Children's Environmental Literacy Foundation

ACTIVITIES FOR EVERYDAY LEARNING

Rainbow in a Jar

Lesson Overview

Students will use the skills of observation to see what happens to the liquids over time. This experiment is a fun way for little scientists to learn about capillary action and color mixing. Parents can use this activity as a way to review primary and secondary colors or a way to introduce how roots pull water from the soil into the plant (against the force of gravity). Kids will be delighted to see how water can "walk" in this colorful science experiment.

GRADE LEVEL

PK- 8TH GRADE

CONNECTIONS TO THE BIG IDEAS OF SUSTAINABILITY

Systems

Change over Time

Children's Book Connections

Color mixtures: 'Mix it Up' by Herve Tullet, 'Mouse Paint' by Ellen Stoll Walsh
Plants: 'Planting a Rainbow' by Lois Ehlert, 'What do Roots do?' By Kathleen V. Kudlinski, 'Up in the Garden and Down in the Dirt' by Kate Messner and Christopher Silas Neal

Materials Needed

- 6 glass jars or drinking glasses
- Food dye/ liquid watercolor (red, yellow and blue)
- Paper towels (select-a-size type)

The Lesson

Essential Questions (choose based on age/interest):

- Art: How can we use color in our art? How can we use primary colors to create secondary colors? Hypothesize the results of mixing primary colors and test your hypothesis. How does color impact our lives?
- Science: How can liquids move? How do plants move water from the soil into the plant? How does an organism's structure enable it to survive in its environment? How are "form" and "function" related in plants?

Background on the Topic

How do plants absorb water from the soil? This phenomenon is called **capillary action** - the ability of a liquid to flow upward (against gravity), in narrow spaces - and occurs in plants to help water climb from a plant's roots to the leaves in the tops of trees. The water enters the plant roots and moves to other parts of the plant through tiny tube-like structures called xylem. These tube-like structures are part of the plant's transpiration system, through which nutrients, including water, are transported through the plant. Paper towels, and all paper products, are made from fibers found in plants called cellulose. In this demonstration, the water flows upwards through the tiny gaps between the cellulose fibers. The holes in the towel act like capillary tubes, pulling the water upwards and seeming to defy gravity as it travels upward due to the attractive forces between the water and the cellulose fibers. The water molecules tend to cling to the cellulose fibers in the paper towel: this is called adhesion. The water molecules are also attracted to each other and stick close together, a process called **cohesion**. So as the water slowly moves up the tiny gaps in the paper towel fibers, the cohesive forces help to draw more water upwards. At some point, the adhesive forces between the water and cellulose and the cohesive forces between the water molecules will be overcome by the gravitational forces on the weight of the water in the paper towel, hence the need to minimize the arch over the glasses (shorten the paper towel).

Activity Directions

1. Gather supplies.
2. Fold paper towels lengthwise into halves or thirds (depending on the size) - if you are using small glasses, you may need to cut off 1-2 inches so they fit better. You will need to test the size so it fits in the glass - it should arch just over the brim of the two glasses it is traveling between.
3. Line the glasses up side by side.
4. Gather the three colors.
5. In the first glass, have your student drop 5-10 drops of red food coloring in the glass. In the third glass, drop 5-10 drops of yellow, and in the fifth glass, have them drop 5-10 drops of blue food coloring. Leave the other glasses empty. You may need to assist your little scientist in this step.
6. Fill the first, third and fifth glass with water ¾ of the way full. If using mason jars, add water to the brim of the jar. Leave the other glasses empty. You may need to assist your little scientist in this step.
7. Move the glasses into a circle and add the paper towels. You should have an empty glass/jar between each colored water glass/jar.
8. Observe.

During the Activity

Have your little scientists sit and observe. Provide a snack and watch what happens. If you don't see much water movement within the first 15 minutes, you may need to add more water to the first, third, and fifth glass/jar.

Post Activity Reflection

(adapt to age level; these questions spur inquiry and can lead to other questions while motivating creativity and critical-thinking)

Reflection:

- What do I know now?
- How do I know it?
- How has my thinking changed about……?

Extension (for older and/or curious little scientists):

- Little scientists may question how a rainbow is formed. Rainbows form from a combination of reflection, refraction and dispersion. For the purpose of this extension, we are providing background on reflection. Light moves at different speeds through different mediums. When light travels from air into a water droplet, the speed the light is traveling changes, as does the wavelength. This change causes the light to bend when it enters a water droplet. The bending of light is what scientists call refraction. The angle the light changes, or refracts, changes the wavelength (color) of the light the human eye can see. Different wavelengths (colors) appear different colors to the human eye. The length of the wavelength will determine the color the human eye sees. Longer wavelengths (red) of light are bent the least while shorter wavelengths (violet) are bent the most. In order for a rainbow to occur, you need many water droplets, since only one color of light is seen through each rain droplet.

- Fun Fact: The Sun must be behind the observer in order for the rainbow to be seen. Inquiry-based learning can drive this observation when students are asked “what other factors must occur in order for a person to see a rainbow?”

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Name: ______________________ Date: ___________

Walking Rainbow Record Sheet

◯	+	◯	=	◯
◯	+	◯	=	◯
◯	+	◯	=	◯
◯	+	◯	=	◯
◯	+	◯	=	◯

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