

EED 480

Student Project-Based Learning Outlines

I. Title and Grade Level: 4<sup>th</sup> grade

Water Pollution

II. **BIG IDEA:**

*How do human actions and activities ~~effeet~~ affect the quality of water in sources around the earth (oceans, lakes, rivers, streams?)*

*How can the very choices each individual makes contribute to or help protect water from being polluted?*

*Let's investigate the factors that may be contributing to the pollution of water sources in our area and take into consideration what kinds of human activities, actions, and choices contribute to the quality of water on our planet?*

*Let's be ~~scientists~~ and test the different samples of water sources to investigate how a source of water's location, surrounding, and human activities of the area contribute to the pollution of water. Let's observe and test water samples to find evidence of water pollution and provide possible attributions to the quality of water in the area.*

*Let's be engineers and create a plan for keeping our water sources clean and free from pollution.*

III. **TASKS:**

A. We will investigate how human activity may affect the quality of water in given sources by researching the history and development around two give sources of water and then based on the research acquire may predictions as to which body of water will contain a greater percentage of pollutants.

B. We will test two water samples to test for various contaminants found in the water and therefore make a conclusion as the degree to which the water has been polluted. We will provide evidence of human activity in the area that has led to water pollution of this sources of water or human activity and actions that may be aiding in conserving and keeping the body of water sustainable and clean.

C. Finally, we will come up with a plan of action to sustain and help regulate water pollution in this given area, utilizing the resources available and describing a step-by-step plan of action.

Commented [BSF1]: I like the way you have used these questions, Syuzanna!

A. **JUSTIFICATION** This lesson series features STEAM and social studies integration:

**Science:** Students must use the scientific process to make a hypothesis, observe and experiment, and draw conclusions based on results while testing water sample of different sources for contaminants found the water.

**Technology:** Students will research using the internet to gain information on the history and location/human activities of the two water sources given to the team and will create a PowerPoint presentation to summarize their finding and present their plan of action.

**Engineering:** Students will design a plan of action that includes new and innovative ways to conserve water and regulate for pollution (example: a system of drainage to avoid draining harsh chemicals into the water supply.) Students will present an outline and model of the plan and specific invocative inventions to help stop water pollution.

**Art:** students will create a sketch of any innovative inventions created as well as “ideal” model of the area that features the geographical outline of the area but may include the reduction of factories within the area, integration of waste baskets and recycling bins, possible signs, and other ideas to demonstrate an area that is being regulated and accounted for **pollution**.

**Mathematics:** Students will take into account the different contaminants that were found in the water and provide the fraction representation to demonstrate the percentage of which the water is contaminated by each of the contaminants found in the source. Students may use a pie chart to demonstrates the fraction of contaminants found in the water.

**Social Studies:** student will research the California history of the area in which their water sources are located as well as take into account any geographic changes in the area and factory development/ other human activities that may have affected the quality of water. Students will demonstrate knowledge of American government by suggesting policies changes and laws that can possibly reduce water pollution in that **area**.

**Commented [BSF2]:** Wow! This is great☺

**Commented [BSF3]:** Excellent inclusion of government policies!

IV. **STANDARDS: Grade Level and Subject Area: Kindergarten to 5<sup>th</sup> Science, Social Studies, Language Arts, Mathematics and the Arts**

**Commented [BSF4]:** This is just terrific—you have detailed the many standards that are addressed and achieved through this comprehensive PBL.

## **SOCIAL STUDIES**

**4.1 Students demonstrate an understanding of the physical and human geographic features that define places and regions in California.**

3. Identify the state capital and describe the various regions of California, including how their characteristics and physical environments (e.g., water, landforms, vegetation, climate) affect human activity.

5. Use maps, charts, and pictures to describe how communities in California vary in land use, vegetation, wildlife, climate, population density, architecture, services, and transportation.

## ELA/Literacy:

### Communication and collaboration:

#### CCSS.ELA-LITERACY.SL.4.1

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

#### CCSS.ELA-LITERACY.SL.4.1.A

Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

#### CCSS.ELA-LITERACY.SL.4.1.B

Follow agreed-upon rules for discussions and carry out assigned roles.

#### CCSS.ELA-LITERACY.SL.4.1.C

Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.

## CCSS MATHEMATICS:

#### CCSS.MATH.CONTENT.4.NF.B.3

Understand a fraction  $a/b$  with  $a > 1$  as a sum of fractions  $1/b$ .

#### CCSS.MATH.CONTENT.4.NF.B.3.A

Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.

#### CCSS.MATH.CONTENT.4.NF.B.3.B

Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples:*  $3/8 = 1/8 + 1/8 + 1/8$ ;  $3/8 = 1/8 + 2/8$ ;  $2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8$ .

## NGSS (Next Generation Science Standards)

### ESS3.A: Natural Resource

4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

#### A. Disciplinary Core Ideas

### ESS3.A: Natural Resources

Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)

**B. Science and Engineering Practices**

**Constructing Explanations and Designing Solutions**

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-ESS3-2)

**Obtaining, Evaluating, and Communicating Information**

Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluate the merit and accuracy of ideas and methods. Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)

**C. Crosscutting Concepts**

**Cause and Effect**

- Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)
- Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS3-2)

**VI. ENGAGING CONTEXT: Hook- Launch activity**

**Day 1: Introduction and research.**

**Motivation: (hook)**

Show students two images of the ocean:

- 1) ideal ocean with crystal clear waters
- 2) real image of the pollution that **affects** the **oceans**

**Ask students:**

Which image do you think is accurate representation of our oceans today?

**Classroom discussion:** Introduce water pollution and have students as a class discuss various human activities and actions that may lead to an ocean pollution and the pollution of other bodies of water.

Students will watch a video demonstration (acquired from Tree **People**) following how human activity and actions can affect the quality of water in that given area. Students will watch a video of how throwing trash on the side walk may lead to the pollution of the ocean by following a wrapper as it makes its way through the sewer system and into the oceans.

**Commented [BSF5]:** Affects-Effects are common errors. Usually when it is a verb it is with an "A"

**Commented [BSF6]:** I am personally going to follow up on this! I think this is a wonderful instructional activity!

Students will be divided into groups of 5 and assigned two bodies of water (streams, lakes, ocean (divided by beaches), rivers, etc.) within the area.

Students will research and gather information of the history of the given region and discuss the various human activities or structures that are located within that region that may have an impact of the quality of water in that given water sources (for example: factories that are located close to that area.)

**Day 2-3: Investigation and experiment:** Each group will be provided with two water samples of the two sources of water that they researched in the given area.

- Initially students will make a hypothesis on which water sample they predict will have the greatest number of contaminants using evidence found during their research of the history and location of the water source to support their hypothesis.
- Students will use water-testing kits that come with a package of strips that change color to indicate the presence of bacteria, lead, pesticides, nitrites/nitrates, chlorine, harness, pH, mercury, etc.
- Students will write out a report on both water samples detailing:
  - the contaminants that were found in the water sample
  - degree or percentage of the water sample that was polluted with the contaminants
  - possible causes (human activity) that may have led to the presence of each contaminant in the water sample.
- Students will come to a conclusion describing the degree to which that water source has been polluted and discuss whether their predictions were correct or not

**Day 4: Application and engineering:**

- Students will create a plan of action to reduce water pollution in the area of focus. The plan of action must include 1) individual choices to reduce water pollution, 2) community choices and actions to reduce pollution and 3) possible government actions that can aid in the reduction of water pollution.
- Students will create a PowerPoint presentation providing pictures, illustrations, and written descriptions of the research they acquired on the history of the area of the water source, their finding (report) on the various contaminants found in the water, evidence to demonstrate how human activity in that area has led to water pollution of the water source and a detailed plan of action.
- Students will sketch an “ideal” model of the area that features the geographical outline of the area but may include the reduction of factories within the area, integration of waste baskets and recycling bins, possible signs, and other ideas to demonstrate an area that is being regulated and accounted for pollution.
- Students will include reflective questions such as
  - Why is water pollution an important topic that must be address?
  - Who does the pollution of water sources around the earth effect? (quality of life for animals and marine life that must inhabit the habitat)

**Commented [BSF7]:** So are students behaving as expert groups here?

**Commented [BSF8]:** They really are being engaged as researchers and scientists!!

- In what ways are animals affected by water pollution at the hands of human?

## VII. MEASURABLE OBJECTIVES

A. As student thinking drives this lesson, students can pursue their own inquiry:

Students will be able to use research in combination with observations to make predictions about the contaminants that may be found in their water samples.

Students will be able to collaborate with peers and form ideas, suggestions, and evaluations of human activity that may be causing water pollution while using research and evidence to support claims.

B. As the culminating activity of this PBL students will create a project or presentation that meets the objective of the Big idea.

Students will be able to create a PowerPoint presentation to summarize their finding including a report of the quality of water in the area, possible human activities that may be contributing to water pollution, and a plan of action with innovative ideas and suggestions to help regulate water pollution.

## VIII TOTAL TIME:

**Launch event-One:** Class Periods of 60 minutes;

**Day 1** will consist of introduction and information about water pollution, group formation and research into the two areas in which the two water sources are located. (60 min)

**Building Knowledge:** Two- Class Periods; 60 minutes

**Day 2** will consist of the experimentation of the two water samples and a recording and report of different contaminants found in the water samples.

**Day 3** will consist of analysis of the two water samples and research found to draw conclusions based on what kinds of human activities may be causing water pollution of that specific contaminant in the area. Students will create a pie chart to demonstrate the fractions of contaminants found in the water. Students will link evidence found from research to support their conclusions.

**Showing Knowledge** (Claims and Evidence) 60 minutes  
(Students develop and revise products and or performances)

**Day 4** will consist of students creating a PowerPoint presentation to summarize findings as well as innovations and a plan of action to help regulate for water pollution and conservation in that area.

**IX. Social Skills and or Habits of Mind to Engage/Assess**

<input type="checkbox"/> Persistence	<input type="checkbox"/> Problem posing
<input type="checkbox"/> Decreasing impulsivity	<input type="checkbox"/> Drawing on past knowledge
<input type="checkbox"/> Empathic listening	<input type="checkbox"/> Application to new situations
<input type="checkbox"/> Flexibility in thinking	<input type="checkbox"/> Precision of language and thought
<input type="checkbox"/> Metacognitive awareness	<input type="checkbox"/> Using all the senses
<input type="checkbox"/> Checking for accuracy	<input type="checkbox"/> Ingenuity, originality, insightfulness and creativity
<input type="checkbox"/> Questioning	<input type="checkbox"/> Inquisitiveness, curiosity
	<input type="checkbox"/> Enjoyment of problem solving

**IX. Level of Voice Appropriate for Activity:**

## Noise Levels

	<b>SILENT MISSION:</b> Silent - No talking at all
	<b>TOP SECRET PLAN:</b> Quiet - Only you and a partner
	<b>SUPER TEAM TASK:</b> Normal - Just your table team
	<b>POWER VOICE:</b> Strong - Hear it across the room
	<b>BIONIC NOISE:</b> Loud - Only used outside

### X. **BSCS 5-E Framework**

#### **Engage:**

- A. **DIRECT INSTRUCTION:** forming groups, assigning roles, describing roles and tasks

**Materials Manager/ Spy Tasks:** Make sure your team receives and uses the materials without spilling the water samples. Make sure that each of the strips are used properly throughout the experiment. If the team has a question go to another team to answer your question [or see what they have learned.]

**Checker's Tasks** - Make sure the time limits are observed. Help others complete their tasks. Let the instructor know when your team has completed each one of the tasks.

**Recorder's Tasks:** Carefully observes and records the different contaminants and degree of contamination found in each one of the water samples. Ensuring that recording is accurate and adhere to the correct water sample. In collaboration with peers write down a full report of each contaminant found in the water sample.

**Encourager/Observer' s Task** - Coach the team to work together and stay on task while ensuring that all team members have had a chance to communicate their ideas. Notice, identify and record occurrence of team members' social skills and habits of mind.

( Observer records individual performance)



**Checklists and Rubrics** provided for student goal setting and self-assessment; Peer Assessment (Team Performance Rubric) [Rate Your Mates] Content Assessment (poster)

**Explore:** We will use our inquiry skills of predicting (hypothesis testing) comparing and analyzing to: make predictions on which water sample will have the highest amount of contaminants present based on the research conducted of human activity within that area. We will test our water samples and compare the results found.

**(5 groups of 4 students)** Modified for class composition.

**Explain:** As students complete the launch, inquiry, culminating activity they share their prior knowledge, observations and questions about why each contaminant may be present in the water sample and draw conclusions on which human activity/actions have contributed to the water contaminants present in the sample.

**Extend/Elaborate:** In small groups and in the final performance students have opportunities to extend their knowledge and to elaborate on their ideas by presenting their finding and plan of action. And consulting different groups that may have found the same contaminants in their water supply and the same pattern of human activity that may have contributed to the presence of the contaminant in order to find a pattern of occurrence to further support their conclusions. Students may incorporate and modify their plan of action to feature ideas of different groups and may in turn be beneficial to their over cause of stopping water pollution.

#### **XI. Materials List**

- 2 water samples (per group)
- 2 water testing kits with strips for each contaminant
- paper towels to lay the strips after dipping in water
- Sheet to record the information found
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#### **Evaluate: (Assess):**

There are several formative and summative ways to assess learning in this engaged learning PBL.

1. Students original predictions and questions as well as ability to use the scientific method will be assessed using the think like a scientist work sheet that features the following:

“I Can Write Like a Scientist” experiment worksheet

**Scientist:** *(Student's name)*

**Name of Experiment:**

**Question:**  
**Hypothesis:**  
**Review procedure to test my hypothesis:**  
**Results:**  
**Conclusion:**

The following rubric will be used to assess the **worksheet**.

<p>Student will receive a <b>4</b> on this assignment if:</p> <ul style="list-style-type: none"> <li>○ <i>Student generates specific and clear questions that embody effectively the goal of the experiment.</i></li> <li>○ <i>Student generates a hypothesis and prediction that demonstrates reflection and integration of facts and previously acquired knowledge.</i></li> </ul> <p><i>Student creates a clear and complete step by step description of the procedure.</i></p>	<p>Student will receive a <b>3</b> on this assignment if:</p> <ul style="list-style-type: none"> <li>○ <i>Student generates clear questions that integrate the goal of the experiment.</i></li> <li>○ <i>Student generates a hypothesis and make prediction that demonstrates some integration of facts and previously acquired knowledge.</i></li> </ul> <p><i>Student create a complete step by step description of the procedure.</i></p>
<p>I will receive a <b>2</b> on this assignment if:</p> <ul style="list-style-type: none"> <li>○ <i>Student generates questions that are not parallel with the goal of the lesson.</i></li> <li>○ <i>Student generates a hypothesis and makes predictions that lack integration of facts and previously acquired knowledge.</i></li> <li>○ <i>Student create an incomplete and/or unclear step by step description of the procedure.</i></li> </ul>	<p>I will receive a <b>1</b> on this assignment if:</p> <ul style="list-style-type: none"> <li>○ <i>Student is unable to generate questions that are not parallel with the goal of the lesson.</i></li> <li>○ <i>Student is unable to make a and/or prediction during the experiment.</i></li> </ul> <p><i>Student is unable to create a create step by step description of the procedure.</i></p>

**Commented [BSF9]:** As well thought out and accurate your rubric is, I would suggest that if you have the opportunity to lead this PBL you create more descriptive rubrics with images that inspire and motivate your students.

You also need to create a rubric for the PPT that is expected of the students, so they have an idea of the quality expected from each of the criteria that you describe.

**2. Summative assessment:** Students will create a PowerPoint representation to summarize their learning throughout the entire project. The PowerPoint presentation will be graded using a checklist with the following criteria:

1. Does it include a detailed report of all contaminants found within the water sample?
2. Does it include at least three new science vocabulary words?
3. Does it propose the development of a plan of actions including:

individual goals?  
community goals?  
political goals (propositions)?

4. Does it include a pie chart that shows the fractions of contaminants found in the water?
5. Does it include a sketch of the “ideal” environment of the area the water source is located within?
6. Does it show evidence that all team members were involved?

**3. Formative Assessment of Non-Cognitive Factors:** Students will conduct a Self-Assessment Using the Habits of Mind Check Sheet and Write-up Form and will check off each one of the attributes if they feel they were able to embody the description during the experiment and project.

Children's Literature that Supports the PBL:

*Watch Over Our Water* by Lisa Bullard  
*Water Pollution Rhonda* by Lucas Donald  
*Magic School Bus Water Cycle* by Pat Relf  
*Water Pollution* by Melanie Ostopowich  
*Water in the Park: A Book About Water and the Times of the Day* by Emily Jenkins