

Bay Area Scientists in Schools Presentation Plan

Lesson Name: Follow the River to Clean Waters

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Next Generation Science Standards:

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><i>Developing and Using Models</i></p> <p>Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</p> <p>Develop a model using an example to describe a scientific principle. (5-ESS2-1)</p>	<p><i>ESS2.A: Earth Materials and Systems</i></p> <p>Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1)</p> <p><i>ESS3.C: Human Impacts on Earth Systems</i></p> <p>Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect</p>	<p><i>Cause and Effect</i></p> <p>Cause and effect relationships are routinely identified. (4-PS4-2)</p> <p><i>Systems and System Models</i></p> <p>A system can be described in terms of its components and their interactions. (4-LS1-1), (LS1-2)</p>

Common Core Standards:

ELA/Literacy:

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

Mathematics:

MP.2 Reason abstractly and quantitatively.

MP.5 Use appropriate tools strategically.

MP.4 Model with mathematics.

FOSS Connections:

Grade 5 Module: *Water Planet*

Teaser:

How do we impact water quality? What can we do about it? This fun lesson will reinforce concepts regarding the water cycle and explore water and pollution transport. Students will learn about the 'life cycle' of a water droplet, with emphasis on the transport of pollutants in stormwater runoff. They will come to understand how the actions of people everywhere have an effect on the water around them and what can be done to mitigate these negative consequences. We will use a video, a hands-on activity, a short song and an interactive class discussion to help reinforce the ideas presented. Students will leave excited about their deeper understanding of their surroundings and their power to improve their interactions with the environment.

Concepts:

- Transport in the environment (stormwater runoff)
- Pollution
- Sources (cars, sediments from construction sites, trash, cigarettes buds)
- Concentration and dilution

Classroom Management Strategies

- Provide clear ground rules for students before starting lesson

Classroom Set-up:

- Presenters will need a projector and a screen to a computer for a short video clip at the beginning.
- Students will be broken into 4 groups. Have the students sitting all together at the beginning of the lesson.

Materials:

What will you bring with you?

- Crowns!
- Buckets
- Jars
- Dyes
- Water
- Cups
- Vocab list

1. Personal and Topic Introductions

10 min

- Introduce ourselves and the lesson
- Ground rules
- Brief introduction of the water cycle
- Video (through approx 2 minutes): <http://www.youtube.com/watch?v=Ak-js9MPSMU&feature=related>

2. Learning Experiences

25-35 min

Lesson Explanation:

Ways to introduce concepts (new vocabulary is underlined) -- incorporate the video into the lesson using pictures to help teach basic concepts:

1. Interactive questions about video - eg, "How does water get dirty"
2. Transport in the environment: start with a video or images of the SF Bay depicting pollution before and after a storm event
3. Lead into a discussion about pollution
 - a. What is pollution?
 - b. Where does it come from (sources)?
 - c. Where does it go (watershed)?
4. Discuss how pollution is measured (concentration and dilution)
 - a. Activity: Use students to demonstrate concentration (students wear crowns that represents a contaminant and water molecules)

Learning Activity: Stormwater transport role-playing

- Divide students into groups (4 maybe)--each group is a different watershed with a river running through it
- Assign each student to represent either a tributary or a city
- Assign one big bucket for each group (bucket=river)--start with a moderate amount of 'base flow' already in the bucket
 - Each group will have a map of their watershed with symbols marking where each tributary and urban area is along the central river--students will have

'crowns' with a symbol corresponding to those marking the tributaries/urban areas

- Each student will have a water sample with a concentration of dye depending on their assignment
 - Tributaries have no dye=clean water
 - Urban areas have variable concentrations depending on how well they 'treat' their wastewater
- Students will pour their samples into the bucket in the order that the river flows (probably orient rivers N-S for simplicity, or NW-SE)
- Will be standards showing the range of concentrations for the dye, will indicate which concentration=toxic
- Have student analyze their river after each successive sample is added to determine if and when it becomes toxic (mark the point it becomes toxic on the map?)

3. **Wrap-up: Sharing Experiences**

10 min

- Come together as a class, discuss which rivers became toxic and why
 - Emphasize that dilution is NOT the solution to pollution!
 - Have they consider what where all the polluted water goes and what happens when we continue dumping stuff into it.
 - Water as a limited resource.
 - Things that we put into the environment is not easily destroyed and can stay in the environment for a long time. So if we continue polluting the water thinking that "dilution is the solution to pollution," eventually it can no longer be diluted to a safe level.
 - Have at least one watershed with a lot of urban areas that did not become toxic due to good treatment practices--emphasize that prevention and treatment are good solutions

4. **Connections & Close**

5 min

Teach students a song that will reinforce the concepts

Water Travels in a Cycle
(To tune of 'She'll Be Comin' 'Round the Mountain')

Water travels in a cycle, yes it does (x2)
It goes up as evaporation
Then makes clouds of condensation
And comes down as precipitation, yes it does

Differentiated Instruction:

English Learners: Repeat directions, if necessary, and physically model how to perform role-playing activity. Write vocabulary words on the board and read words aloud. Vocabulary words can also be visually demonstrated using an illustration or action and redefined in very simplistic terms.

Advanced Learners: Have students think of other solutions to the water pollution problem.

Follow-up Possibilities

ELA Activity:

Students answer the following prompt:

“Write a letter to a friend explaining what you learned about the water cycle and pollution.”

Mathematics Activity:

Students can research rain water toxicity and make a graph of different pollutants in rain water in across regions.