waste.

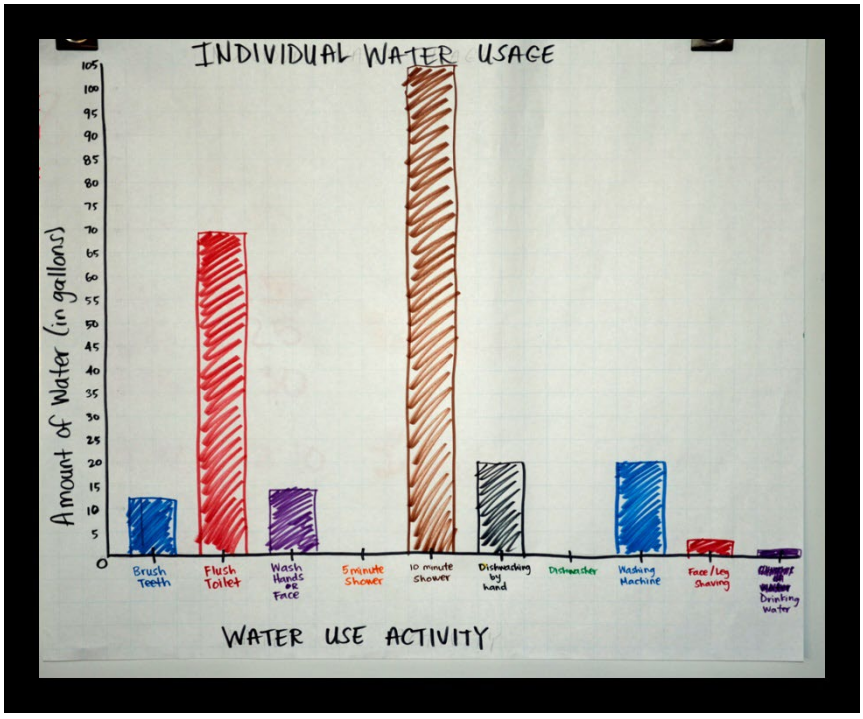
Vocabulary and Concepts

Accuracy: The correctness or truthfulness of something; the ability to be precise and avoid errors.

Data: Information, often in the form of a list of numbers, facts or figures obtained from experiments or surveys, used as a basis for making calculations or drawing conclusions.

Habitat: The landscape of natural and modified conditions in which plants, animal and humans live, e.g. forest, desert, or wetlands.

Irrigation: To bring a supply of water to a dry area, especially in order to grow crops.



Virtual Delivery

Introduction

This activity has two parts and is best done with several days in-between the two parts. In this activity, students will become more aware of the amount of water used in their homes. In Part I, they will discuss the importance of water usage and design a study to measure how much water their households use. In Part II, students will graph, compare, and consolidate their data then draw conclusions about water consumption. They will come up with water conservation ideas.

Students will agree upon a way to measure water use in their homes. While some students might mention reading their water meters (and you may wish to learn to read meters and conduct your study in this way), a less accurate but potentially more fun way to gather the data is to have families "count" the times and ways they use water over a period of time.

Session Outline

Activity	Time
Welcome and foster water awareness	5 minutes
Experiencing (Day 1)	
• Water use and conservation discussion	10 minutes
• Water study introduction	10 minutes
• Data gathering discussion	20 minutes
Sharing, Processing, Generalizing (Day 2)	
• Students individually calculate gallons used and graph	15 minutes
• Graph and explore class data together	30 minutes
• Discuss water conservation	15 minutes

Getting Ready

1. A few days in advance, package materials for students to pick-up. Or share the materials list with them and ask students to gather the materials.
2. Familiarize yourself with the Water Usage Chart.
3. Prepare the Water Use Ideas page and Water Usage Class Graph.

Experiencing

Day 1

1. Welcome students to the virtual room. Create awareness that water is an important and limited resource. Perhaps the students listed water scarcity or conservation as a topic on their "What we know about water" brainstorming list in Session 1: The Water Cycle. If so, revisit that list.
2. Ask students the following:
    a. What do you know about water use and water conservation?
    b. Have you heard anything on the news about this topic?

   c. What ways do you use water?
3. Explain to students that water conservation is an important topic and that they're going to become scientists and develop a study to learn how much water is used in their households.
4. Tell students that the questions they want to answer in their study are "How much water does my family use? How do we use that water?" Ask students for ideas about how they might design a water-use study to answer these questions. Record their ideas on Water Use Ideas page.
5. Create a list of ideas the students have of all the ways they use water in their homes. After they have created the list, ask students to pull up their electronic copy of the Water Usage Chart. How might they use the Water Usage Chart to help them with their study? Are there ways they mentioned using water that are not listed on the chart? How could they find out the quantity of water used for these activities?
6. Ask students to decide on the following for their study:
   a. What household water-using activities do they want to measure?
   b. How will they measure the activities?
   c. How long will the study last? (A day? A weekend? From 7:00 am to 7:00 pm?) Tell them to be specific. The more precise they are, the better their data will be!
   d. What day(s) would be the best to gather data? Why?

Educator Tip: *All students should measure the same activities for the same amount of time.*

7. Ask students for ideas on how they'll gather data. Do they want to put a tally sheet in the bathroom and kitchen or laundry room? Maybe interview family members on how long they shower or for how long they run the yard sprinklers? Use this as an opportunity to explain that scientists are systematic in the way they gather data, and that accuracy is important in any study.
8. Create a take-home Data Sheet that reflects the data the students want to collect. This may include tallies for water use, specific data to be collected through interviews, or other measurement that the group agrees to gather.
9. Tell students they're ready to implement their study. Ask each student to collect data by recording the amount of water used in his or her home over the prescribed time period. Tell them they will analyze their data when they meet again.

Educator Tip: *The students will need to come up with a way to measure the use of water in their homes. The Water Usage Chart gives some ideas. You may have others.*

Sharing, Processing, Generalizing

Day 2

1. Gather students together, making sure they have their Data Sheets. Ask them how their data collection went. Was it easy? Why or why not?
2. Have the students calculate the number of gallons used for each of the items for which they collected data. The Water Usage Chart can help.
3. Ask students to graph their own family's water use on graph paper or the Water Usage Graph. Ask them to graph the number of gallons they used for each item in their study. After the students have done this, have them explore their data:

   a. In pairs or small groups, ask students to compare their graph with others. Ask for volunteers to share their observations with the larger group. What do they notice?
   b. Do they have ideas about why some families use more or less water?
4. After the students have done this, create a class summary by asking for totals for the individual items. Fill the table in the Class Water Usage Graph to graph the class's numbers.
5. Have students examine their class data.
   a. What does the data tell us?
   b. What do you think about it?
   c. Which household activity used the most water?
   d. Were there any surprises?
   e. How might we use this data?
   f. Do you have other questions after doing the study?
6. Explore water conservation with the students. Ask:
   a. What have they heard about water conservation?
   b. Why is it important to conserve water?

Application Suggestions

Invite students to make a list of ways their family might conserve water. Encourage them to share their list with their family.

Educator Tip: *Counting the number of toilet flushes, loads of laundry, lengths of showers or other activities is a simple way to estimate home water usage. Be sure to include ideas students have as to how to collect data and what data to collect.*

In-Person Delivery

Introduction

This activity has two parts and is best done with several days in-between the two parts. In this activity, students will become more aware of the amount of water used in their homes. In Part I, they will discuss the importance of water usage and design a study to measure how much water their households use. In Part II, students will graph, compare, and consolidate their data then draw conclusions about water consumption. They will come up with water conservation ideas.

Students will agree upon a way to measure water use in their homes. While some students might mention reading their water meters (and you may wish to learn to read meters and conduct your study in this way), a less accurate but potentially more fun way to gather the data is to have families "count" the times and ways they use water over a period of time.

Session Outline

Activity	Time
Welcome and foster water awareness	5 minutes
Experiencing (Day 1)	
• Water use and conservation discussion	10 minutes
• Water study introduction	10 minutes
• Data gathering discussion	20 minutes
Sharing, Processing, Generalizing (Day 2)	
• Students individually calculate gallons used and graph	15 minutes
• Graph and explore class data together	30 minutes
• Discuss water conservation	15 minutes

Getting Ready

7. Make copies of the Water Usage Chart and Student Tally Sheet for each student.
8. Familiarize yourself with the Water Usage Chart.
9. Gather supplies
10. Prepare a flip chart paper to graph class water use totals.

Part 1

Experiencing

Day 1

1. Create awareness that water is an important and limited resource. Perhaps the students listed water scarcity or conservation as a topic on their "What we know about water" brainstorming list in Session 1: The Water Cycle. If so, revisit that list.
2. Ask students the following:
    a. What do you know about water use and water conservation?

   b. Have you heard anything on the news about this topic?
   c. What ways do you use water?
3. Explain to students that water conservation is an important topic and that they're going to become scientists and develop a study to learn how much water is used in their households.
4. Tell students that the questions they want to answer in their study are "How much water does my family use? How do we use that water?" Ask students for ideas about how they might design a water-use study to answer these questions. Record their ideas on flip chart paper.
5. Create a list of ideas the students have of all the ways they use water in their homes. After they have created the list, hand out copies of the Water Usage Chart. How might they use the Water Usage Chart to help them with their study? Are there ways they mentioned using water that are not listed on the chart? How could they find out the quantity of water used for these activities?
6. Ask students to decide on the following for their study:
   a. What household water-using activities do they want to measure?
   b. How will they measure the activities?
   c. How long with the study last? (A day? A weekend? From 7:00 am to 7:00 pm?) Tell them to be specific. The more precise they are, the better their data will be!
   d. What day(s) would be the best to gather data? Why?

Educator Tip: *The students will need to come up with a way to measure the use of water in their homes. The Water Usage Chart gives some ideas. You may have others.*

7. Ask students for ideas on how they'll gather data. Do they want to put a tally sheet in the bathroom and kitchen or laundry room? Maybe interview family members on how long they shower for or how long they run the yard sprinklers? Use this as an opportunity to explain that scientists are systematic in the way they gather data, and that accuracy is important in any study.
8. Create a take-home Data Sheet that reflects the data the students want to collect. This may include tallies for water use, specific data to be collected through interviews, or other measurement that the group agrees to gather.
9. Tell students they're ready to implement their study. Ask each student to collect data by recording the amount of water used in his or her home over the prescribed time period. Tell them they will analyze their data when they meet again.

Educator Tip: *All students should measure the same activities for the same amount of time.*

Sharing, Processing, Generalizing

Day 2

1. Gather students together, making sure they have their Data Sheets. Ask them how their data collection went. Was it easy? Why or why not?
2. Have the students calculate the number of gallons used for each of the items for which they collected data. The Water Usage Chart can help.

3. Ask students to graph their own family's water use on graph paper or the Water Usage Graph. Ask them to graph the number of gallons they used for each item in their study. After the students have done this, have them explore their data:
    a. In pairs or small groups, ask students to compare their graph with others. Ask for volunteers to share their observations with the larger group. What do they notice?
    b. Do they have ideas about why some families use more or less water?
4. After the students have done this, create a class summary by asking for totals for the individual items. Fill the table in the Class Water Usage Graph to chart the class's numbers.
5. Have students examine their class data.
    a. What does the data tell us?
    b. What do you think about it?
    c. Which household activity used the most water?
    d. Were there any surprises?
    e. How might we use this data?
    f. Do you have other questions after doing the study?
6. Explore water conservation with the students. Ask:
    a. What have they heard about water conservation?
    b. Why is it important to conserve water?

Application Suggestions

Invite students to list ways that their family might conserve water. Encourage them to share their list with their family.

Educator Tip: *Counting the number of toilet flushes, loads of laundry, lengths of showers or other activities is a simple way to estimate home water usage. Be sure to include ideas students have as to how to collect data and what data to collect.*

How Much Water Do We Use?

Water Usage Chart

Water activity	Average number of gallons used
Brush our teeth	1 gallon
Flush the toilet	3 gallons
Hands and face washing	1 gallon
5 minute shower	25 gallons
10 minute shower	50 gallons
Face and leg shaving	1 gallon
Dishwater per load	15 gallons
Dishwashing by hand	8 gallons
Clothes washing (machine)	25 gallons
Glasses of water drunk	8 oz per glass = 1/16th of a gallon

Information courtesy of USGS – Per Capitt Water Use https://water.usgs.gov/edu/activity-percapita.php

How Much Water Do We Use?

Student Tally Sheet

Water Use Activity	Put a check mark for each time activity took place.	Fill in number of gallons used each time for this water use.	Total number of gallons used.

Water Use Ideas

Ideas for Designing a Study	Ways We Use Water in Our Homes

Class Water Usage Graph

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170																		
165																		
160																		
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Water Usage																		

Session 5: Water Taste Test

Is Bottled Water Better?

Overview

In recent years, millions of Americans have begun to purchase bottled water instead of drinking tap water. People believe bottled water is more convenient, healthier, and tastes better. In this experiment, students participate in a blind taste test in which they sample water taken from various sources and evaluate it for taste.

Purpose

Students will:

- Understand that water from different sources may taste quite different because of differences in dissolved minerals
- Understand that taste is subjective and what that means

Time Needed

Activity 1: 50 minutes **Activity 2:** 30 minutes

Next Generation Science Standards

Conduct an investigation to determine which water sample is preferred.

Practices: Analyzing and interpreting data; Engaging in argument from evidence

Disciplinary Core Idea: Things that people do to live comfortably can affect the world around them.

Crosscutting Concept: Patterns

Materials Activity 1

For Educators	For Students
1. Flip chart and markers (for in-person delivery) 2. Paper grocery bags (for in-person delivery) 3. Water Preference Graph 4. Calculator 5. Permanent marker for labeling water samples and cups (for in-person delivery)	1. 3 different types/brands of bottled water (mini bottles, enough for one of each type per student) 2. Access to tap water 3. Small cups (4 per student; one per water sample) 4. Permanent marker 5. Salt-free soda crackers (optional) 6. Writing utensil – pencil 7. Water Taste Test Score Sheet

Materials Activity 2

For Educators	For Students
1. Metric scale (for in-person delivery) 2. Table salt 3. Sugar 4. Small clear cups (5) 5. Access to drinking water	1. 1 bottle of drinking water per student (20 oz.) 2. Small clear cups (5 per student) 3. Permanent marker 4. Table salt 5. Sugar 6. Access to drinking water 7. Water droppers 8. Writing utensil - pencil

Background Information (for educator only)

Many of us choose to drink bottled water rather than tap water. But does bottled water really taste better?

People choose to drink bottled water for many reasons. It has become quite fashionable to carry bottles of water, and it's now a frequent choice in vending machines. It is convenient and readily available and as a result, people may be drinking more water.

Minerals and other substances in the water, such as calcium and magnesium, affect how water tastes. "Hard water" is the result of a high amount of dissolved minerals in the water. Personal choice is a factor in determining which water tastes better, and this is influenced by the kind of water an individual grew up drinking. Some tap water consistently rates higher than bottled water.

Bottled water is expensive. Some bottled water is simply filtered tap water for which consumers pay a high price and is not necessarily healthier. Water from a community's water supply is tested to make sure it is free of harmful bacteria and chemicals and is therefore considered healthy.

Vocabulary and Concepts

Average: A mathematical value calculated by adding several numbers together and dividing that sum by the number of numbers added.

Objective: Not influenced by personal feelings or opinions in considering and representing facts.

Preference: The choice of one thing over another.

Salinity: The amount of salt dissolved in water.

Bottled water comes in plastic containers, and disposal of these is another factor to consider when choosing what type of water to drink.

When deciding which types of water to drink or when making a scientific decision, the ability to set aside personal feelings when considering related facts is important. Personal preference can change how we look at or feel about something.

Safety: be mindful of allergies or other dietary restrictions (especially if using the crackers). Also note that it is generally unadvisable to consume unknown chemicals (although only water in this activity).

Virtual Delivery

Activity 1: Water Taste Test

Introduction

In this activity, students taste four or more samples of drinking water and determine, individually, which tastes the best. They then pool their data, create a graph, and see which water the class prefers. The taste test is meant to be as objective as possible. The students prepare their water samples, move the bottles away from their workstation, then proceed with a discussion before the taste test to add time between preparing the samples and tasting the water.

Session Outline

Activity	Time
Experiencing	
• Students prepare for the experiment	10 minutes
• Taste preferences discussion	5 minutes
• Review Score Sheet	5 minutes
• Taste test	10 minutes
Sharing, Processing, Generalizing	
• Calculate and chart the results	10 minutes
• Discuss results	10 minutes

Getting Ready

1. *Optional:* Educators may pre-label the water bottles for the tasting before distributing them to students. If doing this, educators may omit the portion of the second “Experiencing” step where students label the bottles themselves. Make sure to include the rest of the second “Experiencing” step so the students properly label the cups.
2. A few days in advance, package materials for students to pick-up. Or share the materials list and ask students to gather the materials at home. Make sure to include the necessary pages from the 4-H Water Wizards Lab Book.

Experiencing

1. Gather students in the virtual room for the experiment. Let them know they are going to do an experiment with drinking water and will be preparing for it together before beginning the discussion.
2. **Preparing the Experiment:** Ask students to gather their mini-water bottles, the four (4) plastic cups, and a permanent marker. Using the permanent marker, have students label the first water bottle sample with an A, the second water sample with a B, and the third with a C. Ensure students are labeling the same brand of water, with the same letter. Next ask the students to label the set of plastic cups with the letters A, B, C, and D. Once the cups and bottles are labeled, have students fill each cup part way with the water bottle with the corresponding letter. For the cup labeled D, have them fill it part way with tap

water. Once the cups have been filled, ask the students to move the bottles to where they can't see them (for example, to the floor or away from their workstation).

3. Instruct the students to set the cups to the side and not touch them until they are instructed to do so.
4. **Taste Preferences Discussion:** Discuss with students why people drink bottled water. Is it because they think it tastes better, they think it is healthier or because it is the popular thing to do? Tell students that today they're going to explore how water tastes. They will conduct a water taste test and investigate data they'll record and graph.
5. Invite students to contribute ideas on how we can assure that people will independently and honestly give their opinion on how water tastes without being influenced by a popular brand or by what others are saying. Reinforce the idea that being **objective**, or not letting our personal **preferences** dictate how we view facts, is important. The water taste test is meant to be as objective as possible.
6. **Score Sheet & Taste Test:** Instruct the students to get out their Water Taste Test Score Sheets. Tell the students they should use the key in the score sheet to assign each water sample a score. If provided, they may cleanse their palate with an unsalted cracker between tastings. All students should use the Score Sheet to record their results.
7. After they have scored each sample, ask students to "rank" the samples. Explain that they may have given more than one water sample the same score (for example, two might score "good" on the scale). Ask students to rank them from worst (#1) to best (#4).

Sharing, Processing, Generalizing

1. **Calculate and chart results:** Calculate a class score for each water sample. You do this by finding an **average** for each sample. (For example, to find the average for sample A, ask each child for their sample A score, add all the scores, then divide by the number of students). Once the group has arrived at a value for each sample, record it on the Data Table of the Water Preference Graph. This information can be used to make comparisons between water samples.
2. Graph the students' water sample preferences in the Water Sample Preferences Graph. Ask students, by show of hands, by the chat, or by a prepared poll, who liked sample A the best. Record the number on bar graph. Do this for each water sample.

Educator Tip: *Take a show of hands or ask students to report their answer in the chat to determine the number of students who liked each water sample the best.*

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3. Ask the group if they have any guesses as to what the different water samples might be, then reveal the water sample identities.
4. **Discuss the results:** Ask the students:
    a. What does this data tell us? Were there any surprises?
    b. According to the average scores for the water samples, which one does the group think tastes best? Which one is the worst tasting? (The best tasting will have the highest average, the worst tasting the lowest average.)
    c. According to the bar graph, which sample do most people prefer?
    d. Is this the same as the sample with the highest average score (on the Water Taste Test Average Table)? What might account for the differences in people's preference for water?
    e. Do you have any other questions?

Application Suggestions

Have students consider whether their own family typically uses tap water, bottled water, or a filtered water for drinking at home. Why does their family choose to do this? Where are other places, they see bottled water used? Why do they think it is used at those places?

Activity 2: Unseen, But Detected by Taste

Introduction

This activity will help students provide reasons for why different water sources taste differently. Students will discover that water can contain things that you cannot see but can taste.

Session Outline

Activity	Time
Activity Introduction	5 minutes
Experiencing	
• Setting up the experiment	10 minutes
• Water tasting	10 minutes
Sharing, Processing, Generalizing	5 minutes

Getting Ready

1. A few days in advance, package materials for students to pick-up. Or share the materials list and ask students to gather the materials at home.

Experiencing

1. Gather students in the virtual room for the experiment. Tell students that they'll be exploring more about the taste of water and will be preparing for an experiment together before beginning the discussion.
2. **Setting Up the Experiment:** Ask students to gather two of their plastic cups, a liquid measuring cup, measuring spoons, table salt, sugar, a spoon, and a permanent marker. Using the permanent marker, have students label one cup NaCl (the scientific formula for salt) and the other $C_6H_{12}O_6$ (the scientific formula for sugar).
    a. Have students prepare the salt solution by using the liquid measuring cup to measure and pour 6 ounces (or ¾ cup) into the plastic cup labeled NaCl. Next, have students use measuring spoons to measure 1 teaspoon of salt and add it to the NaCl cup. Stir mixture to dissolve.
    b. Have students prepare the sugar solution by using the liquid measuring cup to measure and pour 6 ounces (or ¾ cup) into the plastic cup labeled $C_6H_{12}O_6$. Next, have students use measuring spoons to measure 6 teaspoons (or 2 tablespoons) of sugar and add it to the $C_6H_{12}O_6$ cup. Stir mixture to dissolve.
    c. Ask students to set the two mixtures to the side.

Educator Tip: *Encourage students to measure the water, salt, and sugar as precisely as possible.*

3. Have students get the other three plastic cups, the water droppers, a permanent marker, and the 20 oz bottle of water. Have students label cups A, B, and C. Instruct them to put 20 drops of drinking water into each cup.
4. Instruct the students to add 10 drops from the cups marked NaCl into cup A and 10 from the $C_6H_{12}O_6$ solution into cup B. Each cup should then be swirled.
5. Ask students to look at the cups to see if the liquids look different. Get verbal answers.
6. **Water Tasting**: Ask students to sip from each cup to see if the liquids taste different. If some students can taste a difference while others cannot, discuss why. (Students may not have measured exactly; students may have more taste receptors for salt or sugar; students may be answering the way they think someone wants them to answer.) What did you taste?
7. If all students can taste a difference, have all students add another 20 drops of drinking water into each of their cups, swirl, look, and taste again.

Sharing, Processing, Generalizing

1. Prompt students with these questions to help facilitate a discussion:
    a. What about these water samples was similar? (e.g., both clear liquids, but can taste something).
    b. Why might water from different sources taste differently?
    c. What are some other things which could dissolve in water, not be visible, but affect taste? (e.g., minerals from the ground or pipes; chemicals that run into the water and are not removed by water treatment.).
    d. Why is it important to be aware of things which we can taste in our water, but not see?

Application Suggestions

Have students identify food-related items in their homes which they may be able to taste when added to water. When you see the students next, ask them what they found. Were there items which dissolved or were invisible when added to water? Were any of the items surprising?

In-Person Delivery

Activity 1: Water Taste Test

Introduction

In this activity, students taste four or more samples of drinking water and determine, individually, which tastes the best. They then pool their data, create a graph, and see which water the class prefers. The taste test is "blind," meaning that the students don't know where the water samples come from, thus not allowing bias to enter their decisions.

Session Outline

Activity	Time
Introduce Activity	5 minutes
Experiencing	
• Taste preferences discussion	5 minutes
• Review Score Sheet	5 minutes
• Taste test	10 minutes
Sharing, Processing, Generalizing	
• Calculate and chart the results	10 minutes
• Discuss results	10 minutes

Getting Ready

1. Label each water sample with a letter: A, B, C or D. One sample needs to be tap water. Do not have the water sample bottles out for the students to see. Place them in paper grocery bags to keep them hidden.
2. For each student, label a set of cups A, B, C and D. Pour the water samples into their respective cups, and place a set where each student will be seated, and several crackers.
3. Using a flip chart and markers create the Water Preference Graph.

Educator Tip: Before handling the cups, water samples, and other materials needed for the tasting, ensure your hands have been washed or sanitized.

Experiencing

1. Gather students for the experiment. Ask them not to touch anything until they are instructed to do so.
2. **Taste Preferences Discussion**: Discuss with students why people drink bottled water. Is it because they think it tastes better, they think it is healthier or because it is the popular thing to do? Tell students that today they're going to explore how water tastes. They will conduct a water taste test and investigate data they'll record and graph.

3. Invite students to contribute ideas on how we can assure that people will independently and honestly give their opinion on how water tastes without being influenced by a popular brand or by what others are saying. Reinforce the idea that this will be a "blind" test, meaning that in sampling the water we won't get to see what type of water it is we're drinking. Blind tests are used so that people's expectations will not affect the test results.
4. **Score Sheet & Taste Test:** Have students open their 4-H Water Wizards Lab Books and turn to the Water Taste Test Score Sheet. Tell the students they should use the key in the score sheet to assign each water sample a score. If provided, they may cleanse their palate with an unsalted cracker between tastings. All students should use the Score Sheet to record their own results.
5. After they have scored each sample, ask students to "rank" the samples. Explain that they may have given more than one water sample the same score (for example, two might score "good" on the scale). Ask students to rank them from worst (#1) to best (#4).

Sharing, Processing, Generalizing

1. **Calculate and chart results:** Calculate a score for each water sample. Do this by finding an average for each sample. (For example, to find the average for sample A, ask each child for their sample A score, add all the scores, then divide by the number of students). Once the group has arrived at a value for each sample, record it on the Water Taste Test Average Table. This information can be used to make comparisons between water samples.
2. Graph water sample preferences in the Water Preference Graph. Ask students, by show of hands, who liked sample A the best. Record the number on bar graph. Do this for each water sample.
3. Ask the group if they have any guesses as to what the different water samples might be, then reveal the water sample identities.
4. **Discuss the results**: Ask the students:
    a. What does this data tell us? Were there any surprises?
    b. According to the average scores for the water samples, which one does the group think tastes best? Which one is the worst tasting? (The best tasting will have the highest average, the worst tasting the lowest average.)
    c. According to the bar graph, which sample do most people prefer? Is this the same as the sample with the highest average score (on the Water Taste Test Average Table)?
    d. What might account for the differences in people's preference for water?
    e. Do you have any other questions?

Application Suggestions

Have students consider whether their own family typically uses tap water, bottled water, or a filtered water for drinking at home. Why does their family choose to do this? Where are other places, they see bottled water used? Why do they think it is used at those places?

Activity 2: Unseen, But Detected by Taste

Introduction

This activity will help students provide reasons for why different water sources taste differently. Students will discover that water can contain things that you cannot see but can taste.

Session Outline

Activity	Time
Activity Introduction	5 minutes
Experiencing	
• Water tasting	10 minutes
Sharing, Processing, Generalizing	5 minutes

Getting Ready

1. Prepare ahead of time both a salt and sugar solution.
   - To prepare salt solution, measure 2.4 g salt and dissolve into 100 ml water.
   - To prepare sugar solution, measure 14 g sugar and dissolve into 100 ml water.

   Stir solutions to make sure all salt and sugar granules are dissolved. Pour dissolved liquids into enough cups so each student can have a cup of salt and a cup of sugar solution. Label the salt solution NaCl (the scientific formula for salt) and the sugar solution $C_6 H_{12} O_6$ (the scientific formula for sugar).
2. Set out bottles of drinking water, droppers and marking pens on tables.

Educator Tip: Before handling the cups, water samples, and other materials needed for the tasting, ensure your hands have been washed or sanitized. *Be mindful of allergies or other dietary restrictions (especially if using crackers). Also note that it is generally unadvisable to consume unknown chemicals (although only salt and water in this activity).*

Experiencing

3. Tell students that they'll be exploring more about the taste of water.
4. Pass out three cups to each student. Have students label cups A, B, and C. Instruct them to put 20 drops of drinking water into each cup.
5. Instruct students to add 10 drops from the container marked NaCl into cup A and 10 drops from the $C_6 H_{12} 0_6$ solution into cup B. Each cup should be swirled.
6. Ask students to look at the cups to see if the liquids look different. Get verbal answers.
7. Ask students to sip from each cup to see if the liquids taste different. If some students can taste a difference while others cannot, discuss why. (Students may not have measured exactly; students may have more taste receptors for salt or sugar; students may be answering the way they think someone wants them to answer.) What did you taste?

8. If all students can taste a difference, have all students add another 20 drops of drinking water into each of their cups, swirl, look, and taste again.

Sharing, Processing, Generalizing

1. Prompt students with these questions to help facilitate a discussion:
    a. What about these water samples was similar? (e.g., both clear liquids, but can taste something).
    b. Why might water from different sources might taste differently?
    c. What are some other things which could dissolve in water, not be visible, but affect taste? (e.g., minerals from the ground or pipes; chemicals that run into the water and are not removed by water treatment.).
    d. Why is it important to be aware of things which we can taste in our water, but not see?

Application Suggestions

Have students identify food-related items in their homes which they may be able to taste when added to water. When you see the students next, ask them what they found. Were there items which dissolved or were invisible when added to water? Were any of the items surprising?

Session 5: Student Lab Book Page

Water Taste Test Score Sheet

Individual Scores

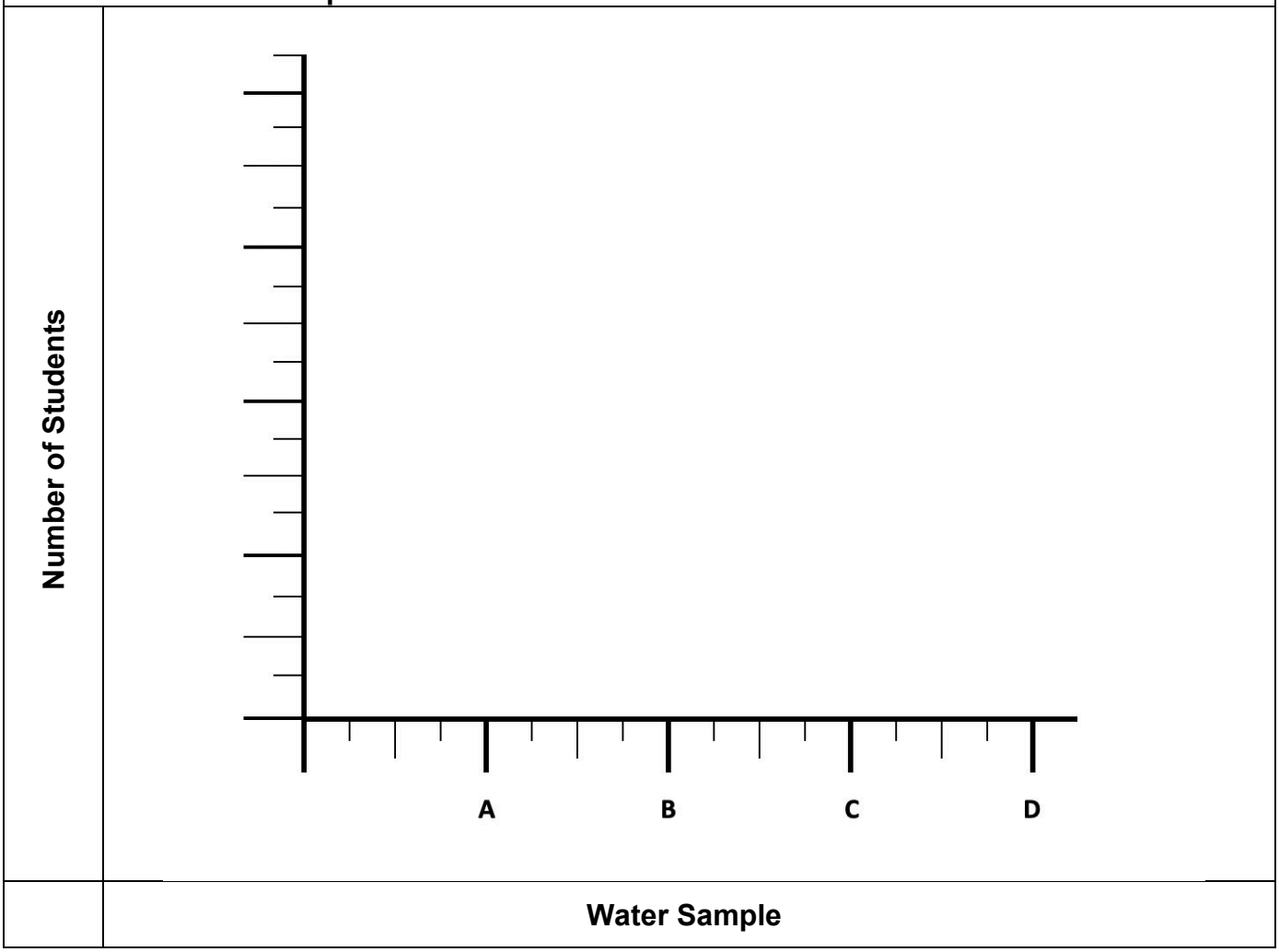
Water Sample	Score	Rank	Comments
A			
B			
C			
D			

Key
5 = Excellent 4 = Very Good 3 = Passable 2 = Not Very Good 1 =Really Awful

Session 5: Educator Aid

Water Preference Graph

Graph 1: Student Water Preferences in a Taste Test



Data Table

Water Sample	A	B	C	D
Class Average				

Session 6: Exploring Salinity

How salty is that water?

Overview

Water makes up a large percentage of the Earth's surface, and most of that water is salty. The salt content of water determines what can live there. In Activity 1, students will learn that saltwater makes up most the world's water. They will conduct an experiment growing seeds to observe how salt content in water affects organisms. In Activity 2, students will learn that salt increases water density and use a hydrometer to measure the salinity of water.

Purpose

In this session, students will:

- Understand that water salinity affects living things
- Know how to use a hydrometer to measure water salinity.

Time Needed

Activity 1: 50 minutes (done over two days)

Day 1: 30 minutes [allow 2 to 4 days for seeds to sprout]

Day 2: 10 minutes

Activity 2: 45 minutes

Next Generation Science Standards

Use observations to describe patterns of what plants and animals (including humans) need to survive.

Practices

Planning and carrying out investigations

Analyzing and interpreting data

Disciplinary Core Idea

Earth materials and systems

Crosscutting Concepts

Cause and effect

Materials

For Students Activity 1	For Students Activity 2	For Educator Activity 2
• Copies of Water Distribution on Earth figure • Copies of Seed Test worksheet • 2 plastic sealable sandwich bags • 2 paper towels • 10 seeds (radish or bean) • Permanent marking pen • Set of measuring spoons • Salt • Water	• Copies of Water Salinity Graph • Pitcher of water • 1 egg • 2 clear plastic cups (12 to 16 oz.) • Salt • Spoon • Set of measuring spoons	• Hydrometer (available online or from pet supply stores; measures density g/mL; <$8) • 4 clear plastic cups (20+ oz.) • Salt • Spoon • Teaspoon

Educator Tip: *There are several different types of hydrometers. Some have floating needles, some are bobber-like. Be sure to follow the directions that come with the hydrometer you're using.*

Background Information (for educator only)

Salinity refers to the number of salts (and other dissolved solids) in water. The salinity of water affects habitat and what plants and animals can live there. Some organisms, like those that live in the ocean, need salt water to survive. Other organisms, including humans, cannot survive without fresh water.

In the water cycle, freshwater from rain and snowmelt flow into rivers, which eventually empty into the ocean. Brackish water is where fresh water and saltwater meet, usually in a delta or estuary. Estuaries and deltas are areas where scientists often test salinity levels since the amount of salt can fluctuate dramatically due to river flow and tidal conditions. During a drought, for example, the salinity in the delta increases—sometimes a lot—because so little freshwater flows through the rivers and into the delta. This has an impact on the organisms that live there and the food chain. Some plants and animals cannot survive in the saltier water and therefore are removed from the food chain. The habitat suffers.

Scientists also measure salinity when they are concerned about saltwater intrusion into freshwater systems. When fresh water is pumped out of the ground, sometimes salt water may seep in to take its place, making the water undrinkable.
The instrument used to measure salinity is called a hydrometer (hy-*drom*-e-ter). There are several types of hydrometers, but they all work on a simple principle: the higher the indicator floats in the water, the saltier the water is.

Examples of different types of hydrometers.

Vocabulary and Concepts

Brackish: A mixture of fresh and salt water.

Buoyancy: The tendency of an object to float.

Density: Mass per volume (how heavy compared to how large something is)

Delta: Where a river meets the sea or ocean.

Germinate: Beginning to grow.

Habitat: The landscape of natural and modified conditions in which plants, animal and humans live, e.g., forest, desert, or wetlands.

Hydrometer: An instrument used to measure the salinity of water.

Salinity: The amount of salt dissolved in water.

Virtual Delivery

Activity 1: Fresh Water versus Salt Water

Introduction

Students begin their exploration of salt water versus fresh water by analyzing graphs showing the earth's water supply. They discuss the importance of freshwater to most things living on land and conduct an experiment with seeds to test their hypothesis.

Session Outline

Activity 1	Time
Welcome and opening questions	5 minutes
Experiencing (Day 1)	
Water distribution on Earth	5 minutes
Seed experiment	20 minutes
Sharing, Processing, Generalizing (Day 2)	10 minutes

Getting Ready

1. Distribute a digital Water Distribution on Earth to students in advance or remind students to have it available in their 4-H Water Wizards Lab Book.
2. A few days in advance, package materials for students to pick-up. Or share the materials list with them and ask students to gather the materials.

Experiencing

Day One

1. Welcome students to the virtual room. Ask students to name the places on the earth with water (e.g., oceans, rivers, lakes).
2. **Water distribution on Earth**. Share the "Water on Earth" chart on screen. Ask students to explore the chart and make observations.
3. What sources of water are available for humans to use?
4. What kinds of living things can use salt water? What kinds of living things need fresh water to live?
5. **Seed Experiment.** Explain that students will conduct a science experiment to determine how salt may affect living things. They will germinate radish seeds and experiment with various conditions.

6. Ask students to find their Seed Test worksheet in their 4-H Water Wizards Lab Book.
7. Ask students what they think will happen to seeds planted in freshwater compared to seeds planted in saltwater. Ask them to write down their hypothesis on the Seed Test worksheet.
8. Explain that they will germinate 5 seeds in each plastic bag and then vary the salt level in one of the bags.
9. Ask students to mark one plastic bag “freshwater” and another plastic bag “saltwater.”
10. Ask students to place a folded paper towel in each plastic bag with 5 seeds. Have them add a tablespoon of water to each bag.
11. Ask students to add ¼, ½, ¾, or 1 teaspoon of salt into the saltwater bag. Mark the bag with the number of teaspoons.
12. Ask students to put the bags in a safe place for a few days to allow the seeds to germinate and sprout.

Educator Tip: *Day two of this first activity (Fresh Water versus Salt Water) may be combined with Activity #2 in this session (Measuring the Salinity of Water) and completed on the same day.*

Sharing, Processing, Generalizing

Day Two

1. Gather students in the virtual room. Ask them to bring their two bags containing the seeds.
2. Ask students what they observe about the seeds. Allow students to show their seed bags to others.
3. What do students think the plants look like?
4. Invite students to revisit their hypotheses and compare what happened to what they predicted.
5. Ask students to come up with possible explanations for what happened.
6. Tell students that the amount of salt in water is called salinity. Return to the “Water Distribution on Earth” figure and invite students to make observations now about freshwater versus saltwater. Reinforce that some living things that live in the ocean or in water near the ocean can use salt water, but that most living things on land need fresh water to survive. Continue with Activity #2.

Activity 2: Measuring the Salinity of Water Samples (Day 2)

Introduction

Students discover that salty water increases the water's density, thereby increasing the buoyancy of objects placed in the water. They discover that eggs sink in fresh water and they can make an egg float by increasing the density of the water (i.e., by adding salt). They will also learn to use a hydrometer to measure salinity in water samples.

Session Outline

Activity 2	Time
Welcome and opening questions	5 minutes
Experiencing	
• Salinity test (egg)	15 minutes
• Salinity measurement (hydrometer)	15 minutes
Sharing, Processing, Generalizing	10 minutes

Getting Ready

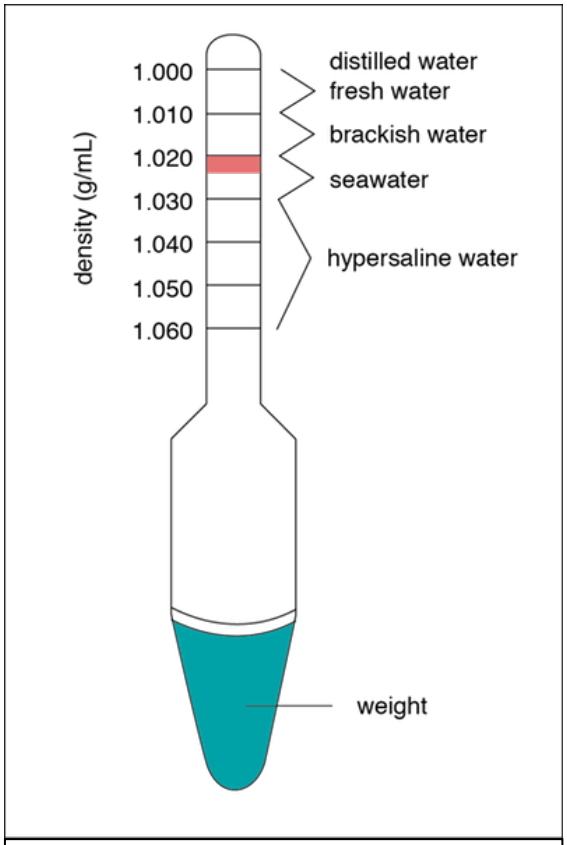
1. Prepare four equal water samples with differing salt levels to use for the hydrometer demonstration. Fill each of 4 containers with 16 oz. of water. Label them A, B, C, and D. Create the varying solutions by adding:
    a. Container C: No salt
    b. Container B: 1/4 teaspoon of salt
    c. Container D: 1 level teaspoons of salt
    d. Container A: 2 level teaspoons of salt
2. Distribute a digital "Water Salinity" graph handout in advance.
3. A few days in advance, package materials for students to pick-up. Or share the materials list with them and ask students to gather the materials at home.

Experiencing

1. Welcome students to the virtual room. Ask students why we may want to know how much salt is in water. Tell students that we're going to continue investigating the properties of salt water.
2. **Salinity test (egg).** Ask students to fill two clear plastic cups ¾ full of fresh water. Invite them to put the egg in one cup and observe what happens.
3. Ask students to add a tablespoon of salt to the second cup and stir until it's dissolved. Have each student place their egg in the cup of salt water. What do they observe?
4. Tell the students to remove the egg, add one more tablespoon of salt, and place the egg back in the water again. What is happening to the egg? Ask students to continue adding salt to the cup of water—one tablespoon at a time—until the egg floats.

Educator Tip: *We recommend that youth experience and try the hydrometer themselves if supplies permit; however, the activity is written as an educator demonstration assuming that you only have one or a few hydrometers available.*

5. **Salinity measurement (hydrometer demonstration):** Tell students that scientists use an instrument called a hydrometer (hy-drom-e-ter) to measure the salt content of water. The educator will use a hydrometer to determine the salinity of each sample and record their data on a graph.
6. Show students the four saltwater samples labeled A, B, C, and D, which you have prepared. Do not let your students know how much salt is in each container.
7. The educator should put the hydrometer in each solution and announce the measurement. Take three (3) measurements of each solution and ask students to average. Ask students to record the finding on their bar graph (Water Salinity Graph worksheet). Repeat this process until all four containers are measured.
8. **Test Solutions with an Egg:** Ask students to predict whether the egg will float or sink in each solution. Test each solution with an egg.



A hydrometer used to determine water densities in g/mL. The pink shaded region indicates the optimum density of saltwater aquaria at an average temperature of 20˚C (68˚F) to 25˚C(77˚F). From Exploring Our Fluid Earth, a product of the Curriculum Research & Development Group (CRDG), College of Education. University of Hawai'i.

Sharing, Processing, Generalizing

1. Ask students to examine their graphs and report out their observations.
2. Invite students to develop and communicate interpretations – why do they think adding salt makes the egg float? Write responses on the board.
3. Ask students where else they might measure the salt in the water. What measurement would they anticipate? (e.g., measuring ocean water).
4. Ask students to explain why they think it would be easier to swim in an ocean rather than a freshwater lake.

Educator Tip: *The observations of how saltwater affects the radish seeds leads well into questions about why scientists would want to know the salinity of water in the environment.*

Application Suggestions

1. Invite students to investigate and share where the water in their home faucet comes from. Encourage them to search online and through their municipal water agency. See if their water agency reports water testing results.
2. Make a map showing your community's water supply source. Share the map with your fellow students.

In-Person Delivery

Activity 1: Fresh Water versus Salt Water

Introduction

Students begin their exploration of salt water versus fresh water by analyzing graphs showing the earth's water supply. They discuss the importance of freshwater to most things living on land and conduct an experiment with seeds to test their hypothesis.

Session Outline

Activity	Time
Welcome and opening questions	5 minutes
Experiencing (Day 1)	
• Water distribution on Earth	5 minutes
• Seed experiment	20 minutes
Sharing, Processing, Generalizing (Day 2)	

Getting Ready

1. Copy the "Water Distribution on Earth" graph, one for every student, or have them refer to it in their 4-H Water Wizards Lab Book.
2. Gather supplies including water.

Experiencing

Day One

1. Ask students to name the places on the earth with water (e.g., oceans, rivers, lakes).
2. **Water distribution on Earth**. Pass out the "Water on Earth" chart. Ask students to explore the chart and make observations.
    a. What sources of water are available for humans to use?
    b. What kinds of living things can use salt water? What kinds of living things need fresh water to live?
3. **Seed Experiment.** Explain that students will conduct a science experiment to determine how salt may affect living things. They will plant radish seeds and experiment with various conditions.
4. Handout the worksheet.
5. Ask students what they think will happen to seeds planted in freshwater compared to seeds planted in saltwater. Ask them to write down their hypothesis.
6. Provide students with 2 plastic sealable sandwich bags, 2 paper towels, 10 seeds. Explain that they will plant 5 seeds in each bag and then vary the salt level in one of the bags.
7. Ask students to mark one plastic bag "freshwater" and another plastic bag "saltwater."

8. Ask students to place a folded paper towel in each plastic bag with 5 seeds. Have them add a tablespoon of water to each bag.
9. Ask students to add ¼, ½, ¾, or 1 teaspoon of salt into the saltwater bag. Mark the bag with the number of teaspoons.
10. Let the bags sit for a few days to allow the seeds to germinate and sprout.

Educator Tip: *Day two of this first activity (Fresh Water versus Salt Water) may be combined with Activity #2 in this session (Measuring the Salinity of Water) and completed on the same day.*

Sharing, Processing, Generalizing

Day Two

1. Ask students to gather with their two bags containing seeds.
2. Ask students what they observe about the seeds.
3. What do students think the plants look like?
4. Invite students to revisit their hypothesis and compare what happened to what they originally predicted.
5. Ask students to come up with possible explanations for what happened.
6. Tell students that the amount of salt in water is called salinity. Return to the “Water Distribution on Earth” figure and invite students to make observations now about freshwater versus saltwater. Reinforce that some living things that live in the ocean or in water near the ocean can use salt water, but that most living things on land need fresh water to survive. Continue with Activity #2.

Activity 2: Measuring the Salinity of Water Samples (Day 2)

Introduction

Students discover that salty water increases the water's density, thereby increasing the buoyancy of objects placed in the water. They discover that eggs sink in fresh water and they can make an egg float by increasing the density of the water (i.e., by adding salt). They will also learn to use a hydrometer to measure salinity in water samples.

Session Outline

Activity	Time
Welcome and opening questions	5 minutes
Experiencing	
• Salinity test (egg)	15 minutes
• Salinity measurement (hydrometer)	15 minutes
Sharing, Processing, Generalizing	10 minutes

Getting Ready

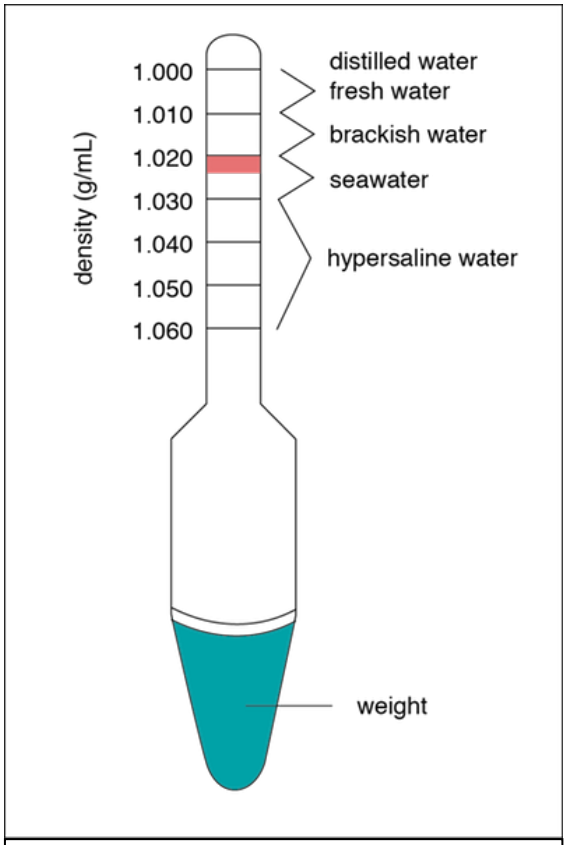
1. Prepare four equal water samples with differing salt levels to use for the hydrometer demonstration. Fill each of 4 containers with 16 oz. of water. Label them A, B, C, and D. Create the varying solutions by adding:
    a. Container C: No salt
    b. Container B: 1/4 teaspoon of salt
    c. Container D: 1 level teaspoons of salt
    d. Container A: 2 level teaspoons of salt
2. Copy the "Water Salinity" graph handout, one for each student.
3. Gather materials and create packets for each student containing an egg, two clear plastic cups, a container of table salt, a spoon for stirring, a set of measuring spoons, and water.

Experiencing

1. Ask students why we may want to know how much salt is in water. Tell students that we're going to continue investigating the properties of salt water.
2. **Salinity test (egg).** Ask students to fill two clear plastic cups ¾ full of fresh water. Invite them to put the egg in one cup and observe what happens.
3. Ask students to add a tablespoon of salt to the second cup and stir until it's dissolved. Have each student place their egg in the cup of salt water. What do they observe?
4. Tell the students to remove the egg, add one more tablespoon of salt, and place the egg back in the water again. What is happening to the egg? Ask students to continue adding salt to the cup of water—one tablespoon at a time—until the egg floats.

Educator Tip: *We recommend that youth experience and try the hydrometer themselves if supplies permit; however, the activity is written as an educator demonstration assuming that you only have one or a few hydrometers available.*

5. **Salinity measurement (hydrometer demonstration):** Tell students that scientists use an instrument called a hydrometer (hy-drom-e-ter) to measure the salt content of water. The educator will use a hydrometer to determine the salinity of each sample and record their data on a graph.
6. Gather students around the four saltwater samples labeled A, B, C, and D, which you have prepared. Do not let your students know how much salt is in each container.
7. The educator should put the hydrometer in each solution and announce the measurement. Take three (3) measurements of each solution and ask students to average. Ask students to record the finding on their bar graph (Water Salinity Graph worksheet). Repeat this process until all four containers are measured.
8. **Test Solutions with an Egg:** Ask students to predict whether the egg will float or sink in each solution. Test each solution with an egg.



A hydrometer used to determine water densities in g/mL. The pink shaded region indicates the optimum density of saltwater aquaria at an average temperature of 20˚C (68˚F) to 25˚C(77˚F). From Exploring Our Fluid Earth, a product of the Curriculum Research & Development Group (CRDG), College of Education. University of Hawai'i.

Sharing, Processing, Generalizing

1. Ask students to examine their graphs and report out their observations.
2. Invite students to develop and communicate interpretations – why do they think adding salt makes the egg float? Write responses on the board.
3. Ask students where else they might measure the salt in the water. What measurement would they anticipate? (e.g., measuring ocean water).
4. Ask students to explain why they think it would be easier to swim in an ocean rather than a freshwater lake.

Educator Tip: *The observations of how saltwater affects the radish seeds leads well into questions about why scientists would want to know the salinity of water in the environment.*

Application Suggestions

1. Invite students to investigate and share where the water in their home faucet comes from. Encourage them to search online and through their municipal water agency. See if their water agency reports water testing results.
2. Make a map showing your community's water supply source. Share the map with your fellow students.

Session 6: Student Lab Book Page

Seed Test: How does saltwater affect seed growth?

Purpose: Test the effect of saltwater on the germination and growth of plants.

	Sample A	Sample B
1. Variable: amount of salt water		
2. Hypothesis: I think		
Results		
3. Day 1: How many seeds germinated?		
4. Day 2: How many seeds germinated?		
5. Day 3: How many seeds germinated?		
6. Day 4: How many seeds germinated?		
7. Day 5: How many seeds germinated?		
8. Conclusion: I learned		

Session 6: Student Lab Book Page

Water Salinity Graph

40				
39				
38				
37				
36				
35				
34				
33				
32				
31				
30				
29				
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14				
13				
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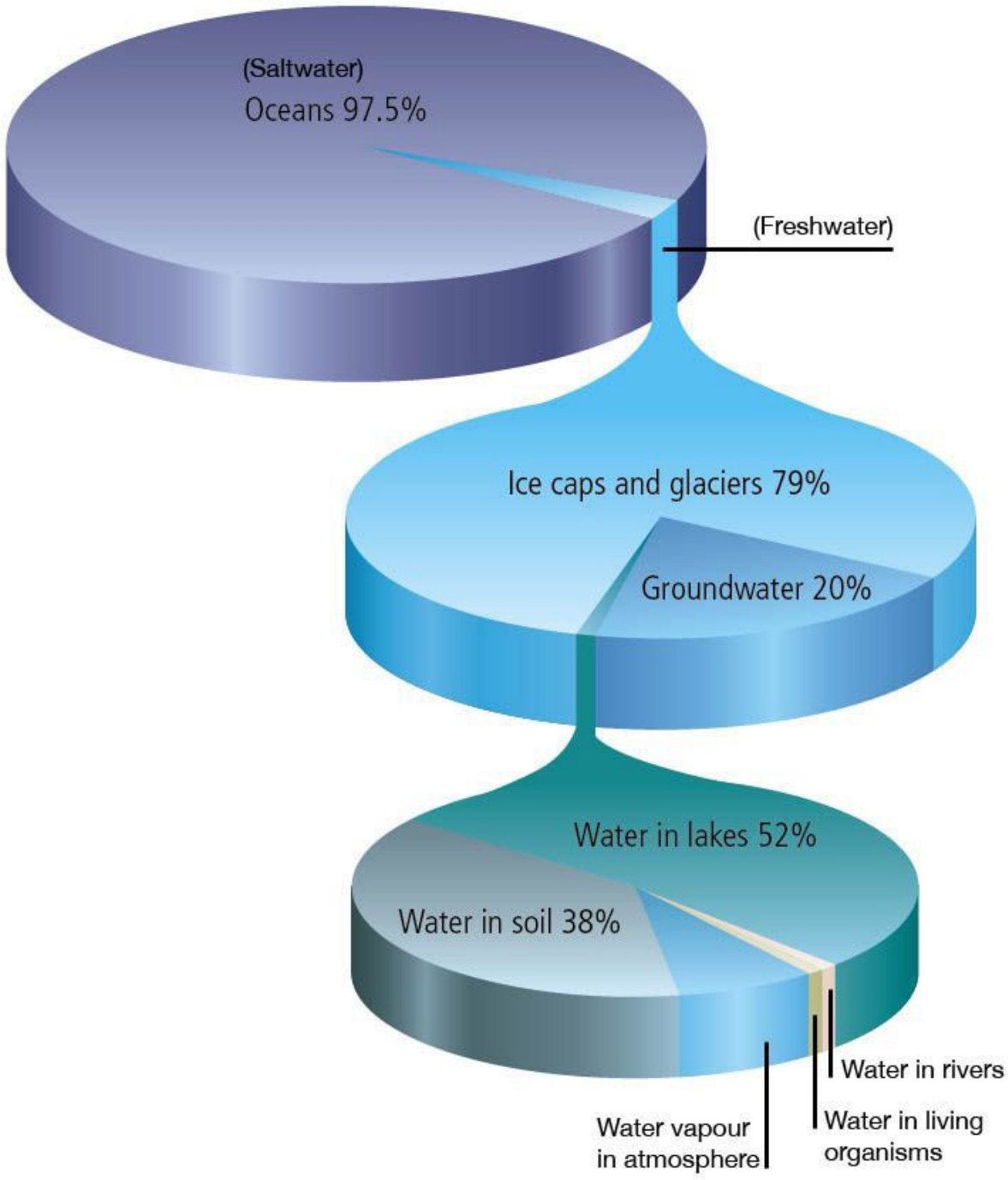
10				
9				
8				
7				
6				
5				
4				
3				
2				
1				
ppt*	**Sample A**	**Sample B**	**Sample C**	**Sample D**

*parts per thousand

Session 6: Student Lab Book Page

Water Distribution on Earth



Earth Forum, Houston Museum of Natural Science

Session 7: Discovering Water Density

Does all water weigh the same?

Overview

We don't think of water as having different densities, but it does! This session ties in with what students learned in the previous activities as they discover that water with dissolved minerals (like salt) is denser than fresh water. Students observe the separation of water according to its density and will place water samples in order relative to their density.

Purpose

Students will:

- Understand what density is.
- Understand that water forms layers with the densest water in the bottom layer
- See that dense water will seek to move to a location below less dense water.

Time Needed

- 35-40 minutes

Next Generation Science Standards

Make observations and measurements to identify the density of water.

Practices: Planning and carrying out investigations

Disciplinary Core Idea: Measurements of properties can be used to identify materials

Crosscutting Concept: Scale, proportion, and quantity

Materials

For Educators

- Two balls or cubes of equal size but different weights (like a cube of clay and a cube of Styrofoam, or a ping pong ball and a golf ball).
- To make water samples:
  - Set of measuring spoons
  - Measuring cup
  - Package of salt
  - 4 pitchers or large containers to mix saltwater solutions.
  - Four colors food coloring: yellow, green, red, blue.
  - Spoon to stir
- 5 clear plastic cups (12-16 oz.)
- Clear plastic straw
- Copy of Water Density Chart
- Water source

For Students

- 4 containers filled with the colored water samples
- Clear straw for each student
- 5 clear plastic cups:
  - 4 for colored water samples
  - 1 to empty water from straw between tests.
- Copy of Water Density Chart

Background Information (for educator only)

Objects that have the same size or volume may have different weight (or masses). When objects have the same size, but one weighs more, the one that weighs more for its size is said to be denser. Liquids also have density. Water with more minerals dissolved in it is denser than water with less minerals dissolved in it.

An effect of differing water densities is that lakes, oceans, and other bodies of water may contain different layers. Because dense water is heavier, it gathers at the bottom; water with fewer minerals is less dense and gathers at the top. When fresh water from rivers and streams enters the delta, ocean, or other saltwater body, it forms a top layer and doesn't readily mix. The water in these areas is layered.

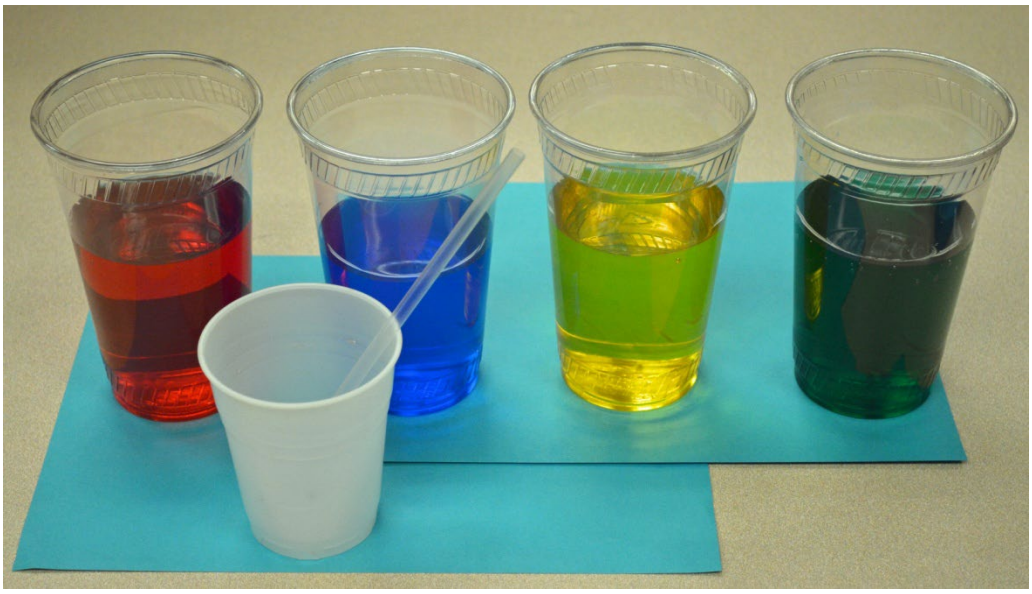
Some aquatic plants and animals prefer a certain level of salinity in their environment. As such, they will travel in the layer for which they are best suited. Fishermen use this information to identify where they might find a specific kind of fish.

Vocabulary and Concepts

Buoyancy: The tendency of an object to float.

Estuary: Where a river joins the ocean and freshwater and salt water meet.

Water Density: The weight of water per its volume.



Virtual Delivery

Introduction

Students will explore water density (salinity levels) using a clear straw to observe how water forms layers. They will experiment to identify and order four water samples of differing densities.

Session Outline

Activity	Time
Welcome and reflections on Exploring Salinity session	5 minutes
Experiencing	
• Student set-up	5 minutes
• Introductory questions	5 minutes
• Experimenting to problem solve water density questions	15 minutes
Sharing, Processing, Generalizing	10 minutes

Getting Ready

1. Read the lesson through to fully understand what students are to take away from this session.
2. Create the varying salt solutions. Fill each of the 4 pitchers or large containers with ½ gallon of tap water, salt, and food coloring as listed below:

Solution	Amount of Salt	Food Color
#1	None	Yellow
#2	1 Tbs.	Green
#3	2 Tbs.	Red
#4	4 Tbs.	Blue

Educator Tip: *Create the water samples well in advance. Warm water dissolves salt best. Use enough food coloring to really tint the water.*

3. Prepare your workspace. Using four clear cups, fill each ¾ with one of the colored solutions. Place an additional empty cup so students can empty water from their straw between tests.
4. Copy the Water Density handout found at the end of this session and in their Student Lab Book.
5. Set two clear plastic cups filled with tap water for demonstration.
6. Position your laptop or camera so that students have a clear view of the cups when you work.

Experiencing

1. Welcome students to Session 7 of 4-H Water Wizards. Ask students what they recall from the last session, Exploring Salinity.
2. **Student set-up:** Ask students to make sure they have their supplies for today's session with them. Remind them that they will need:
    - The 4 containers filled with the colored water samples
    - A clear straw
    - 5 clear plastic cups
    - Copy of Water Density Chart from their 4-H Water Wizards Student Lab Book
3. **Student Set Up:** Ask the students to set four of their plastic cups out and to carefully remove the lid on their four different colored water samples. Tell them to pour the water samples into the plastic cups. Show them your example. Ask them to open their 4-H Water Wizard Lab Book to the Water Chart.

Educator Tip: *Colored water may stain clothing and some surfaces. Students should do this activity outside or on surfaces where drops of colored water can be wiped up. A paper towel under the cups may also help.*

4. **Introductory Questions:** Make sure all students can see the cups of water prepared for the demonstration. Show them the two objects of similar size and shape (e.g., the ping-pong ball and golf ball). Drop the balls or cubes into the water, one in each container. Ask students what they observe and to explain.

Educator Tip: *Students may respond verbally, or you might want to have them type their ideas in the chat pod.*

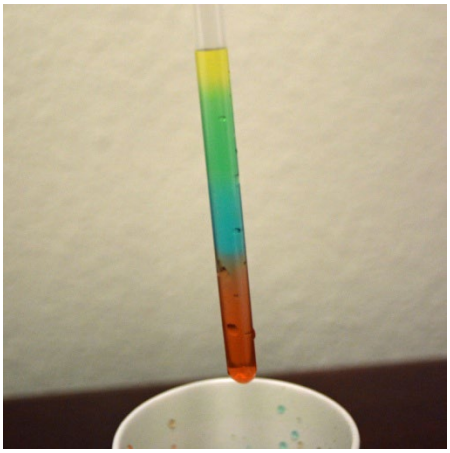
5. **Experimenting to Problem Solve:** Perform the following demonstration:
    a. Holding a finger over the top of a drinking straw, insert it about 1 inch into the yellow water. Remove your finger from the top of the straw, allowing air to escape and yellow water to flow into the straw. Replace your finger on the top of the straw and remove the straw from the water. Yellow water will stay in the bottom half of the straw.
    b. Keeping your finger on the half-filled straw, insert it about 2 inches into the blue water container. Remove your finger from the top of the straw, allowing blue water to enter. Replace your finger on the top of the straw and remove the straw from the water. Hold it so everyone can observe.
    c. Ask students what they observe. (The two colors will remain unmixed, with the blue on the bottom.)
    d. Repeat the above procedure, this time placing the straw first in the blue water followed by the yellow. Ask students to describe what they see. (They should note that the blue water gradually "moves down" to mix with the yellow, making a green mixture.)
    e. Ask for a hypothesis to explain why the colors blended in one instance but not the other? (Students may offer a variety of guesses.) As a hint, ask one person to taste the blue and yellow waters by dipping a fingertip into each and touching it to their tongue.

Educator Tip: *Be sure that students empty their straws into the extra cup so that they don't contaminate their water samples. Model this during the demonstration. Also, note that it is generally unadvisable to consume unknown chemicals (although only salt water in this activity).*

6. Tell the students that each colored water sample has a different amount of dissolved salt. Their task is to line up the four cups of the water from least salty to most salty. Tell them to use the empty cup to "empty" their straws as they experiment.
7. Allow the students to experiment with the waters. Encourage them to develop a plan to solve the problem. They can record their findings on the Water Density worksheet in their 4-H Water Wizards Lab Book.

Educator Tip: *Salt, a dissolved mineral, in the water makes the water more dense and denser water is "heavier" and settles toward the bottom, underneath less dense "lighter" water. Make sure students understand that while salt may make the water layer, it's the water's density (caused by the salt) that causes different layers to form.*

Sharing, Processing, Generalizing



1. Ask students to report their conclusions. Compare results.
2. Explore the experiment using the following questions:
    - When objects are a similar size and shape, why do some float and others sink?
    - What makes the water layer?
    - Do ocean and estuaries have different "layers?"
    - Why would this information be important?

Tell students they can discard their water samples by pouring them into a sink. Tell them to be careful not to spill when moving and pouring the colored water.

Application Suggestions

Have students investigate the different densities of fruits, vegetables, or other objects at home. Ask them to fill a bowl with water and collect a variety of objects (with an adult's permission) to put in the bowl to see what happens. Students can hypothesize what will happen when items are put in the bowl, then check their guesses. Which float best (or are more buoyant)? Which sink? Have students make notes and compare their findings.

In-Person Delivery

Introduction

Students will explore water density (salinity levels) using a clear straw to observe how water forms layers. They will experiment to identify and order four water samples of differing densities.

Session Outline

Activity	Time
Welcome and reflections on Exploring Salinity session	5 minutes
Experiencing	
• Introductory questions	5 minutes
• Experimenting to problem solve water density questions	15 minutes
Sharing, Processing, Generalizing	10 minutes

Getting Ready

1. Read the lesson through to fully understand what students are to take away from this session.

2. Create the varying salt solutions. Fill each of the 4 pitchers or large containers with ½ gallon of tap water, salt, and food coloring as listed below:

Solution	Amount of Salt	Food Color
#1	None	Yellow
#2	1 Tbs.	Green
#3	2 Tbs.	Red
#4	4 Tbs.	Blue

Educator Tip: *Create the water samples well in advance. Warm water dissolves salt best. Use enough food coloring to really tint the water.*

3. Prepare workstations. Using four clear cups, fill each ¾ with one of the colored solutions for every one or two students. Place an additional empty cup so students can empty the water from their straw between tests.

4. Copy the Water Density handout found at the end of this session, or have students bring their 4-H Water Wizards Lab Book that contains this chart.

5. Set two clear plastic cups filled with tap water for demonstration.

Experiencing

1. Welcome students to Session 7 of 4-H Water Wizards. Ask students what they recall from the last session, Exploring Salinity.

2. **Introductory Questions:** Make sure all students can see the cups of water prepared for the demonstration. Show them the two objects of similar size and shape (e.g., the ping-pong ball and golf ball). Drop the balls or cubes into the water, one in each container. Ask students what they observe and to explain.

3. **Experimenting to Problem Solve:** Either perform the following demonstration or ask a student to do it:
    a. Holding a finger over the top of a drinking straw, insert it about 1 inch into the yellow water. Remove your finger from the top of the straw, allowing air to escape and yellow water to flow into the straw. Replace your finger on the top of the straw and remove the straw from the water. Yellow water will stay in the bottom half of the straw.
    b. Keeping your finger on the half-filled straw, insert it about 2 inches into the blue water container. Remove your finger from the top of the straw, allowing blue water to enter. Replace your finger on the top of the straw and remove the straw from the water. Hold it so everyone can observe.
    c. Ask students what they observe. (The two colors will remain unmixed, with the blue on the bottom.)
    d. Repeat the above procedure, this time placing the straw first in the blue water followed by the yellow. Ask students to describe what they see. (They should note that the blue water gradually "moves down" to mix with the yellow, making a green mixture.)
    e. Ask for a hypothesis to explain why the colors blended in one instance but not the other? (Students may offer a variety of guesses.) As a hint, ask one person to taste the blue and yellow waters by dipping a fingertip into each and touching it to their tongue.

Educator Tip: *Be sure that students empty their straws into the extra cup so that they don't contaminate their water samples. Model this during the demonstration. Also, note that it is generally unadvisable to consume unknown chemicals (although only salt water in this activity).*

4. Send students to a workstation with straws and a set of cups containing the four colored water samples. Provide each station with an empty cup (in which students can "empty" their straws as they experiment). Tell the students that each colored water sample has a different amount of dissolved salt. Their task is to line up the cups of the water from least salty to most salty.

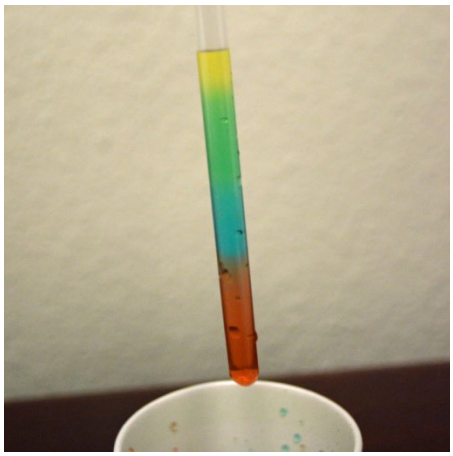
Educator Tip: *Give students time to work with their plan. Don't give helpful hints unless they are really struggling.*

5. Allow the students to experiment with the waters. Encourage them to develop a plan to solve the problem. They can record their findings on the Water Density worksheet in their 4-H Water Wizards Lab Book.

Educator Tip: *Salt, a dissolved mineral in the water, makes the water more dense and denser water is "heavier" and settles toward the bottom, underneath less dense "lighter" water. Make sure students understand that while salt may make the water layer, it's the water's density (caused by the salt) that causes different layers to form.*

Sharing, Processing, Generalizing

1. Ask students to report their conclusions. Compare results.



6. Explore the experiment using the following questions:
    - When objects are a similar size and shape, why do some float and others sink?
    - What makes the water layer?
    - Do ocean and estuaries have different "layers?"
    - Why would this information be important?

Application Suggestions

Have students investigate the different densities of fruits, vegetables, or other objects at home. Ask them to fill a bowl with water and collect a variety of objects (with an adult's permission) to put in the bowl to see what happens. Students can hypothesize what will happen when items are put in the bowl, then check their guesses. Which float best (or are more buoyant)? Which sink? Have students make notes and compare their findings.

Session 7: Student Lab Book Page

Water Density Chart

	Color of Water
Light (not dense) **Density of Water** Heavy (very dense)	

Session 8: The Science of Soap Suds

Can we determine which water samples are "harder" or "softer" than others?

Overview

Communities get their water from different sources and as such, their water supply contains differing types and amounts of dissolved minerals. Water hardness (the amount of dissolved minerals in water) affects water's taste and properties (for example, its ability to make soap suds).

In this activity, students will make a prediction based on their prior experience or knowledge about dissolved minerals in water, then perform a controlled experiment using soap suds as a variable to test their hypothesis. Student will learn that in a controlled experiment, accuracy is important. Controlling variables—in other words, making sure that everything is the same—is necessary to produce accurate results.

Next Generation Science Standards

Plan and conduct an investigation to describe and classify different kinds of water by their observable properties.

Practices: Planning and carrying out investigations

Disciplinary Core Idea: Structure and properties of matter

Crosscutting Concept: Patterns

Purpose

In this session students will:

- Understand what makes water hard and soft
- Make predictions about the relative hardness of different water samples
- Perform an experiment to test their predictions, using the ability to make suds as an indicator of water hardness

Time Needed

40 minutes (in-person delivery) 50 minutes (virtual delivery)

Materials

For Educators

(For in-person delivery)

1. Table salt
2. Tablespoon
3. Liquid measuring cup
4. Pitcher (2)

For Students

1. Three small cups per student
2. Four small jars with tight fitting lids per student
3. Liquid dishwashing soap (not detergent) – mini bottles (3 oz) work well
4. Distilled water
5. Bottled mineral water (like Pellegrino or Perrier)
6. Tap water
7. Table salt (for virtual delivery)
8. Liquid measuring cup
9. Measuring spoons
10. Markers and tape for labeling jars
11. Eye droppers

Background Information (for educator only)

Table salt (NaCl) is not the only mineral that dissolves in water. Many kinds of compounds or chemicals dissolve in water. Most water sources for humans have small amounts of different things dissolved in them. The kinds of things dissolved in water will differ depending on the rocks that are present in the area and the mineral salts in those rocks. Therefore, water in different areas may taste a little different.

When water contains a lot of dissolved calcium and magnesium minerals, it is called “hard water.” Hard water tastes a little different from “soft water,” which contains very little calcium and magnesium. Hard water is often good tasting. Hard water also prevents soap from forming bubbles and cleaning. The calcium and magnesium in hard water bind onto part of the soap molecule and inhibit its ability to make suds. Hard water can be treated to make it softer (less calcium and magnesium) and better for cleaning.

Soft water has high salt content, forms better suds and is better for cleaning. Often it does not taste as good as hard water. It may also be less healthy to drink.

Pure water can be created by heating it so that the water turns to steam and leaves the salt behind. The steam can then be collected and cooled to form liquid water again. This pure water is called distilled water.

Controlled experiments are important in science. In controlled experiments, variables (things that might be altered) are reduced so that scientists can better understand what has led to a specific result. The conditions for the experiment—temperature, time, quantity, etc.— need to be constant. By reducing the number of variables in the experiment, scientists can better conclude what has led to a specific result.

Vocabulary and Concepts

Controlled Experiment: A way to search for cause and effect by testing, limiting, or controlling variables.

Distilled Water: Water that has no minerals.

Variable: Any factor, trait, or condition that can exist in differing amounts or types. An experiment usually has three kinds of variables: independent, dependent, and controlled.

Virtual Delivery

Introduction

Students will hypothesize which of four water samples will make the best soap suds. They will then set up a controlled experiment to test their hypothesis.

Session Outline

Activity	Time
Experiencing	
• Students prepare for the experiment	10 minutes
• Water "hardness" or "softness" discussion	5 minutes
• Explain and conduct experiment	15 minutes
Sharing, Processing, Generalizing	
• Students share and compare findings	10 minutes
• Discuss the experiment	10 minutes

Getting Ready

1. Optional: Create distilled water samples for each student. To do this, measure 100 mL (about 1/3 cup) of distilled water and put it in a jar or bottle with tight fitting lid – one for each student.
2. A few days in advance, package materials for students to pick-up. Or share the materials list with them and ask students to gather the materials at home.

Educator Tip: *Distilled water and bottled mineral water can be purchased at most grocery stores.*

Experiencing

1. Gather students in the virtual room for the experiment. Let them know they are going to do an experiment regarding water "hardness" and water "softness" will be preparing for it together before beginning the discussion.
2. **Preparing the Experiment:** Ask students to gather their bottled water, distilled water sample, four jars and lids, measuring cup and spoons, dish soap, eye dropper, and table salt. Have students create a salt mixture by mixing 1/3 cup water with ½ teaspoon of table salt. Instruct the students to set the mixture to the side and not touch the supplies until they are instructed to do so.
3. **Water "Hardness" or "Softness" Discussion:** Tell students that today they will explore water "hardness" and "softness." Ask if anyone knows what these terms mean. Ask student what kinds of minerals might be dissolved in water? (They may recall the lessons on water salinity and density.) Once the students have given their ideas, remind them that water has many dissolved minerals and salts in it, not just table salt.
4. Ask students if they know the difference between distilled water, mineral water, salt water, and tap water. Once students have given guesses about the differences, describe the four different water samples and refer to the discussion about salinity. Each water has different properties and taste. Ask them to predict which water sample is the hardest and which is softest, based on what they know of distilled water. Have students record their predictions and their reason for the predictions on their Soap Suds Data Sheet.

5. **Explain & Conduct Experiment:** Tell the students that now they will do an experiment to test their prediction. They'll be measuring the hardness of water by seeing how difficult it is to form soap suds with their water samples. Do they have ideas as to how they might do this? Allow students to tell you their ideas how this might work. Next, explain that we'll be adding drops of soap to the water samples and shaking them to create suds.
6. Inform students that to draw accurate conclusions, we need to treat all the water samples the same way. Ask why. What are the conditions we need to keep constant? The students should come up with the following:
    a. Starting with the same amount of water in each container
    b. Using the same kind and size of container
    c. Adding one drop of liquid soap at a time
    d. Doing the same number of shakes to create suds
    e. Seeing if the suds last the same amount of time (to the count of 10)
    f. Carefully recording the number of drops of liquid soap it takes to make lasting suds.
7. Tell the students to label one of their containers as "Distilled Water" using tape and a pen. Next, have the students measure 1/3 cup of distilled water into a covered container and add one drop of liquid soap (if you supplied the distilled water sample, have the students label the sample's container and add one drop of liquid soap to the water sample). Put the cap on tightly and shake five times. Count to 10 and see if the suds remain. If not, add another drop of soap and repeat the procedure until there are lasting suds. Ask students to record on their data sheet the number of drops of liquid soap needed to produce lasting suds.
8. Discuss briefly how scientists perform experiments by holding all variables constant, except for the one variable that is being tested. In this experiment, water will be the one variable that will change: the amount of soap, the amount of water, and how much the jar is shaken will all remain the same.
9. Allow time for students to conduct their experiment using the other three water samples (tap water, bottled mineral water, salt water). Be sure to remind them to label their containers using the tape and pen, and to record their findings on their data sheet.

Educator Tip: *It is not appropriate to praise or reward those who made correct predictions. The most important thing is to make predictions and then test them. When testing an incorrect prediction, you still learn.*

Sharing, Processing, Generalizing

1. As a group, allow the students to share and compare their findings.
    a. Which sample of water had the longest lasting suds?
    b. Is your tap water hard or soft?
    c. Which type is the hardest water?
    d. Which water type is the softest?
    e. What kind is best for washing clothes?
    f. Were your predictions correct?
    g. What is distilled water? Where does it come from?

2. **Discuss the experiment**.
    a. What were the variables that were controlled? (soap, amount of water, amount of shaking)
    b. What was the variable that was changed? (type of water)
    c. What was the variable we were observing to see if it was affected by the variable we changed? (soap suds)
    d. What different procedures might be used to get similar results? (Drop soap into all samples of water at the same time, shake them all at the same time, for the same amount of time, and then note the differences in suds.)

Application Suggestions

1. Invite students to consider how hard or soft the water in their own home is. In the experiment, which was just conducted, how did the soap suds for the tap water compare to the distilled water sample? What effects might hard (or soft) water have in your home?
2. What is another simple experiment which can be done at home? What would the variables be? Which would you keep constant as the controlled variable?

In-Person Delivery

Introduction

Students will hypothesize which of four water samples will make the best soap suds. They will then set up a controlled experiment to test their hypothesis.

Session Outline

Activity	Time
Experiencing	
• Water "Hardness" and "Softness" Discussion	5 minutes
• Explain and Conduct Experiment	15 minutes
Sharing, Processing, Generalizing	
• Students share and compare findings	10 minutes
• Discuss the experiment	10 minutes

Getting Ready

1. Copy Soap Suds Data Sheet, one for each student.
2. Make saltwater mixture – mix 1Tablespoon table salt with 20 ounces of water in a pitcher.
3. Get distilled water jug and bottled mineral water ready. Fill a pitcher with tap water.
4. Keep water samples at educator's station.
5. Set up a workstation for each student. Include one jar (with lid), soap, eye dropper, tape, pen, and measuring cup.

Educator Tip: *Distilled water and bottled mineral water can be purchased at most grocery stores.*

Experiencing

1. **Water "Hardness" and "Softness" Discussion:** Ask students not to touch their workstation until told to do so. Tell students that today they will explore water "hardness" and "softness." Ask if anyone knows what these terms mean. Ask student what kinds of minerals might be dissolved in water? (They may recall the lessons on water salinity and density.). Remind them that water has many dissolved minerals and salts in it, not just table salt.
2. Ask students if they know the difference between distilled water, mineral water, salt water, and tap water – allow them to guess the differences. Once the students have given their ideas, describe the four different water samples and refer to the discussion about salinity. Each water has different properties. Ask them to predict which water sample is the hardest and which is softest, based on what they know of distilled water. Have students record their predictions and their reason for the predictions on their Soap Suds Data Sheet.

Educator Tip: *Each student should make and record their own predictions.*

3. **Explain & Conduct Experiment:** Tell the students that now they will do an experiment to test their prediction. They'll be measuring the hardness of water by seeing how difficult it is to form soap suds with their water samples. Do they have ideas as to how they might do this? Allow students to tell you their ideas how this might work. Next, explain that we'll be adding drops of soap to the water samples and shaking them to create suds.
4. Inform students that to draw accurate conclusions, we need to treat all the water samples the same way. Ask why. What are the conditions we need to keep constant? The students should come up with the following:
    a. Starting with the same amount of water in each container
    b. Using the same kind and size of container
    c. Adding one drop of liquid soap at a time
    d. Doing the same number of shakes to create suds
    e. Seeing if the suds last the same amount of time (to the count of 10)
    f. Carefully recording the number of drops of liquid soap it takes to make lasting suds.
5. Break students into groups of four. Let the students know that each group member will have one water sample to add soap to and shake.
6. Fill each of the four jars with 100 ml (or about 1/3 cup) of one of the four water samples (distilled, tap water, mineral water, salt water). Have each student take a jar.
7. Remind students to label their jars. Tell them they will record their findings on their data sheet.
8. Ask each student to use their eye dropper to put a single drop of liquid soap in their water sample. Remind them that the drops of soap should all be the same amount.
9. Tell the students to put the cap on tightly and, with their team, shake their bottles five times. Ask them to place their jars on a table and compare the suds. Count to 10 and see if the suds remain. Which water sample(s) made suds? Add another drop of soap and repeat the procedure until there are lasting suds for each water sample.
10. Ask students to record on their data sheet the number of drops of liquid soap needed to produce lasting suds for each water sample.
11. Discuss briefly how scientists perform experiments by holding all variables constant, except for the one variable that is being tested. In this experiment, water will be the one variable that will change: the amount of soap, the amount of water, and how much the jar is shaken will all remain the same.

Educator Tip: *It is not appropriate to praise or reward those who made correct predictions. The most important thing is to make predictions and then test them. When testing an incorrect prediction, you still learn.*

Sharing, Processing, Generalizing

As a group, allow the students to share and compare their findings.

a. Which sample of water had the longest lasting suds?
b. Is your tap water hard or soft?
c. Which type is the hardest water?
d. Which water type is the softest?
e. What kind is best for washing clothes?

f. Were your predictions correct?

g. What is distilled water? Where does it come from?

Discuss the experiment.

a. What were the variables that were controlled? (soap, amount of water, amount of shaking)

b. What was the variable that was changed? (type of water)

c. What was the variable we were observing to see if it was affected by the variable we changed? (soap suds)

d. What different procedures might be used to get similar results? (Drop soap into all samples of water at the same time, shake them all at the same time, for the same amount of time, and then note the differences in suds.)

Application Suggestions

1. Invite students to consider how hard or soft the water in their own home is. Encourage students to conduct the experiment with tap water from their home. How did the soap suds for the tap water compare to the distilled water sample? What effects might hard (or soft) water have in your home?
2. What is another simple experiment which can be done at home? What would the variables be? Which one would you keep constant as the controlled variable?

Session 8: Student Lab Book Page

Soap Suds Data Sheet

Let's look at four (4) different samples of water:

Distilled
Tap
Bottled Mineral Water
Salt water

Predictions:

Which type of water do you think is the softest and will make soap suds the quickest?

Which type of water do you think is the hardest and will take the longest to make suds?

Observations:

Type of Water	Number of Drops
Distilled water	
Tap water	
Bottled mineral water	
Salt water	

Session 9: Exploring Service Learning

What is community service? Why volunteer? What are our community's water issues?

Overview

While participating in 4-H Water Wizards, students have come to understand more about water and that water issues—quality, use of, and conservation—exist. It is important for young people to recognize that they can make a positive impact on these issues. As residents, they have a responsibility to act. Youth feel empowered when they successfully complete a community service project and recognize that they can make a difference in their world.

In this session, students will define volunteerism and understand why service in their community is important. They will brainstorm water issues where they live and identify one, they would like to address.

Next Generation Science Standards

Design a method for minimizing a human impact on water in the local environment.

Practices

Obtaining, evaluating, and communicating information

Disciplinary Core Idea

Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.

Crosscutting Concept: Cause and effect

Purpose

Students will:

- Explore the concepts of volunteering, community, and community service.
- Brainstorm water issues in their community and select one they would like to take on as a project.

Time Needed

- 55 minutes

Materials

For Educators	For Students
In-Person Delivery 1. Flip chart and markers; whiteboard and markers	In-Person Delivery 1. Paper 2. Writing utensils (pencils)

Background Information (for educator only)

Civic engagement is more than voting in elections. Democracy requires active participation of citizens working together to make their communities a better place to live. It is everyone's responsibility to be involved in community life and to seek ways to address needs and issues where they study, work and live. Civic engagement is taught. Children see it modeled and should be given opportunities and encouragement to

actively participate in community life. Young people are capable and have ideas and energy to make important contributions where they live.

Volunteerism is giving of time, resources, and energy to something you believe in or care about, without expecting payment in return. People volunteer through their churches, schools, community groups, and workplaces. There are many reasons why people volunteer: they see a need they can fill; they believe they can make a difference for someone else; they believe in being generous; it makes them feel good; it can be fun. Volunteers want to see something happen, and they take responsibility to help achieve it.

A **community** is where people live. It can be as close as family and as broad as the world (think global community). It includes schools, workplaces, neighborhoods, and towns on the local level, and the state and country on a broader scale. All of these are communities in which we live, make an impact upon, and that support us.

Why is it important to empower young people? It allows kids to see themselves as capable, builds self-esteem, and teaches skills. Youth feel like they're a part of the larger community and that they can make a difference. It promotes a sense of belonging and encourages engagement. Perhaps more importantly, young people have ideas, enthusiasm, skills, and energy that make them valuable contributors.

Vocabulary and Concepts

Civic Engagement: working to make a difference in your community

Community: a group of people that either live in the same place or have a thing in common.

Service Learning: a form of education where learning occurs through helping others.

Volunteer: a person who does something without being paid

Key Components of Service Learning

- **Integrates Learning.** Learning is integrated into relevant content (often 4-H project-based). The service informs content, and the content informs service.
- **Meets Genuine Needs.** Youth identify and learn about a recognized need in their community.
- **Promotes Youth Voice and Choice.** Youth demonstrate decision making in a safe environment that allows them to make mistakes and still succeed.
- **Creates Partnerships.** Youth participate in the development of community partnerships and share responsibility with community members.
- **Benefits Everyone.** Mutual teaching and learning, and shared responsibility benefit all participants in the service-learning experience.
- **Builds Civic Responsibility.** Young people understand they have a role in improving society and are empowered by their ability to improve the quality of life in the community.

Virtual Delivery

Introduction

Students begin planning for their community service project by discussing what it means to volunteer and defining what is meant by community. Students then revisit water issues they have identified in earlier 4-H Water Wizards sessions and select one around which to build their service project. This lays the groundwork for planning their project in the next session.

Session Outline

Activity	Time
Welcome	5 minutes
Experiencing	
Part 1: Introduction to Volunteerism	15 minutes
Part 2: Selecting a Community Service Project	30 minutes
Sharing, Processing, Generalizing	5 minutes

Getting Ready

1. Prior to the session, keep a watch in newspapers, on the Internet, or television for local water issues. If possible, save links for information.
2. Ready a Word document or virtual whiteboard to share with students when recording their responses.

Experiencing

1. **Part 1: Introduction to volunteerism.** Gather students together in the virtual room. Open a virtual whiteboard (or share your screen). Write the word "*VOLUNTEER*." Ask students to share what the word means to them. Record their responses.
2. Ask students to describe who they know that volunteers and what they do in their volunteer job. Record their responses on the virtual whiteboard. Get several responses.
3. Ask the students to describe their own volunteer experience. What did they do? They may have volunteered at school (crossing guard, classroom helper), or with their families or friends. Have they ever helped in their family? How? If you get an allowance or a reward for helping, is that volunteering?
4. Ask students why they think people volunteer. Record their answers.
5. Explain to students that part of the 4-H Water Wizards is to be a volunteer in a community service project. Let them know that today they can come up with an idea for a water-related service project in their community.
6. Remind students that they are a part of many different communities. Write the word "*COMMUNITY*." Ask students to share what the word means to them. Record their responses. Ask students to name some of the communities in which they belong. (These might include their neighborhood, their school, their city, etc.). Tell the students to keep these different communities in mind as we discuss potential service projects.

Educator Tip: *Volunteering may be done in any of these communities.*

7. **Part 2: Selecting a community service project.** Remind students that in 4-H Water Wizards we have learned a lot about how important water is and about some water issues. Tell them that now they can be part of the solution for one of these issues.
8. *Small groups generate ideas.*
    a. *With virtual breakout rooms*: Split the class into smaller breakout rooms. Ask each breakout to come up with responses to the following questions:
        i. How have you observed water being wasted?
        ii. How have you observed water pollution happening in your community?
        iii. What are personal, family, and community problems with water?
    b. *Without virtual breakout rooms*: Pose the same questions (i., ii., and iii. above) and allow enough time for every student to contribute. You may ask students to submit responses verbally or through chat. Collect all ideas and create lists.

Educator Tip: *Remind students that their community can be as small as their family or as big as the world. If groups are having difficulty identifying community specific issues, give them some examples. Maybe their school's sprinkler system runs too long creating a runoff problem, or perhaps people in the neighborhood are not well-informed about how soap or oil enters the water systems through storm drains. Facilitators might wish to identify a focus area prior to this discussion. Will your group focus on a need in your community/your school or program site/within the homes of the youth?*

9. *Small groups narrow ideas*. After students have generated responses to the questions, ask each team (or entire class) to discuss and select one issue they would like to work on. Once the teams have identified their issue, ask them to come up with ideas of how they might solve the problem. What kinds of things might they do? What is needed to make it happen? Ask each team to record their chosen issue and an idea for addressing it.
10. *Pitch the idea*. Ask each team to select a speaker to present the group's service project idea. Allow time for the larger group to ask questions about the team's proposed project.
11. *Class to decide on one (or a few) projects*. Tell the students that now we're going to come to consensus as a large group on which project we'd like to work. You may use the "Service Learning Project Ideas" Educator Aid to help list the ideas. Lead the group in discussion:
    a. What are some of the advantages for each choice?
    b. What are some disadvantages?
    c. What resources do they need?
    d. Which ideas seems most exciting?

Educator Tip: *There are many ways to make the decision about which project to do. Voting is one way, but it may not allow for buy-in from everyone. In consensus, the choice selected may not be everyone's favorite, but all agree they can, and will, support the group decision. To help ensure all youth can contribute to a project, you may want to allow options for several different projects (perhaps around the central theme) or different iterations (same project, different timing, or location). Determine ideal group size based on your group, setting, and projects.*

12. After discussing the options, ask students which project they would like to work on as a group. Hopefully, through the discussion, they have become aware of the possibilities, limitations and work involved for each idea, and are beginning to narrow their options. Remind them that while the choice they're making may not be everyone's preference, we're looking for an idea everyone can support.
13. Once consensus is reached, circle the idea on virtual whiteboard. Congratulate the class (consensus building is rarely easy) and tell them that the next time the meet they will be designing a project plan.

Educator Tip: *Many things may enter the group's decision-making process. They will want to consider how "doable" the project is including the time they must commit to it and the resources needed to make it happen.*

Educator Tip: *Save all the student responses as these will be valuable later in the project.*

Sharing, Processing, Generalizing

1. Explain how your new understanding of water can be used to help solve the issue we selected.
2. Given the resources we have (people, time, transportation, money) explain ways we can contribute to our community/school? What resources do we need?
3. Explain why you chose this project.
4. Describe the main goal you want to accomplish when doing this project.
5. Describe what you learned in today's activity.
6. Describe how you felt while doing today's activity.

In-Person Delivery

Introduction

Students begin planning for their community service project by discussing what it means to volunteer and defining what is meant by community. Students then revisit water issues they have identified in earlier 4-H Water Wizards sessions and select one around which to build their service project. This lays the groundwork for planning their project in the next session.

Session Outline

Activity	Time
Welcome	5 minutes
Experiencing	
Part 1: Introduction to Volunteerism	15 minutes
Part 2: Selecting a Community Service Project	30 minutes
Sharing, Processing, Generalizing	5 minutes

Getting Ready

1. Gather flip chart and pens. Set up the room to encourage discussion.
2. Prior to the session, keep a watch in newspapers, on the Internet, or television for local water issues. If possible, save links for information.

Experiencing

1. **Part 1: Introduction to volunteerism.** Gather students together in a circle with the flip chart nearby. Write the word "*VOLUNTEER*." Ask students to share what the word means to them. Record their responses.
2. Ask students to describe who they know that volunteers and what they do in their volunteer job. List the jobs on the flip chart as students share. Get several responses.
3. Ask the students to describe their own volunteer experience. What did they do? They may have volunteered at school (crossing guard, classroom helper), or with their families or friends. Have they ever helped in their family? How? If you get an allowance or a reward for helping, is that volunteering?
4. Ask students why they think people volunteer. Record their answers.
5. Explain to students that part of the 4-H Water Wizards is to be a volunteer in a community service project. Let them know that today they can come up with an idea for a water-related service project in their community.
6. Remind students that they are a part of many different communities. Write the word "*COMMUNITY*." Ask students to share what the word means to them. Record their responses. Ask students to name some of the communities in which they belong. (These might include their neighborhood, their school, their city, etc.). Tell the students to keep these different communities in mind as we discuss potential service projects.

Educator Tip: *Volunteering may be done in any of these communities.*

7. **Part 2: Selecting a community service project.** Remind students that in 4-H Water Wizards we have learned a lot about how important water is and about some water issues. Tell them that now they can be part of the solution for one of these issues.
8. *Small groups generate ideas*. Split the class into smaller groups. Ask each group to come up with responses to the following questions:
    i. How have you observed water being wasted?
    ii. How have you observed water pollution happening in your community?
    iii. What are personal, family, and community problems with water?

Educator Tip: *Remind students that their community can be as small as their family or as big as the world. If groups are having difficulty identifying community specific issues, give them some examples. Maybe their school's sprinkler system runs too long creating a runoff problem, or perhaps people in the neighborhood are not well-informed about how soap or oil enters the water systems through storm drains. Facilitators might wish to identify a focus area prior to this discussion. Will your group focus on a need in your community/your school or program site/within the homes of the youth?*

9. *Small groups narrow ideas*. After students have generated responses to the questions, ask each team (or entire class) to select one issue they would like to work on. Once the teams have identified their issue, ask them to come up with ideas of how they might solve the problem. What kinds of things might they do? What is needed to make it happen? Ask each team to record their chosen issue and an idea for addressing it.
10. *Pitch the idea*. Ask each team to select a speaker to present the group's service project idea. Allow time for the larger group to ask questions about the team's proposed project.
11. *Class to decide on one (or a few) projects*. Tell the students that now we're going to come to consensus as a large group on which project we'd like to work. You may use the "Service Learning Project Ideas" Educator Aid to help list the ideas. Lead the group in discussion:
    a. What are some of the advantages for each choice?
    b. What are some disadvantages?
    c. What resources do they need?
    d. Which ideas seems most exciting?

Educator Tip: *There are many ways to make the decision about which project to do. Voting is one way, but it may not allow for buy-in from everyone. In consensus, the choice selected may not be everyone's favorite, but all agree they can, and will, support the group decision. To help ensure all youth can contribute to a project, you may want to allow options for several different projects (perhaps around the central theme) or different iterations (same project, different timing, or location). Determine ideal group size based on your group, setting, and projects.*

12. After discussing the options, ask students which project they would like to work on as a group. Hopefully, through the discussion, they have become aware of the possibilities, limitations and work involved for each idea, and are beginning to narrow their options. Remind them that while the choice they're making may not be everyone's preference, we're looking for an idea everyone can support.

13. Once consensus is reached, circle the idea on whiteboard. Congratulate the class (consensus building is rarely easy) and tell them that the next time the meet they will be designing a project plan.

Educator Tip: *Many things may enter the group's decision-making process. They will want to consider how "doable" the project is including the time they must commit to it and the resources needed to make it happen.*

Educator Tip: *Save all the student responses as these will be valuable later in the project.*

Sharing, Processing, Generalizing

1. Explain how your new understanding of water can be used to help solve the issue we selected.
2. Given the resources we have (people, time, transportation, money) explain ways we can contribute to our community/school? What resources do we need?
3. Explain why you chose this project.
4. Describe the main goal you want to accomplish when doing this project.
5. Describe what you learned in today's activity.
6. Describe how you felt while doing today's activity.

Session 9: Educator Aid

Making Our Community a Better Place

Volunteer	Community

Session 9: Educator Aid

Service Learning Project Ideas

Group Project Ideas

Session 10: Planning a Service Learning Project

Choosing and Planning a Community Service Learning Project

Overview

In the previous session, students came to consensus on a water issue on which they will act. In this session, youth will create a plan to support their idea on how to address the issue.

Next Generation Science Standards

Design a method for minimizing a human impact on water in the local environment.

Practices

Obtaining, evaluating, and communicating information

Disciplinary Core Idea

Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.

Crosscutting Concept: Cause and effect

Purpose

Students will:

- Design a plan for their community service project.
- Brainstorm and agree upon tasks needed to fulfill their plan.

Time Needed

- 60 minutes

Materials

For Educators	For Students
In-Person Delivery 1. Students' responses from previous session 2. Flip chart and markers; chalkboard and chalk or whiteboard and markers	In-Person Delivery 1. Paper 2. Writing utensils (pencils)

Background Information (for educator only)

Planning a project can be exciting, fun, frustrating, and fulfilling. Groups will share ideas and works together to create something meaningful. It's an opportunity for young people to learn an array of practical skills, from organizing and communicating, to teamwork and responsibility.

Planning involves several things. First, there is the gathering of ideas and agreement on what to pursue. Planners need to list and prioritize tasks to be done, who will complete them, and when they need to be completed. We call this a timeline. Planners need to think through logistics and assure the details are attended to. Reflecting on the completed project—and evaluating how it went—is another important part of the process.

In choosing and planning a service project in 4-H Water Wizards, often students will come up with ideas that involve educating others on the water issue they intend to address. There are lots of creative ways they might communicate through teaching including creating a video, writing a skit, designing posters, and writing articles or letters for a newsletter or the media. They may also decide to plant a tree, label storm drains to advise that they empty directly into creeks and rivers or demonstrate water conservation techniques at a community event or school assembly. The ideas are many and varied.

Sometimes group process is challenging. It's important that everyone feels as though they have contributed to the project and that they have been part of a team. Everyone should come away with a job to do. Working as part of a greater group—and learning to express ideas, compromise, and support others while keeping a positive attitude—is a tremendous life skill.

In supporting children as they participate in planning and doing their project, adult leaders need to be encouraging, look for opportunities to praise, and be positive. There may be logistical pieces of the plan (such as permission slips or arrangements for transportation) that adults may need to be involved with, but young people should be given every opportunity to complete the tasks outlined (with adult support and guidance). Remember, most of us learn best when we are the "doers."

Educator Tip: *Creating a plan helps to assure success. It serves as a guideline to get things done and helps us organize our time, tasks, and responsibilities. Children don't often can do planning in their young lives. It's important for them to learn why planning is important and some of the parts that make up a good plan.*

Virtual Delivery

Introduction

Students learn how to create an action plan for their service idea agreed upon last session. This includes listing tasks that need to be done, arranging them into a timeline, determining who will do what, and creating a list of supplies needed to complete their project.

Session Outline

Activity	Time
Welcome	5 minutes
Experiencing	
Birthday party planning example	10 minutes
Planning their project.	40 minutes
Sharing, Processing, Generalizing	5 minutes

Getting Ready

1. Have student responses on their idea from the previous session readily available to share digitally.
2. Create a “Project Timeline” on a blank document (example found at the end of this session).

Experiencing

1. **Welcome.** Gather students in the virtual room. Ask students what they remember from the previous session. (Important points for them to recall include discussing volunteerism, brainstorming some of the water issues in their community, and deciding on a way that they thought they could help with one of these problems.) Refer to the brainstorming sheet they created together and read the chosen issue and the strategy the students came up with.
2. Ask students what additions or changes they would like to make to what they have suggested.
3. **Birthday party planning example.** Tell the students that today we are going to plan so that our idea can happen. Ask them why planning is important. Invite them to pretend that they are going to plan a birthday party. What kinds of things do they need to think about and plan for?

Educator Tip: *As children are listing things to think about in planning a pretend birthday party, make sure they mention things like what type of party, location, when, guest list, etc.*

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4. **Planning their project.** Tell the students that we are going to begin our planning process by listing everything we think we need to do, or might want to do, to complete our project. Instruct them not to worry about the order of the ideas; we’ll arrange them later. Record student ideas on a blank whiteboard (or on the “Project Planning Ideas” document and share your screen).
5. After all ideas are listed, read them back to the group. Now is the time to evaluate the ideas presented. Are there any ideas listed that may not be relevant to the plan? What items may not work?

6. Ask student to prioritize their action steps by numbering, from first to last, the order the activities need to be done. While ordering the list, look for activities that students may have forgotten. Bring these to their attention and ask if they think they need to be added. Make sure to include an evaluation of the project in the timeline.

Educator Tip: *Look for ways to involve students in recording ideas and making the Project Timeline. In creating the timeline, it may be easiest to start with the end date (the date the event happens) and work backwards.*

7. Once the list is complete and prioritized, transfer the actions steps, in order, to the previously prepared Project Timeline chart.
8. After the Project Timeline has all action items listed in order, re-read it to the group to assure nothing has been left out. Tell the group that now we'll decide completion dates for each item on the list. Fill in a completion date for each action item.
9. Tell the students it's time to assign volunteers to tasks. Ask them to think about what part of the plan they'd like to take responsibility for. Some action plan items may involve the whole group, others done by a team of students, and still others completed by individuals. In assigning students to jobs, be aware that some jobs may be more popular than others and look for opportunities to create teams. Be sure that everyone is included. Add names to the Project Timeline chart.

Sharing, Processing, Generalizing

1. How did you feel about the planning process?
2. Describe what you found easy and what you found difficult about the planning process.
3. Discuss how your group worked together as a team.
4. Describe other information you believe you need to embark upon this project.
5. What other kinds of things might you use this planning process for?

Time to Complete the Project!

Return to Session 11 after the project is completed.

In-Person Delivery

Introduction

Students learn how to create an action plan for their service idea agreed upon last session. This includes listing tasks that need to be done, arranging them into a timeline, determining who will do what, and creating a list of supplies needed to complete their project.

Session Outline

Activity	Time
Welcome	5 minutes
Experiencing	
Birthday party planning example	10 minutes
Planning their project.	40 minutes
Sharing, Processing, Generalizing	5 minutes

Getting Ready

1. Gather flip chart and pens. Set up the room to encourage discussion.
2. Post student responses on their idea from the previous session.
3. Create a “Project Timeline” on a flip chart (example found at the end of this session).

Experiencing

1. **Welcome.** Ask students what they remember from the previous session. (Important points for them to recall include discussing volunteerism, brainstorming some of the water issues in their community, and deciding on a way that they thought they could help with one of these problems.)
   Refer to the brainstorming sheet they created together and read the chosen issue and the strategy the students came up with.
2. Ask students what additions or changes they would like to make to what they have suggested.
3. **Birthday party planning example.** Tell the students that today we are going to plan so that our idea can happen. Ask them why planning is important. Invite them to pretend that they are going to plan a birthday party. What kinds of things do they need to think about and plan for?

Educator Tip: *As children are listing things to think about in planning a pretend birthday party, make sure they mention things like what type of party, location, when, guest list, etc.*

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4. **Planning their project.** Tell the students that we are going to begin our planning process by listing everything we think we need to do, or might want to do, to complete our project. Instruct them not to worry about the order of the ideas; we’ll arrange them later. Record student ideas on the flip chart.
5. After all ideas are listed, read them back to the group. Now is the time to evaluate the ideas presented. Are there any ideas listed that may not be relevant to the plan? What items may not work?

6. Ask student to prioritize their action steps by numbering, from first to last, the order the activities need to be done. While ordering the list, look for activities that students may have forgotten. Bring these to their attention and ask if they think they need to be added. Make sure to include an evaluation of the project in the timeline.

Educator Tip: *Look for ways to involve students in recording ideas and making the Project Timeline. In creating the timeline, it may be easiest to start with the end date (the date the event happens) and work backwards.*

7. Once the list is complete and prioritized, transfer the actions steps, in order, to the previously prepared Project Timeline chart.
8. After the Project Timeline has all action items listed in order, re-read it to the group to assure nothing has been left out. Tell the group that now we'll decide completion dates for each item on the list. Fill in a completion date for each action item.
9. Tell the students it's time to assign volunteers to tasks. Ask them to think about what part of the plan they'd like to take responsibility for. Some action plan items may involve the whole group, others done by a team of students, and still others completed by individuals. In assigning students to jobs, be aware that some jobs may be more popular than others and look for opportunities to create teams. Be sure that everyone is included. Add names to the Project Timeline chart.

Sharing, Processing, Generalizing

1. How did you feel about the planning process?
2. Describe what you found easy and what you found difficult about the planning process.
3. Discuss how your group worked together as a team.
4. Describe other information you believe you need to embark upon this project.
5. What other kinds of things might you use this planning process for?

Time to Complete the Project!

Return to Session 11 after the project is completed.

Session 10: Student Lab Book Page

Project Timeline

Every project needs a detailed project plan. The plan will outline all the tasks that need to be done, who will do them, and when they will be accomplished.

- Identify specific tasks to be accomplished to address your community problem.
- Decide when each task needs to be done. Make sure that you give enough time for each task.
- Decide who will be the team leader for each task.

Project Name	
Project Goal	
Target Completion Date	

Action Item	Who Will Do It	Due Date	Done
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐

Session 10: Educator Aid

Project Planning Ideas

Session 11: Project Evaluation

Evaluating and Celebrating Our Project

Overview

After completion of their community service project, students explore what went well and any challenges they experienced in planning and it. They'll think critically and suggest how they might improve their project if they were to do it again. This session should also be a time to celebrate their work.

Next Generation Science Standards

Evaluating a service project for minimizing a human impact on water in the local environment.

Practices

Obtaining, evaluating, and communicating information.

Disciplinary Core Idea

Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.

Crosscutting Concept: Cause and effect.

Purpose

Students will:

- Evaluate their work on the community service project they planned and implemented.
- Feel acknowledged for their effort.

Time Needed

- 45 to 60 minutes

Materials

For Educators	For Students
In-Person Delivery 1. Flip chart and markers; chalkboard and chalk or whiteboard and markers	In-Person Delivery 1. Copies of the 4-H Water Wizards Evaluation

Background Information (for educator only)

Sometimes when a project concludes successfully, we tend to say, "Wow! That was great!" or if things have not gone well, "Boy, I'm glad that's over." Often in our busyness we put the task in the done column and move on to the next project at hand. Yet looking back on our work offers a learning opportunity and a chance to realize that reflection is a tool for growth.

Reflection is the term used to describe the process by which participants think about an experience they've had. Reflection is part of understanding the experience and making sense of it. It is a form of scientific inquiry: examining the experience, asking questions, wondering how or why, formulating ideas, and fitting new information into previously held ideas.

There are two elements to consider when reflecting on the service-learning experience. First, there is the product or what the group did. Perhaps their plan called for stenciling storm drains, presenting informational skits to younger children, or creating a campaign to save water at home or school. In reflecting upon the product, participants might consider whether the plan was completed, what helped or hindered their work, and whether the project made a difference (i.e., did the younger children learn things through the skit? Is the school saving more water?).

The other element to examine is the process the group experienced. How did the team work together? What created the success and challenges we encountered? If we were to do the project again, what would we change?

It's easy when groups evaluate their project to focus on what went wrong. Begin the discussion with positive reflections. When exploring challenges or problems in the project, frame the discussion in terms of what the group could do differently to address these concerns.

Remember that the willingness to address a community concern, to try something new, to create a plan and attempt to make a difference, is something to celebrate! Effort is important and should always be acknowledged.

Virtual Delivery

Introduction

Students conclude their service learning project and their exploration about water by reflecting on the service project they've just completed and analyzing their product, process, and feelings about their work. They also think back to different activities they completed in 4-H Water Wizards and evaluate what they learned.

Session Outline

Activity	Time
Experiencing, Sharing, Processing, Generalizing	
Reflection and evaluation	25 minutes
Student surveys	5 minutes
Celebration	20-30 minutes

Getting Ready

1. Prepare the Project Evaluation table (found at the end of this session) on a virtual whiteboard or Word document that can be shared with students. In each quadrant, write one of the following:
    a. How did the project meet the needs of our school or community?
    b. Describe how you felt about the project.
    c. What worked well in the project?
    d. If you were going to do this project again, what would you do differently?
2. In advance, distribute paper copies of the 4-H Water Wizards Student Evaluation form (found at the end of this session), one for every student. Or obtain a URL link for students to complete the survey digitally.
3. Have something in mind to help the children celebrate their project's completion. This might include a small remembrance for each child, or perhaps a festive treat.
4. This activity should be done shortly after the service project is completed so that ideas are fresh and enthusiasm still high.

Experiencing, Sharing, Processing, Generalizing

1. **Reflection and evaluation.** Gather students in a virtual group. Invite the group into a discussion about the service project they've recently completed. Ask the students why we take time to evaluate a project after we're done with it. Invite students to think back on the project implementation itself and on the planning and all the steps leading up to the project. Give them a moment to think about what they liked about the project, what worked well, and what they would change to make it better if they were to do it again.

Remind the group that in our evaluation, we don't want to talk about people, but about the work itself. For example, do not to use people's names in praising or criticizing, but focus on what did or did not work well with the project.

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2. Beginning with the first quadrant, ask the students to share how their project met the needs of their school or community. Capture each thought on the flip chart in the appropriate column.

3. Continue the process for each question, asking students to share their thoughts and ideas, and recording them.
4. Read the finished responses back to the group. Ask if anyone has anything else to add. Thank them for their effort in completing their project. Remind them that planning and working together on a group project can be very hard work.

Educator Tip: *Make sure the comments are specific and seek clarification if necessary. For example, if someone says, "The food was good," ask "Exactly what do you mean?" to understand if it was tasteful, plentiful, well-liked by participants, etc.*

When exploring things that need improvement, encourage participants not to list what didn't work, but what would make it better. For example, if someone says, "There wasn't enough time," ask how that might be fixed—like leaving earlier, reducing the number of activities, etc.

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5. After finishing the service project evaluation, tell students you'd like to know how they felt and what they learned in participating in 4-H Water Wizards. Let them know that their comments are important and will be used to help you evaluate the project. As a refresher, ask students if they can remember some of the different activities, they've done in 4-H Water Wizards. Call on students to share with the group what those activities were. Record responses.
6. **Student surveys.** Ask students to complete the 4-H Water Wizards Student Evaluation by pencil at home or through the digital URL link. Allow students ample time to complete the survey.
7. **Conclude with the celebration.**

In-Person Delivery

Introduction

Students conclude their service learning project and their exploration about water by reflecting on the service project they've just completed and analyzing their product, process, and feelings about their work. They also think back to different activities they completed in 4-H Water Wizards and evaluate what they learned.

Session Outline

Activity	Time
Experiencing, Sharing, Processing, Generalizing	
Reflection and evaluation	25 minutes
Student surveys	5 minutes
Celebration	20-30 minutes

Getting Ready

1. Prepare a flip chart with four quadrants. In each quadrant, write one of the following:
    a. How did the project meet the needs of our school or community?
    b. Describe how you felt about the project.
    c. What worked well in the project?
    d. If you were going to do this project again, what would you do differently?
2. Copy the 4-H Water Wizards Student Evaluation form (found at the end of this session), one for every student.
3. Have something in mind to help the children celebrate their project's completion. This might include a small remembrance for each child, or perhaps a festive treat.
4. This activity should be done shortly after the service project is completed so that ideas are fresh and enthusiasm still high.

Experiencing, Sharing, Processing, Generalizing

1. **Reflection and evaluation.** Invite the group into a discussion about the service project they've recently completed. Ask the students why we take time to evaluate a project after we're done with it. Invite students to think back on the project implementation itself and on the planning and all the steps leading up to the project. Give them a moment to think about what they liked about the project, what worked well, and what they would change to make it better if they were to do it again.

Remind the group that in our evaluation, we don't want to talk about people, but about the work itself. For example, do not to use people's names in praising or criticizing, but focus on what did or did not work well with the project.

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2. Beginning with the first quadrant, ask the students to share how their project met the needs of their school or community. Capture each thought on the flip chart in the appropriate column.

3. Continue the process for each question, asking students to share their thoughts and ideas, and recording them.
4. Read the finished responses back to the group. Ask if anyone has anything else to add. Thank them for their effort in completing their project. Remind them that planning and working together on a group project can be very hard work.

Educator Tip: *Make sure the comments are specific and seek clarification if necessary. For example, if someone says, "The food was good," ask "Exactly what do you mean?" to understand if it was tasteful, plentiful, well-liked by participants, etc.*

When exploring things that need improvement, encourage participants not to list what didn't work, but what would make it better. For example, if someone says, "There wasn't enough time," ask how that might be fixed—like leaving earlier, reducing the number of activities, etc.

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5. After finishing the service project evaluation, tell students you'd like to know how they felt and what they learned in participating in 4-H Water Wizards. Let them know that their comments are important and will be used to help you evaluate the project. As a refresher, ask students if they can remember some of the different activities, they've done in 4-H Water Wizards. Call on students to share with the group what those activities were. Record responses.
6. **Student surveys.** Pass out the 4-H Water Wizards Student Evaluation. Allow students ample time to complete the survey.
7. **Conclude with the celebration.**

Session 11: Student Lab Book Page & Educator Aid

Project Evaluation

Project Name	
Project Goal	
How did the project meet the needs of our school or community?	**Describe how you felt about the project.**
What worked well in the project?	**If you were going to do this project again, what would you do differently?**

4-H Water Wizards Evaluation for Students

School you attend: _____ Date: _____

Did you like participating in 4-H Water Wizards? Yes No

List three things you learned in 4-H Water Wizards.

1.

2.

3.

Can you name two water issues in our community?

1. _____

2. _____

Which 4-H Water Wizards activities were your favorites? (Choose only two)

_____ Evaporation activity
_____ Building a model watershed
_____ Enviroscape® (the plastic town)
_____ Measuring your family's water use
_____ Guest presenter who spoke about wetlands
_____ Bottled water taste test
_____ Water salinity (growing radish seeds and the floating egg)
_____ Water density (colored water in straws)
_____ Testing soap suds
_____ Planning and doing a community service project

Are you using less water since participating in 4-H Water Wizards? Yes No

If so, what are you doing to conserve water?

Glossary of Terms

Accumulate – To pile up, gather, collect.

Accuracy – The correctness or truthfulness of something; the ability to be precise and avoid errors.

Agriculture –The occupation, business, or science of cultivating the land, producing crops, and raising livestock to produce food.

Atmosphere – The layer of air surrounding the earth.

Aquifer – A layer of permeable rock, sand, or gravel through which groundwater flows, containing enough water to supply wells and springs.

Aqueduct – Human made canals that carry water from its source (rivers, lakes, and other bodies of water) to their place of use (towns, cities, agricultural fields).

Artesian well – A body of ground water that is held under the surface between layers of hard rock under pressure that is strong enough to cause the water to flow upwards without the need for pumping. The water may even spurt out of the ground if the natural pressure is high enough and there is an outlet for the water to pass through.

Average – A mathematical value calculated by adding several numbers together and dividing that sum by the number of numbers added.

Bedrock – The solid rock beneath a layer of soil, rock fragments, or gravel.

Brackish – A mixture of fresh and salt water.

Buoyancy – The tendency of an object to float.

Civic Engagement – Working to make a difference in your community**.**

Combustion – The burning of a fuel, through rapid oxidation (a chemical process) in which a substance (the fuel) reacts vigorously with oxygen to produce heat and light (seen as a flame) and a small amount of water, in the form of vapor. Examples: a car engine, or a fire.

Community – A group of people that either live in the same place or have something in common.

Condensation – The conversion of vapor gas to a liquid.

Conservation practices – Things done (including rules followed) to preserve, manage and take care of natural resources (such as water, forests, animals).

Controlled Experiment – A way to search for cause and effect by testing, limiting, or controlling variables.

Dam – A barrier to prevent the flow of water partially or fully for storage or diversion purposes.

Data – Information, often in the form of a list of numbers, facts or figures obtained from experiments or surveys, used as a basis for making calculations or drawing conclusions.

Debris – Scattered pieces left behind after something has been broken down or destroyed.

Delta—Where a river meets the sea or ocean.

Density – Mass per volume (how heavy compared to how large something is).

Distilled Water — Water that has no minerals

Drainage basin – An area of land that is drained by a river.

Earth's topography – The surface features of a region including hills, valleys, rivers, lakes, canals, bridges, roads, cities, etc.

Estuary – Where a river joins the ocean and freshwater and saltwater meet.

Evaporation – To remove moisture; to change a liquid or a solid into vapor.

Expelled – Eliminated, thrust out.

Flood – Any relatively high flow of water that overflows natural or artificial banks of a stream, river, lake, or body of water inundating the floodplain or the valleys.

Flood plain – A strip of relatively flat land bordering a stream, river, or lake that can accommodate the overflow of flood waters.

Germinate – Beginning to grow.

Grassed waterways – Streams, creeks, sloughs, lakes that have grass growing at their edges or in the shallow edges of the waterway.

Groundwater – Water found in pores or cracks in sand, gravel, and fractured rock beneath the land surface.

Habitat –The landscape of natural and modified conditions in which plants, animal and humans live, e.g., forest, desert, or wetlands.

Hydrology –The study of water, its properties, laws, and distribution.

Hydrometer – An instrument used to measure the salinity of water.

Infiltrate – To pass through a substance by filtration, or to make a liquid or gas pass through a substance by filtration.

Inhospitable – An area that does not offer protection or refuge, an area that is difficult to live in, an area with poor habitat conditions, that is barren.

Irrigation – To bring a supply of water to a dry area, especially to help crops to grow.

Intercept – To prevent from reaching a destination or target by stopping or diverting.

Infiltrate – To filter or travel through; permeate.

Molecules – The smallest parts of an element or compound that can exist and keep the characteristics of that element or compound.

Non-point source pollution – Pollution that comes from many sources indirectly through run-off into water sources.

Objective – Not influenced by personal feelings or opinions in considering and representing facts.

Percolate – To make a liquid or gas pass, or filter through, a porous substance; to pass slowly through something or spread throughout a space.

Point source pollution – Pollution that flows from pipes or comes from specific points such as industrial plants, sewage treatment plants, or storm water drains.

Precipitation – Rain, hail, sleet, and snow.

Preference – The choice of one thing over another.

Reservoir – A place where large amounts of water are collected and stored for later use. A container of water.

Respiration – The process by which a living organism or cell takes in oxygen from the air or water, utilizes it and gives off products of oxidation such as water vapor and carbon dioxide.

Respire – To breathe air in and out.

Retained – Held back.

Runoff – Water that drains or flows off surfaces to collect elsewhere.

Salinity – The amount of salt dissolved in water.

Seep – *v.* To pass, flow or ooze gradually through a porous substance, *n*. a small pool or spring where liquid from the ground escapes to the surface.

Service Learning — A form of education where learning occurs through helping others.

Spring – A source of water that flows out of the ground as a small stream or pool.

Terrace – A flat raised strip of beach or ground that has been formed naturally along the coast, beside a river or lake, or along the side of a valley by erosion.

Transpiration – The passage of water through a plant from the roots, through the vascular system in the leaves, to the atmosphere.

Vapor – A gas, such as mists, fog, steam, and or clouds.

Variable – *A*ny factor, trait, or condition that can exist in differing amounts or types. An experiment usually has three kinds of variables: independent, dependent, and controlled.

Volunteer — A person who does something without being paid

Water Density – The weight of water per its volume.

Watershed – The land area that drains water to a stream, river, lake, or ocean.

Appendix 1: 4-H Waters Wizards Materials Lists

In this Appendix, you will find a Materials List to assist you in organizing the materials and making the purchases needed to implement and deliver the Water Wizards program:

- Materials needed for each lesson
- Materials included in the curriculum
- Materials to be printed
- Materials to purchase

The Materials List is also divided into two delivery modes:

- In Person Delivery
  - with groups of 20
- Virtual Delivery
  - with individual students

A key resource of suggested stores to purchase materials is also included for:

- Large and Bulk Purchases
- Small Group Purchases
- Individual Student Purchases
- Recommended Store Purchases

Water Wizards Sessions

Session 1: The Water Cycle– Nature's Recycling System

Session 2: Watersheds: Where We Live

Session 3: My Community Watershed — Keeping Our Waterways Clean

Session 4: Water Use and Conservation

Session 5: Water Taste Test

Session 6: Exploring Salinity

Session 7: Discovering Water Density

Session 8: The Science of Soap Suds

Session 9: Exploring Service Learning

Session 10: Planning a Service Learning Project

Session 11: Project Evaluation

Session 1: The Water Cycle – Nature's Recycling System

Materials List

Kit 1: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 1: The Water Cycle – Nature's Recycling System	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
Activity 1: Exploring the Water Cycle Crayola Crayons or Felt-Tip Markers	Set of 8	Set of 8	Ofc Str/Am		
Drawing or Construction Paper – 11"x17"	1 pk	1 sheet	Ofc Str/Am		
White Chart Paper or White Board	1		Ofc Str/Am		
Water Wizards Student Lab Book	1 per student	1 copy		Prt.	
Water KWL Chart	1 copy	1 copy		Prt.	Incl
Water Cycle Poster	1 copy	1 copy			Incl
Water Cycle Video	1 upload	1 upload			Incl
Written Activity Instructions		1 copy		Prt.	Incl
Water Word Bank/Graphics		1 copy			Incl
Water Wizards Curriculum (optional)				Prt.	Incl
Access to Water					
Activity 2: Investigating Evaporation Plastic Ruler	10	1	Ofc Str/Am		
Sponge-Cellulose 6"x3"	5	1	Grc Str/Am		
Clear Plastic Cups-7-9 oz.	15	3	Grc Str/Am		
Rubber Band	1 pk	1-3	Ofc Str/Am		
Plastic Wrap	5 pk	3 sheets	Grc Str/Am		
Measuring Cup-liquid/1cup	5	1	$ Tree/Am		
Permanent Maker	5	1	Ofc Str/Am		
Pencil	20	1	Ofc Str/Am		
Instruction for Experiment		1 copy		Prt.	Incl
Video of Experiment/Demo material list		1 copy/set		Prt.	Incl
Access to water					
Paper Towels	1 roll	5 sheets	Grc Str/Am		

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Grc Str/Am *Grocery Store/Smart & Final/Amazon
Ofc Str/Am *Office Stores/Amazon
$ Tree/ Am*Dollar Tree Stores/Amazon

Session 2: Watersheds: Where We Live

Materials List

Kit 2: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 2: Watersheds: Where We Live	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
Pan or meat try with lip	20	1	Online Purc		
Large Cardstock Sheets	1 pk	2-3 sheets	Ofc Str/Am		
Food Coloring-blue/or Soluble marker	5	1	Grc Str/Am		
Masking tape	5 rolls	1 roll	Ofc Str/Am		
Saran Wrap (sheets or roll)	5 pk	3 sheets	Grc Str/Am		
Pen or Pencil	20	1	Ofc Str/Am		
Spray bottle	5	1	Ofc Str/Am		
Paper Towels	5 rolls	5 sheets	Grc Str/Am		
Book to lift one end of pan, 1”-2” in height	20	1	Recyclable		
Activity Instructions				Prt.	
Watershed Poster					Incl

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Grc Str/Am*Grocery Store/Smart & Final/Amazon
Ofc Str/Am*Office Stores/Michaels/Walmart/Amazon
Online Purc *Online Purchasers
Recyclable*Recyclables

Session 3: My Community Watershed-
Keeping Our Waterways Clean

Materials List

Kit 3: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 3: My Community Watershed-Keeping Our Waterways Clean	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
Water Supply and Usage Poster	1	1	Enviro Onl		Incl
Enviroscape Model in Carrying Case	1	1	Enviro Onl		
Enviroscape Community Set	1	1	Enviro Onl		
London's Afternoon in Big River Story	1	1		Prt.	Incl
Set of Pollutants -Cocoa (powder) -Chocolate sprinkles (cake decoration) -Colored sprinkles (cake decoration) -Flavored drink mix or powered gelatin of different colors: •Red •Green •Yellow	 2 cont. 2 cont. 2 cont. 2 cont. 2 cont. 3 cont.	 1 cont. 1 cont. 1 cont. 1 cont. 1 cont. 1 cont.	Grc Str/Am		
Watershed Model (Created by students in last session)					
Spray Bottle w/Water	1	1	Ofc Str/Am		
Zip Lock Baggies-Snack size	1 box	6	Grc Str/Am		
Water Access					
Paper Towels	1 roll	5 sheets	Grc Str/Am		

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Enviro Onl *Enviroscape Online: Consult 4-H
Grc Str/Am *Grocery Store/Smart & Final/Amazon
Ofc Str/Am *Office Stores/Michaels/Walmart/Amazon
Recyclable*Recyclables

Session 4: Water Use and Conservation

Materials List

Kit 4: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 4: Water Use and Conservation	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
Flip Chart Paper	1	N/A	Ofc Str/Am		
Flip Chart Markers	1 set	N/A	Ofc Str/Am		
Water KWL Chart (completed in Ses. 1)	1	1			
Graph Paper	2 pk	1 pk	Ofc Str/Am		
Calculator (can use personal phones)	5	1	$ Tree/Am		
Pencils	20	1 copy	Ofc Str/Am		
Lab book: Water Usage Chart					Incl
Lab book: Student Tally Sheet				Prt.	Incl
Water Usage Class Graph					Incl
Water Use Ideas					Incl
Paper Towels	1 roll	5 sheets	Grc Str/Am		

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Grc Str/Am *Grocery Store/Smart & Final/Amazon
Ofc Str/Am *Office Stores/Amazon
$ Tree/ Am*Dollar/Dollar Tree Stores/Amazon

Session 5: Water Taste Test

Materials List

Kit 5: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 5: Water Taste Test	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
Activity 1:Water Taste Test Bottle Water-3 different brands ½ - 1 gal.	3	N/A	Grc Str/Am		
Pitcher-at least ½ gal. size	2	2	$ Tree/Am		
Tap water					
Mini cups-dixie cup size	1 pk	4	Grc Str/Am		
Large Plastic Cups (16 oz)	10	2	Grc Str/Am		
Paper bags	8 grocery size	N/A	Grc Str/Am		
Permanent marker	5	1	Ofc Str/Am		
Several salt free crackers *(optional)*	1 pk	3-4	Grc Str/Am		
Chart paper	1	N/A	Ofc Str/Am		
Chart Markers	1 set	N/A	Ofc Str/Am		
Felt-tip markers	5 sets	1	Ofc Str/Am		
Calculator	1	1	$ Tree/Am		
Mini Bottles of Water/3 different brands	N/A	3	Grc Str/Am		
Paper Towels	1 roll	5 sheets	Grc Str/Am		
Lab book: Score Sheet					incl
Lab book: Water Taste Test Score sheet					Incl
Lab book: Taste Test Average Table					Incl
Charted Graph-Water Preference					Incl
Activity 2:Unseen, But Detected by Taste Bottle of Water (20 oz)	2	1	Grc Str/Am		
Large Clear Plastic Cups or Measuring Cups	5	3	Grc Str/Am		
Clear Plastic Cups (12 oz)	20	2	Ofc Str/Am		
Box of Table Salt	2 boxes	6 Salt pks.	Grc Str/Am		
Box of Granular Sugar	2 boxes	4 Sugar pks.	Grc Str/Am		
Beverage Stirs	10	2	Grc Str/Am		
Eye dropper	20	1-3	Ofc Str/Am		
Measuring Cups	1 set	1 set	$ Tree/Am		
Measuring Spoons	1 set	1 set	$ Tree/Am		
Pencil	5	1	Ofc Str/Am		
Paper Towel	1 roll	5 sheets	Grc Str/Am		
Permanent Marker	5	1	Ofc Str/Am		
Calculator	5	1	$ Tree/Am		

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Grc Str/Am *Grocery Store/Smart & Final/Amazon
Ofc Str/Am *Office Stores/Amazon
$ Tree/Am *Dollar/Dollar Tree Stores/Amazon

Session 6: Exploring Salinity

Materials List

Kit 6: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 6: Exploring Salinity	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
Activity 1: Fresh Water vs Salt Water Sealable Plastic Bags-sandwich size	60	3	Grc Str/Am		
Paper Towels	1 roll	5 sheets	Grc Str/Am		
Radish Seeds or Beans	200	10	Garden Ctr		
Measuring Spoon Set	5	1	$ Tree/Am		
Liquid Measuring Cup-2c	5	1	$ Tree/Am		
Plastic Cups 12-16 oz	60	3	Grc Str/Am		
Table Salt	2 boxes	5 pks	Grc Str/Am		
Water 2 cups-salted					
Water 2 cups-fresh					
Permanent Marking Pen	5	1	Ofc Str/lAm		
Lab book: Water Distribution on Earth figure	1 copy	1 copy			Incl
Lab book: Seed Test worksheet	1 copy	1 copy			Incl
Activity 2:Measuring Salinity of Water Samples Clear Containers of Water: *premixed solutions* -Container C: No Salt -Container B: 1/2 teaspoon of salt -Container D: 1 teaspoon of salt -Container A: 2 teaspoons of salt	4 20 oz cups or 4 liquid measuring cups	4 20 oz cups or 4 liquid measuring cups			
Container of Water	1 sample	1 sample			
Clear Plastic Cups 16 oz	8		Grc Str/Am		
Stir Spoons	4	1	$ Tree/Am		
Hydrometer	4	1	Pet Str		
egg	4 uncooked	1 uncooked	Grc Str/Am		
Box of Table Salt	2 boxes	5 pks	Grc Str/Am		
Lab book: Water Salinity Graph	1 copy	1 copy			Incl

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Grc Str/Am *Grocery Store/Smart & Final/Amazon
Ofc Str/Am *Office Stores/Amazon
$ Tree/ Am*Dollar Tree Stores/Amazon
Garden Ctr*Walmart Garden Center/Home Depot Garden Center
Pet Str *Petco/Aquarium Store/Pet Mountain (online)

Session 7: Discovering Water Density

Materials List

Kit 7: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 7: Discovering Water Density	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
2 balls-different density-golf ball or bouncy ball/ping pong or 2 squares -different density-clay/styrofoam	4	1	$ Tree/Am Ofc Str/Am		
Water	2-2 cups	2-2 cups			
Clear Plastic Cups (12-16 oz)	8	2	Grc Str/Am		
Clear Plastic Straws	40	2	Grc Str/Am		
Clear Plastic Cup (12-14 oz)	20	2	Grc Str/Am		
Measuring Cups	4 sets	1 set	$ Tree/Am		
Water Source	1 cup of water	1 cup of water			
Pitcher or large containers	4	1	$ Tree/Am		
Stir Spoons (1 set of 4)	4 sets	1 set	$ Tree/Am		
Box of Table Salt	2 boxes	1 box	Grc Str/Am		
Food Coloring-blue, green, red, yellow	1 cont. each	1 pk each	Grc Str/Am		
4 containers with lid	4 sets	1 set	$ Tree/Am		
Lab book: Water Density Chart	1 copy	1 copy			Incl
Paper Towel	1 roll	5 sheets	Grc Str/Am		

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Grc Str/Am *Grocery Store/Smart & Final/Amazon
Ofc Str/Am *Office Stores/Amazon
$ Tree/ Am*Dollar/Dollar Tree Stores/Walmart/Amazon

Session 8: The Science of Soap Suds

Materials List

Kit 8: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 8: The Science of Soap Suds	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
Small Cups (dixie size)	16	4	$ Tree/Am		
Small jars with lids (same size)	16	4	$ Tree/Am		
Distilled Water	1 (20 oz)	1 (8 oz)	Grc Str/Am		
Mineral water (like Pellegrino or Perrier)	1 (20 oz)	1 (8 oz)	Grc Str/Am		
Tap water	1 (20 oz)	1 (8 oz)			
Salted water (1 tsp of salt per 20 oz)	1 (20 oz)	1 (8 oz)			
Water source	Access	Access			
Eye dropper	4	1	$ Tree/Am		
Liquid dishwashing soap-small	1 bottle	1 bottle	Grc Str/Am		
Table Salt	1 box		Grc Str/Am		
Measuring spoons	1 set	1 set	$ Tree/Am		
Pitchers	4	1	$ Tree/Am		
Liquid measuring cup	4	1	$ Tree/Am		
Permanent Marker	4	1	Ofc Str/Am		
Masking Tape	1 roll	1 roll	Ofc Str/Am		
Soap Suds Data Sheet					Incl
Paper Towels	1 roll	5 sheets	Grc Str/Am		

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Grc Str/Am *Grocery Store/Smart & Final/Amazon
Ofc Str/Am *Office Stores/Amazon
$ Tree/ Am*Dollar/Dollar Tree Stores/Walmart/Amazon

Session 9: Exploring Service Learning

Materials List

Kit 9: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 9: Exploring Service Learning	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
Flip chart and markers or whiteboard and markers	1	1	Ofc Str/Am		
Paper	20	1	Ofc Str/Am		
Writing Utensils (pencils)	20	1	Ofc Str/Am		

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Grc Str/Am *Grocery Store/Smart & Final/Amazon
Ofc Str/Am *Office Stores/Amazon
$ Tree/ Am*Dollar/Dollar Tree Stores/Walmart/Amazon

Session 10: Planning a Service-Learning Project

Materials List

Kit 10: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 10: Planning a Service-Learning Project	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
Flip chart and markers or whiteboard and markers	1	1	Ofc Str/Am		
Paper	20	1	Ofc Str/Am		
Writing Utensils (pencils)	20	1	Ofc Str/Am		
Project Timeline	5	1	Ofc Str/Am	Prt.	Incl

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Grc Str/Am *Grocery Store/Smart & Final/Amazon
Ofc Str/Am *Office Stores/Amazon
$ Tree/ Am*Dollar/Dollar Tree Stores/Walmart/Amazon

The Service-Learning Project the students plan will determine what supplies are needed. Create list below.

Session 11: Project Evaluation

Materials List

Kit 11: Materials and Supplies	Materials Needed		Where to Locate Materials		
Session 11: Project Evaluation	**In Person Per Grp of 20**	**Virtual Per Student**	**Purchase at stores**	**Prt.**	**Incl.**
Flip chart and markers or whiteboard and markers	1	1	Ofc Str/Am		
4-H Water Wizards Evaluations	20	1	Ofc Str/Am	Prt.	Incl
Treats	20	1	Grc Str/Am		
Certificate or tokens to celebrate project completion	20	1	Ofc Str/Am		

*COVID-19 Protector Supplies on Hand: gloves, hand sanitizer, Clorox wipes

Suggested Stores to Make Purchases

Grc Str/Am *Grocery Store/Smart & Final/Amazon
Ofc Str/Am *Office Stores/Amazon
$ Tree/ Am*Dollar/Dollar Tree Stores/Walmart/Amazon

Shopping List

In Person Delivery		Per Group of 20	
Quantity	Item	Quantity	Item

Virtual Delivery		Per Student	
Quantity	Item	Quantity	Item

This Shopping Inventory List for Sessions 9•10•11 will be complete as needed

*Personal safety supplies: gloves, hand sanitizer, Clorox wipes

Suggested Stores for Making Purchases

***Smart & Final/Grocery Store-**
***Office Supply Store/Amazon-**
***Dollar /Dollar Tree Stores/Online/Amazon-**

Appendix 2: 4-H Water Wizards

Next Generation Science Standards (NGSS) Summary

These pages provide a summary for educators of the Next Generation Science Standards (NGSS) which are covered in the 4-H Water Wizards cirriculum.

NGSS Summary Table

Session	Standard	Practices	Disciplinary Core Idea	Crosscutting Concept
1	Describe ways the geosphere, biosphere, hydrosphere, and atmosphere interact.	Analyzing and interpreting data; Obtaining, evaluating, and communicating information.	Earth systems interact in multiple ways to affect Earth's surface.	Energy and matter: Flows, cycles, and conservation.
2	Describe the amounts of salt water and fresh water to provide evidence about the distribution of water on Earth.	Developing and using models; Planning and carrying out investigations.	The roles of water in Earth's surface processes.	Scale, proportion, and quantity.
3	Conduct an investigation to demonstrate how pollution is created and travels through a watershed.	Constructing explanations; Engaging in argument from evidence.	As human populations increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	Cause and effect.
4	Conduct an investigation to understand home water usage.	Planning and carrying out an investigation; Obtaining, evaluating, and communicating information.	As human populations increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	Cause and effect.
5	Conduct an investigation to determine which water sample is preferred.	Analyzing and interpreting data; Engaging in argument from evidence	Things that people do to live comfortably can affect the world around them.	Patterns.

NGSS Summary Table Continued

Session	Standard	Practices	Disciplinary Core Idea	Crosscutting Concept
6	Use observations to describe patterns of what plants and animals (including humans) need to survive.	Planning and carrying out investigations; Analyzing and interpreting data	Earth materials and systems.	Cause and effect.
7	Make observations and measurements to identify the density of water.	Planning and carrying out investigations.	Measurements of properties can be used to identify materials.	Scale, proportion, and quantity.
8	Plan and conduct an investigation to describe and classify different kinds of water by their observable properties.	Planning and carrying out investigations.	Structure and properties of matter	Patterns.
9	Design a method for minimizing a human impact on water in the local environment.	Obtaining, evaluating, and communicating information.	Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.	Cause and effect.
10	Design a method for minimizing a human impact on water in the local environment.	Obtaining, evaluating, and communicating information.	Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.	Cause and effect.
11	Evaluating a service project for minimizing a human impact on water in the local environment.	Obtaining, evaluating, and communicating information.	Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.	Cause and effect.