

6.6 Leave No Trace

Story Extension for This Lesson:

This lesson has tie-ins throughout the story. Students can infer where in the story waste may have been left behind by John Rae and his team. The Indigenous peoples believed in using all materials and leaving no trace of their presence.

Grade: 6

Strand: Biodiversity

Big Ideas:

- Humans make choices that can have an impact on biodiversity. (Overall expectation 1)

Overall Expectations:

1. assess human impacts on biodiversity, and identify ways of preserving biodiversity

Specific Expectations:

- 1.1 analyze a local issue related to biodiversity, taking different points of view into consideration propose action that can be taken to preserve biodiversity, and act on the proposal
- 2.1 follow established safety procedures [when conducting science investigations]
- 2.4 use appropriate science and technology vocabulary in oral and written communication

Inquiry Skills:

Inferring, Gathering Data, Experimenting

Instructions:

The purpose of this activity is to research and identify pollutants that are left or brought into the arctic either by Rae or the Franklin Expedition. How did these pollutants impact the arctic? What quantities of pollutants would cause a devastating impact to all life in the arctic? What species is most sensitive to pollutants in the arctic? To fully understand this concept, this lesson has been divided into two parts. Part one is an investigation involving the concept of parts per unit (e.g., parts per million, parts per ten million). Part two is a student-directed or teacher-guided inquiry where students design an experiment to see how concentration levels affect plants.

Part 1: Pollution Dilution

What does one part per ten thousand look like? Is it possible to see what one part per million looks like? In this experiment, students will have the opportunity to see and understand what this unit of measurement means and its importance when studying how pollutants affect the biodiversity of the arctic. **Procedure:**

- Fill one small container with water and the other with red food colouring.
- Label the outside of each egg carton cup from A to F.
- Take the eyedropper and fill it with water. Put 9 drops of water into each egg carton cup.
- In cup A, add one drop of red food colouring. This amount is one part per 10. Record on a chart (refer to Pollution Dilution) what you see.
- Rinse out the eyedropper. In cup B, add one drop of solution from cup A. The new solution is one part per 100. Record on a chart (refer to Pollution Dilution) what you see.
- Rinse out eyedropper. In cup C, add one drop of solution from cup B. The new solution is one part per 1000. Record on a chart (refer to Pollution Dilution) what you see.
- Rinse out eyedropper. In cup D, add one drop of solution from cup C. The new solution is one part per 10,000. Record on a chart (refer to Pollution Dilution) what you see.
- Rinse out eye dropper. In cup E, add one drop of solution from cup D. The new solution is one part per 100,000. Record on a chart (refer to Pollution Dilution) what you see.
- Rinse out eye dropper. In cup F, add one drop of solution from cup E. The new solution is one part per 1,000,000. Record on a chart (refer to Pollution Dilution) what you see.

Questions:

- At what concentration did the food colouring become invisible?
- In the past, people believed if you dump chemicals into lakes and oceans, the water will dilute the chemicals, is it true? Reference your data to support your answer

NOTE: The activity used in Part One comes from a resource published by Scholastic called Easy Science Activity Journals by Mary Kay Carson.

Part 2: An Inquiry on Pollution**Inquiry Question:**

- Is it possible the belief of "Dilution is the solution to pollution" is misguided? Design a test to prove your point of view.

For a teacher-guided inquiry, you can conduct this inquiry by using white carnations and mason jars or beakers filled with water and red food colouring at different concentrations. Have students see whether the white carnations are dyed pink or red.

- Refer to: <https://www.stevespanglerscience.com/lab/experiments/colorful-carnations/>

For an open inquiry, it is recommended you use the Smarter Science framework to help students develop their own inquiry questions. For more information about Smarter Science and access resources to help implement this framework in your classroom, please go to www.smarterscience.ca. Refer to BLM - Steps to Inquiry Level 1 for framework posters.

Articles:

- Arctic Pollution: <http://www.scholastic.com/teachers/article/arctic-pollution>

Materials List:

- Steve Spangler Science: <https://www.stevespanglerscience.com/lab/experiments/colorful-carnations/>

Connections:

This lesson can be used to teach proportional reasoning from the Grade 6 Mathematics curriculum.

Assessment Strategy:

It is recommended you focus your assessment on process skills. To help get you started on this path, a series of charts have been provided for you.

- Process-Skill-Gathering-Data-8
- Process-Skill-Infering-12
- Process-Skill-Experimenting-1.p

Subject Area:

Math

Connects to:

Grade 6

Handouts:

- Pollution Dilution
- Steps to Inquiry Level 1-2

Pollution Dilution

Complete your observations in the chart provided.

[illegible]

Planning Our Investigation

Step 1: Observing & Questioning

Place sticky notes of the same colour in the space below.

Place sticky notes of a new colour in the space below.

OBSERVE

See



Smell



Hear



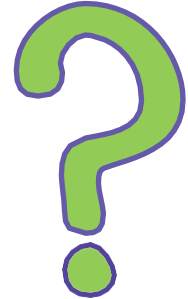
Touch



Taste



WONDER



Level: 1

Planning Our Experiment

Step 2(a): What could we measure or observe about the object, or event?

Brainstorm (Place sticky notes of the same colour in the space below.)

Measure or Observe

Step 2(b): What could we change or vary about the object or event that may affect what we could measure or observe?

Brainstorm (Place sticky notes of a new colour in the space below.)

Variables

Level 1

of 4

Planning Our Experiment

Step 3(a): What will we change?

ONE VARIABLE WE WILL CHANGE:

WE WILL MEASURE OR OBSERVE THIS RESULT:

Changed Variable

(Place a sticky note from Step 2(b))



Measure or Observe

(Place a sticky note from Step 2(a) here)

Step 3(b): What will we not change?

VARIABLES WE WILL NOT CHANGE:

What conditions will be held constant so it is a fair test? Place remaining sticky notes from Step 2(b) here.

Unchanged Variables

Level: 1

Planning Our Experiment

Step 4: What is the question we want to explore?

If we change

Changed Variable

what will happen to

Measure or Observe

compared to our control?

Step 5: What is our prediction?

State how we will change the variable and predict the outcome.

We predict that...

We think this will happen because...

Level: 1



Process Skill - Gathering Data

Process Skill	Students	Teachers	What This Skill Should Lead To
Gathering Data	☐ working independently or in groups to collect and record data for inquiry ☐ using a wide variety of data-gathering tools (e.g., scientific instruments/equipment, surveys, observation checklists, statistics, online databases, interviews) to collect data ☐ locating data through research and organizing it for their purposes ☐ using appropriate strategies (e.g., tables, checklists) to organize and record data so it can be easily retrieved and analyzed at a later time ☐ ensuring the information collected is accurate; using proper data collection methodologies ☐ taking steps to minimize bias in the data collected (e.g., randomly choosing samples)	☐ making available scientific instruments/equipment and technology for students to select and use in their inquiries ☐ instructing students on the importance of accuracy (e.g., using a thermometer is superior to using touch) and quantity (e.g., multiple replications increase the reliability of the data) ☐ introducing data-gathering techniques. These can be modeled and explored before being used independently in investigations.	Students will be more engaged and will develop better data management skills.

Teacher Notes:

Process Skill - Inferring

Process Skill	Students	Teachers	What This Skill Should Lead To
Inferring	☐ deducing information from incomplete evidence using reasoning or logic. The information does not need to be factual or correct. (For example, “The grass is wet in the morning, so I infer that it rained overnight.” This is a valid inference, but not necessarily a correct one— the wet grass could be from morning dew or a sprinkler system.) ☐ clarifying observations as evidence ☐ making a connection between what is known and what is unknown ☐ creating a tentative understanding of the situation without knowing or being given the “answer”	☐ guiding students to make logical connections from available evidence ☐ encouraging students to consider alternative inferences ☐ scaffolded and deliberate ☐ using a modified K-W-L chart to show the process of making an inference: replace “What I know,” “What I want to learn,” and “What I learned” with “What I know,” “What I observed,” and “What I infer”	☐ improved observation and deduction skills ☐ the ability to identify and analyze available evidence ☐ improved literacy skills as inferencing skills are applied to make meaning of written texts

Teacher Notes:

Name: _____

Process Skill - Experimenting

Process Skill	Students	Teachers	What This Skill Should Lead To
Experimenting	☐ deliberately manipulating one characteristic of a situation or object to discover how it affects another characteristic ☐ designing and performing all of the steps involved in an inquiry-based investigation, including the question, associated variables, procedure, type of data to be collected, format for organizing and interpreting data, and the format in which results will be shared	☐ providing rich experiences to help generate relevant, curriculum-based questions that students can explore ☐ giving students opportunities to solve a problem or answer a question by designing and performing their own experiment ☐ supporting students through the gradual release of responsibility by scaffolding the process of experimentation (e.g., Smarter Science Steps to Inquiry, PEOE, Problem Based Learning)	☐ More engaged students ☐ Greater appreciation for precision, accuracy, and repeated trials in experimentation ☐ Increased ability to think critically about scientific and pseudo-scientific claims and the processes that support them

Teacher Notes: