KENAN FELLOWS PROGRAM
FOR TEACHER LEADERSHIP

Seeing Solutions

OVERVIEW

Students will be able to make a solution and identify the solvent and solute.
Students will be able to observe the interactions between solutes and solvents.
Students will be able to make connections between actions and consequences.

AUTHOR	GRADE LEVEL	CONTENT AREA
Kathleen Janes	2nd Grade	Science Social Studies

ESSENTIAL QUESTIONS	TIME NEEDED	STANDARDS
What is a solution? What matters in solutions? How do individual choices affect communities?	Solution Experiment - 30 min Backwards Solution Experiment - 30 min Discussion and Reflection - 30 min	• 2.P.2 Understand properties of solids and liquids and the changes they undergo. 2.P.2.1 Give examples of matter that change from a solid to a liquid and from a liquid to a solid by heating and cooling. 2.P.2.2 Compare the amount (volume and weight) of water in a container before and after freezing. 2.P.2.3 Compare what happens to water left in an open container over time as to water left in a closed container.

Making Connections

The intent of this lesson is for students to build an understanding of solutes and solvents. Students will review the states of matter and the effect of temperature on changing states. They will make comparisons to their choices within their community.

Background

In this lesson, students will make their own solutions using water, food coloring, salt, and sugar. Students will observe how the solutions are made and predict what might happen when they mix those solutions. Students will add various quantities to a communal bin and observe what they see. Teacher will challenge the students to think how they might return the solution back to its original form and students will test their hypotheses. The class will then discuss various social and emotional scenarios that reflect the observations of the experiment.

Students will reflect personally on how their actions affect their community.

Materials

- water
- food coloring
- spoon
- plastic cups
- plastic bin
- reflection sheets

Teacher Tips

Students may need support in understanding the solution when they cannot see the visual addition, such as with the salt and sugar. Students could “taste” the water to assure that it is mixed.

The Activity

Part 1: Activating Prior Knowledge

- Review the definition for “mixture”. Ask students to list examples of things they have mixed before such as paint colors, food, patterns, etc. Discuss how a

mixture is different from the separate parts combined to create the mixture.

- Tell students that today we will learn about a special type of science mixture called a solution. Remind students that this word can have other meanings. Discuss the meanings.

Part 2: Seeing and Not Seeing Solutions

- Pass out the project materials to students. Have them label the materials.
    - Water in a big plastic cup, not labeled
    - Sugar in cup labeled solute
    - Salt in cup labeled solute
    - 3 small empty cup labeled solvent
    - Food coloring labeled solute
- Tell students to pour some water into the empty cup. Record what they notice.
- Then have them add a spoonful of sugar to the cup. Mix the sugar and observe what happens. Record on observation sheet.
- Repeat with a second cup and salt.
- In the third cup, add water and 3 drops of food coloring. Observe and record what happens.

Part 3: Discussing Observations

- Ask students what they notice about the three solutions. Identify the solvents and solutes for each solution.
- Tell students that these solutions are homogeneous - everything in the solution is spread out evenly. Compare to heterogeneous solutions that have a higher concentration of something in one part of the system than the other.
- Define solubility as the ability of the solvent to dissolve the solute.

Part 4: Digging Deeper

- Ask students how they might find the solubility of their solvent. Guide students through the process of adding more solute until it can't dissolve anymore.
- Have each group add the three solutes to the original solutions. Keep adding and mixing until they notice solute not mixing. Stop and ask why.
- Call the class back together. Ask what might happen if we changed some of the conditions with our experiment like

temperature. Do you think the solvent would dissolve more or less solute and why?

- Repeat experiments with hot water and record observations.

Part 5: Making Connections

- Tell students that there are other solutions in our world besides those we mix together in cups during science time.
- Tell students that we can think of our classroom as a solution. Refer back to student definitions of the word solution and use different contexts in examples about the classroom. Tell students we can use the experiment to understand the nature of "solutions of people" like our classroom community.
- Ask students if the classroom community is a heterogenous or homogenous mixture and why. Ask what might be the solvent and solute in our class community. What makes them think that? Have them share other examples of communities.
- Discuss various conditions that might affect the solubility of the classroom community (eg. space, number of people, time). Guide students to the idea of feelings and choices or actions.
- Read "What if Everybody Did That?" Add food coloring for each action and discuss the observations. Each student will add a drop of color when the teacher reads the line, "What if everybody did that?"
- As a class, create a list of examples from the text or from classroom or life experiences that demonstrate the idea of collective action, both negative and positive.

WRAP UP **AND** ACTION

Using the Experiment and Reflection Template, students will define the word solution, explain how they are made, and provide three examples. These examples can be scientific or analogies of applications of the principle. Students will be assessed on their comparison of solutions and use of academic vocabulary.

Extensions

Students can research a collective action problem in their environment. They can identify the problem and suggest solutions to solve it.

Resources

Brainpop Compounds and Mixtures

What if everybody did that?

About the **Author**

Kathleen Janes is a 2019 - 2020 Kenan Fellow. She is an elementary teacher in Durham, North Carolina.

About the **Fellowship**

Kelly Witter is the Director of Community Engagement and STEM Education at the Environmental Protection Agency at Research Triangle Park. In my three week internship with Kelly at the EPA, I conducted over 30 interviews with various researchers and engineers throughout the EPA to learn about their work as well as the talent pipeline applying to open positions at the EPA. Additionally, I assisted 4 summer student camps and attended 3 workshops at the EPA.

Through those discussions and events, I discovered that most people who engaged in environmental science work shared this idea of their wonder and appreciation for nature and their community as an inspiration for their studies. I wanted to instill that same sense of fascination in my students so I designed this lesson to help them connect this incredible design pattern to the everyday natural world.

Student **Pages**

Experiment and Reflection Templates

Appendix

Reflection Rubric		
1	2	3
Student does not provide any definition for solution	Student begins to define solution	Student defines solution
Student provides 1 example of a solution	Student provides at least 2 examples of solutions	Student provides 3 examples of solutions