

10 Science/Ecology: Working with the Eight Intelligences

In seeking a framework to broaden the means by which scientific knowledge could be communicated, we utilized Howard Gardner's theory of multiple intelligences (Fogarty, 1997).

Broadening the Means of Scientific Communication

When co-planning the Ecology component of the Life Sciences strand in the Grades 6 and 7 science curriculum, the resource teacher and teacher librarian worked with me (the classroom teacher) to enhance our students' ability to communicate scientifically. The activities in this unit were designed to allow students to build their knowledge and then demonstrate it in a variety of ways. Students learning English as a second language can build their understanding through a variety of experiences, not just reading and writing. Students who thrive on open-ended exploration have no ceiling placed on their participation. Students who experience academic difficulties can prove to be very powerful learners when provided with new ways to demonstrate their understanding.

In multiple-intelligence theory, there are eight ways of learning. These intelligences are

- verbal-linguistic
- logical-mathematical
- visual-spatial
- musical
- bodily-kinesthetic
- naturalist
- interpersonal
- intrapersonal

Building Background Information

The concepts we chose to teach in this unit included the following terms: *herbivore, omnivore, carnivore, decomposer, food web, food chain, ecosystem, biogeoclimatic zone, predator, prey, biodiversity, interdependent, life cycle, producer, consumer, photosynthesis.*

During our planning it became clear that, to reach the goal of teaching students to communicate scientifically, we needed to provide opportunities for the students to develop a repertoire of skills that enabled them to integrate these intelligences.

We designed a variety of lessons that involved students in discovering more about the important concepts through small group activities:

- a People Hunt at the beginning of the unit to determine the level of understanding that the students possessed about these ecological concepts (see People Hunt on page 112)
- making three-column notes (see Three-Column Notes on page 113) when watching a video or reading non-fiction texts; students then worked together to ensure that each group member had accurately recorded facts, details, and drawings for each of the concepts

See also People Search on pages 14–16.

People Hunt

Directions

Meet for short periods of time with your classmates so you can learn more about the following concepts. As you gather information, record the answer and ask the student to sign his/her name in corresponding box. Each box must contain the name of a different student.

Find someone who:

<p>Knows the name of a carnivore from a famous movie or fairy tale</p> <p>_____</p> <p>_____</p> <p>Signature</p>	<p>Can explain what the prefix <i>bio</i> means</p> <p>_____</p> <p>_____</p> <p>Signature</p>	<p>Can make a sketch of a local ecosystem</p> <div style="border: 1px solid black; height: 100px; width: 150px; margin: 10px auto;"></div> <p>_____</p> <p>_____</p> <p>Signature</p>
<p>Knows some of the things that a herbivore would eat</p> <p>_____</p> <p>_____</p> <p>Signature</p>	<p>Can name a decomposer that is eaten in salads</p> <p>_____</p> <p>_____</p> <p>Signature</p>	<p>Can explain why photosynthesis is important</p> <p>_____</p> <p>_____</p> <p>Signature</p>
<p>Can draw and label a predator as it stalks its prey</p> <p>_____</p> <p>_____</p> <p>Signature</p>	<p>Can name a famous omnivore living in BC forests</p> <p>_____</p> <p>_____</p> <p>Signature</p>	<p>Is able to guess what a Biogeoclimatic zone is</p> <p>_____</p> <p>_____</p> <p>Signature</p>

Three-Column Notes

Word and its meaning	Details	Drawing
1.	a. b. c.	
2.	a. b. c.	
3.	a. b. c.	
4.	a. b. c.	
5.	a. b. c.	

- making personal connections, text/media connections, and connections to the world around them when students discussed these concepts in small and large groups (see Making Connections on page 115)
- showing a food web or life cycle using movement or drama and music
- obtaining information through multi-source and multi-level resources, including picture books, magazines, non-fiction books, pamphlets, video, and websites; for students in Grades 6/7, the selection of books included those read by students in Grades 4 through 8.

Once the students had gained an understanding of these concepts, a field trip was planned to develop the students' observational skills and their naturalist and bodily-kinesthetic intelligences in a forest setting. Park naturalists designed the outdoor activities so that these concepts would come alive for the students. The naturalists reinforced the vocabulary that had been used throughout the unit, demonstrating to the students how biologists used these concepts when communicating with others.

Evaluation: Multiple Representations of Understanding

We wanted to assess how well the team worked together to achieve their goal of communicating in a scientific way, and we also wanted to know how well individual students could communicate their knowledge.

To deepen the students' understanding, we designed our summative assessment so that they could make connections between the concepts taught in the unit and a local ecosystem. The evaluation had to be both group and individual.

Here are the steps we followed:

1. Students were placed in heterogeneous groups. From a list of local ecosystems—seashore, pond, estuary, river, forest, marsh, or creek—each group chose one for their project.
2. The students arranged a field study so that they could visit the ecosystem together. Observations of the area were made in a variety of ways including life lists, photographs, video recordings, observational notes, and drawings
3. Each student in the group would become an expert by learning in-depth about one organism in the ecosystem. A two-page essay was written by each student (following the Essay Outline on page 116) about his/her chosen organism.
4. The art teacher showed students techniques for constructing a diorama.
5. Each group constructed a diorama, using non-living materials to show the insects, birds, plants, reptiles, and animals living in the ecosystem. The diorama had to include the organisms researched by each group member and also a clearly labeled food web.

Evaluation of the essays and dioramas was completed using the following process:

- The students brainstormed all the important components of the dioramas and of the essays.
- The teachers helped the students to organize the criteria into categories for ease of evaluation. If needed, we added criteria and explained to the students why these were important to include.

Making Connections

Topic _____

Things I know and things about me	Other things I've read, watched in movies, or seen on TV	Connections to the world and big ideas

Essay Outline: Interdependence Project

Use the following format as a guide for the essay about the organism you chose for your part of the Interdependence Project.

Paragraph 1

- topic sentence that introduces the essay subject
- identify the organism that has been studied
- include the Latin and common names (if both can be found)
- tell whether your organism is a predator or prey

Paragraph 2

- location of the organism
- describe the ecosystem, niche, climate, and biogeoclimatic zone where your organism lives and finds shelter
- describe the other organisms that live in this ecosystem

Paragraph 3

- explain how the organism fits into the Food Web
- describe and provide evidence of the organism as a herbivore, carnivore, or omnivore
- explain how the organism is interdependent with other organisms

Paragraph 4

- describe changes in the ecosystem that have occurred or are still occurring
- describe problems which this organism has to face
- describe the adaptations, if any, the organism has made to survive

Paragraph 5

- summarize the main ideas of your essay
- describe what needs to be done to protect this organism
- describe what must be done to protect the ecosystem where it lives
- leave the readers with an idea of something that they could do to assist in protecting the biodiversity in our local ecosystems

Bibliography

Please include all of the resources you used and follow the bibliography format outlined by the Teacher Librarian.

Essay components included

- accurate use of scientific vocabulary
- bibliography format used consistently
- all paragraph subtopics included
- conventions of writing.

Diorama components included

- realistic representation of the ecosystem
- food web clearly shown
- overall impact of the diorama
- organisms represented in the diorama.

Throughout this process, students were able to read and see the projects produced by other students in the class. When they saw the range of ways to complete the project, they gained new ideas for tackling future assignments.

- The criteria and rating scale were posted and the teams polished their dioramas against these criteria before moving to the team evaluation process.
- During the team evaluation process, students continued to work in the same groups. Each group was given a different component of the project to evaluate.
- Each group worked together to arrive at a consensus before assigning a score out of 5 for the project component they were evaluating.
- The teachers reviewed the marks assigned by the student teams.
- The essays were read by the teachers and evaluated using the following scale:
 - 5 The student has exceeded the expectations, demonstrating insight and creativity.
 - 4 The student has successfully met all of the criteria.
 - 3 The student has met most of the criteria.
 - 2 The student has met only some of the criteria.
 - 1 The task was inappropriate for the student at this time.

The evaluation process gave students a chance to witness how a subjective evaluation is completed. Some of the groups' debates on how to score particular projects were very illuminating for us as teachers. In most cases, it was evident that the students valued the same things that we did when evaluating their work. The students had fun, experienced a great deal of success, learned a lot of science, and moved their learning outside the traditional boundaries of the classroom. The following two essays are samples of how all students could participate with success in this unit.

Raccoon

By: Lindsay

Have you ever shoed away a raccoon eating your garbage? Next time that you see one, stop and watch it for awhile. You will see that raccoons are very misunderstood. Raccoons are very playful creatures and they are not trying to upset humans. The fact that they have adapted to city life and are not afraid of humans is not their fault at all. Raccoons are consumers. They eat other things. So why are they living in the center of the city? This and much more will be answered in this report.

The raccoon is an omnivore. This means they eat a variety of different things. Some of the raccoons favorite foods are: crayfish, fish, frogs, garbage, mice and squirrels. The raccoon also eats things that are already dead and some plants. Because most things raccoons eat live in the water, they like to live where there is fresh water nearby. There is not a lot of things that eat raccoons but since they live near the city, the raccoon population is kept down by people in cars and the fact that they are not protected. Some things that do eat raccoons are cougars, bears, wolves and other big cats. Most of these animals prefer to eat the babies.

The raccoon lives in the forest. They live in cavities in trees, ditches in the ground and other sheltered areas. Raccoons are not very picky about their location but since they like to live near water, they usually don't live very high up in the mountains. They also can't survive in very, very cold climates like the Yukon. Most raccoons don't care about what kind of forests they live in as long as they have all of the above. This is probably why they like Vancouver so much. The fact is, they are not living in the city, we are living in the forest. If you think about it, raccoons have probably been living in Vancouver for hundreds of years. Then we decided to build our city right in the middle of the forest. For example, the North shore mountains, Stanley

Park and Pacific Spirit Park were all here before us and were all homes for raccoons. Now raccoons have decided to live in city parks because we took down so much of their habitat.

A raccoon's life cycle is very simple. They are considered babies for around two years. For the first year, they stay in their homes almost all of the time. They live on their mothers' milk for only about six months. When they are two years old, they can leave their homes but they usually stay close to their mothers for the first month. Baby raccoons are very playful and curious. This is how most baby raccoons are hurt or killed. They sometimes might wander on to a busy road without their mothers seeing and end up badly injured. Raccoons in zoos can live up to about fifteen years but in the wild they live about only twelve years because of the amount of dangers.

Some drastic changes that have happened in the raccoons ecosystem are clear cutting, highways and toxic garbage. Raccoons are now used to traffic and people but they don't always remember about cars when they are crossing the road. They have become so used to roads being there that they don't consider them being a threat. One major change to the ecosystem is that the forest is being cut down rapidly. This is why raccoons are not living in parks, riverbeds and even people's backyards. Another threat to raccoons is that if people throw away some fish and toxic garbage in the same bag, the raccoons might eat the poison and get sick or die.

So next time you see a raccoon, watch it and learn. Try to be careful not to throw away toxins and food in the same bag and learn to care about the forest. We protect our homes from burglars but raccoons can't protect the forest against us.

Cat Tails Byron

The cat tail has two names—one is called a cat tail and the other name is bull rush. Some people and a lot of books call it a cat tail because at the end of the brown round part it looks like it has a tail. The cat tails have flat leaves about an inch wide. They have a strong stem that grows high. Four quarters of the way up is a dark brown and oval shape, which is part of the cat tail. The cat tail contains pollen grains and just above it is a little tip that looks like a tail. The Latin name for cat tails is *Typha Latifolia*. This organism is prey for the Red Wing Black birds and the Muskrats.

This organism is located in estuaries in Vancouver and Richmond and many other places. I saw them in Terra Nova next to the river – there are thousands of them growing there. Cat tails live in many different climates including those which get snow to heat. It lives in very swampy waters, but has no shelter from rain. A lot of dead trees are in the area where they live.

The cat tails fit into the food web when Red Wing Black birds or Muskrats take the pollen for food. Then they die over the years and make better soil which the cat tails use to survive. When the snow geese come near winter they drop their droppings and that is good for the soil too. Cat tails are eaten by Herbivores because they use the soil to survive. If there was no soil or animals there would not be any cat tails.

There is less room for them to grow because people took up all the room in the beginning of Terra Nova and in other places. It is also facing pollution because you drive right up to where they are when you go for a walk. To survive, the dark brown just before the tip turns into fluff to spread to make more cat tails in years to come.

To protect the cat tails we should give them more room to grow, move them away from the pollution and we will see many more. To protect where it lives there should be not any cars around so that it can live without pollution. No one should litter because it is hard for them to live with all the garbage so throw it in the garbage bins.