**Lesson Number 3: Exploring Contaminants**

**Problem statement:**  What kind of contaminants do we add to our water source and how can we reduce those pollutants.

**Learning objectives:** Students become aware of the types of contaminants we add to our water supply and brainstorm solutions for reducing these pollutants.

**Lesson standards (**Source: [Next Generation Science Standards](https://www.nextgenscience.org/search-standards)**)**

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| **Standard** | **How the Standard Will Be Assessed** |
| **NGSS** Practice 1 Asking Questions and Defining Problems (Grades 3-5):  Asking questions and defining problems in 3–5 builds on K–2 experiences and progresses to specifying qualitative relationships. | No summative assessment for this lesson. Only formative check-ins based on students’ questions and interactions. |

**Soft skills: (**[Source: Social Emotional Learning Standards, Benchmarks, and Indicators](https://www.k12.wa.us/sites/default/files/public/studentsupport/sel/pubdocs/Appendix%20D%20Standards%2C%20Benchmarks%20Indicators.pdf)**)**

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| **Soft Skill** | **Standard** |
| Collaboration | STANDARD 3: SELF-EFFICACY – Individuals have the ability to motivate themselves, persevere, and see themselves as capable. BENCHMARK 3A Demonstrates the skills to set, monitor, adapt, persevere, achieve, and evaluate goals. |

**Success Criteria:**

* Ask questions about what would happen if a variable is changed.
* Identify scientific (testable) and non-scientific (non-testable) questions.
* Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
* Use prior knowledge to describe problems that can be solved.
* Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constrain

**Locally and/or personally relevant for students (whole unit):**

Our community (Washington State) has many waterways that have the potential to be contaminated, or are already contaminated. As a region, we have many industries (and people) that rely on seafood. Keeping the water clean, and reducing pollution, will help ensure future generations have access to the seafood and marine animals that are so important to our community (industries-food, tourism, seafood, local Tribes).

**Connections to career and educational pathways (whole unit):**

* They will learn about maritime careers (Port of Seattle) and scientific careers that relate to the maritime industry.

**Materials:**

* 4 plastic bottles with lids and labels (Roads, Factories, Farms, Homes)
* Labels for bottles (Roads, Factories, Farms, Homes)
* Contaminants to add to bottles (below are some suggestions)
* BOTTLES:
  + **ROADS**: Salt (winter time), gasoline, windshield wiper fluid, lead (homes & business roofs/automobiles), copper (brake pads), garbage, cigarettes, oil, rubber (tires), exhaust pollution. \*Bottle does not contain actual gasoline or copper, and vegetable oil used (not motor oil), no exhaust pollution in the bottle, lead is pencil graphite.
  + **FACTORIES**: Bleach, dye, oil, metal (from machinery), smoke/ask (from heating elements-air pollution that settles into water), plastics. \*The dye is food dye
  + **FARMS**: Animal waste, fertilizer, oil (machinery), gasoline, vegetation & dirt debris, animal feed. \*Bottle does not contain fertilizer or gasoline, oil is vegetable oil.
  + **HOMES**: Gasoline (driveways & lawnmowers), animal waste (pet waste & local wildlife-squirrels, etc), cleaning products, oil, soap (car wash), fertilizer (yards), lead (roofing), yard waste (leaves, dirt, etc.) \*Bottle does not contain gasoline, oil is vegetable oil, lead is pencil graphite.
* Chart paper and markers (For teacher)
* Water Contaminants KWL Chart (1 per student)
* River Picture (1 colored picture)
* River Poster (similar to GLAD Pictorial Input Chart) This should be drawn ahead of time with the words written on it for students to add pictures to after the conversation. Coloring the poster is also suggested. (example below)
* Pictures for River Poster (print in color)
* Notice/Wonder Observation Chart papers (1 per bottle)
* Tape (if you plant to tape the pictures to the river poster)
* Velcro (if you plan to laminate the poster and use it for multiple years)
* Clipboards and pencils for students (KWL chart and Notice/Wonder poster)
* Document camera

**Lesson preparation:**

* Pre-mix contaminants into bottles. Fill mostly with clean water, then add contaminants, and add a label on the bottle lid. You can add more bottles, or change what the contaminants are, based on your needs/wants.
* Print a KWL chart for each student.
* Print Notice/Wonder observation chart papers (one per bottle).
* Print pictures for river poster (I suggest printing in color and laminating- for future use. If you plan to use these in the future, add a Velcro sticker to the back of the laminated picture).
* Use a projector to project the river poster image and trace it onto larger chart paper. I suggest laminating the poster for future use. Then add Velcro stickers next to the words, so you can add the Velcro pictures over the words/beside the words. If you don’t want to laminate the poster or the pictures, you can use “tape bubbles” to attach the pictures to the river poster.

**Time required:**

* 1 hour

**Grouping of students for instruction:**

1. Students should be in groups of 6 for the majority of this unit (working group). However, students will be split into **4 groups** for this activity.

**What is the instruction? Consider the PBL Procedure that is being addressed here:**

**Understanding the Problem**

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| **Lesson Steps** | |
| **Teacher** | **Student** |
| 1. Give each student a copy of the KWL chart, pencils, and clip board (if needed). Have them fill out the K and W individually (or in their small group). | 1. Work independently or with group to figure out what they know already about the types of contaminants that are in our waterways, as well as how the contaminants get into the water.  \*Students will discuss each bottle with their group and chart what they notice/wonder. |
| 2. Place 1 bottle on each table (4 tables) with the Notice/Wonder chart by it. Have groups move around (4-5 minutes per bottle) and chart what they notice and wonder about the bottles (color, contaminants, location of bottle contaminants, etc.). | 2. Each group should only have 1 student who is actively writing. This will cut down on wasting time for students arguing over who gets to write. Students will look at the bottles and discuss what they notice/wonder. |
| 3. Students should read the previous group’s notices and wonderings before charting their own (this reduces duplicates, as well as activates new ideas for the students). If the previous group has the same idea as the new group, they can put a “checkmark” next to the idea, instead of duplicating it on the paper. | 3. Read the information from the previous group to help to activate new thoughts and show similar thinking with positive feedback for previous groups (by using a checkmark). If students finish early they should be encouraged to think deeper and discuss where the contaminants might have come from (within each bottle). |
| 4. Pull students (and notice/wonder bottle charts)to carpet (or meeting area) to discuss what they noticed about the bottles (lead groups towards contaminants, how it affects the water, which products they use at their home that may be adding to the contamination problem, etc.) Chart this on paper or simply discuss whole class. | 4. Students will sit together and discuss (and listen) to processed information about the bottles of contaminants. Teacher will call on students to add their ideas to the chart. All students should be ready with information to contribute to the poster, to encourage on-task behavior. |
| 5. Encourage students to discuss which types of jobs might lead to water cleanup or contaminant cleanup. Think about scientists and engineers who create solutions to these problems. | 5. Students will use their prior knowledge to discuss potential related jobs with their small groups and report out to the teacher. |
| 6. Show the colored river picture (under the document camera). Discuss how the water looks (clean, even though it’s contaminated). Then put up the river poster (tape it to a wall or white board). Discuss how all of the contaminants in the bottles make their way from our homes, factories, farms, and roads into the waterways (remind them of the watershed). | 6. Students will see how clean looking water isn’t really clean. They will make connections between the contaminants in the bottles and the words on the poster. |
| 7. Give each group some of the colored pictures for the river poster. Allow them a few minutes to discuss which pictures they have and where the contaminants might have come from (factory, home, roads, farms). | 7. Students will discuss the pictures they have with their groups. They will discuss which bottles they think the contaminants belong in, and how all of these things (no matter where they start from-roads, homes, factories, farms) end up in our waterways. |
| 8. Call out each of the contaminants from the poster and have the student with the corresponding picture come and add the picture to the poster. The purpose of this activity is for students to see how the seemingly clean water quickly looks so contaminated. It also helps them understand how their homes and roads are contributing to the water pollution. | 8. This is the listening and movement part of the lesson, where students will “contribute” to the contaminations. Students who need support for learning new words or understanding certain contaminants will use the visuals (pictures) to make better self-to-world connections. Classmates/group members will also help students understand these words and the items on the pictures. |
| 9. Students will fill out the L part of the KWL chart with their groups or individually. Teacher will circulate to help make sure the “big ideas” are understood and that the students are using all their knowledge on the chart (not just one word answers). | 9. Students will put their new knowledge about contaminants onto their KWL chart. Students can use bullet points, a list, drawings, etc. to help communicate their understanding/new knowledge. If they finish early, they should look across the KWL chart to make sure all their wonders (W) have been addressed. |
| 10. Bring class together- chart solutions to the contaminated water problem. (eco-friendly products, rain garden, using less chemicals around the house (car wash, fertilizer, etc.), making sure yard waste is put in a container so it doesn’t get into the storm drains, thinking about the types of products you buy from factories/lessen the amount of “stuff” you buy that needs to be produced, consider using farm products from local farms that don’t use fertilizer/big machinery/etc.). | 10. Students will work as a whole class to brainstorm how they can affect the amount of pollutants in the water. Teacher can use different ways of calling on students to have their ideas added to the chart paper. |
| 11. Conclude by telling students they will start the next lesson learning more about rain gardens and working to build one. | 11. Students will listen as the instructor/teacher discusses the “solution” for the project, rain gardens. |

**Accommodations:**

* Visual labels for EL students. Repetition of information (lots of small group work).

**Extensions:**

* Print out information for students to read (cross-text synthesis). Have students research possible solutions in their small group (technology component).

**Assessment:**

* No assessment for lesson #3, other than walking around and listening to students’ conversations, whole class discussion, and checking in about the ‘new ideas’ during the KWL and Notice/Wonder charting.

**References:**

* Instructional Plan Created during the 2019-2020 school year by Verónica West, Jenn McNease, Erin Wells, and Tim Rhoades of the Northshore School District in Washington State as part of their work with the Washington Alliance for Better Schools (WABS) ACCESS STEM program.
* Instructional Plan Consultants (not responsible for the content of this instructional plan):
  + Steve Harvey, teacher, Everett School District in Washington State
  + Linda Richard, Associate Director of Instructional Leadership, Washington Alliance for Better Schools (WABS)
  + Mick Shultz (Port of Seattle), Lisa Hiruki-Raring (NOAA-Alaska Fisheries Science Center)

**Resources:**

* **River Picture: David Baldwin, the NOAA Fisheries biologist**