Engaging Students in Phenomena Relevant to the Interdependence of Life: Feeding Interactions

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Abstract

Much of science involves finding patterns in observations and explaining them in terms of a small number of principles or ideas. For students to appreciate how science works, they need to have a sense of the range of observations (phenomena) that are used to form the patterns and the helpfulness of the principles or ideas in explaining them. Project 2061's evaluations of science textbooks revealed that textbooks rarely engaged students with phenomena relevant to important science ideas, rarely included phenomena that directly address the often incorrect ideas that students may already have, and rarely guided students in reconciling phenomena with scientifically accepted ideas (Kesidou & Roseman, 2002; Stern & Roseman, 2004; American Association for the Advancement of Science [AAAS], 2002, 2005). In response to these deficiencies, Project 2061 and other CCMS researchers are identifying phenomena that could be used to support the teaching and learning of ideas recommended in *Benchmarks for Science Literacy* (AAAS, 1993) and in *National Science Education Standards* (National Research Council, 1996).

In this poster we show an example of a set of phenomena that can be used to help middle school students gain an understanding of some of the concepts targeted by the key idea: Animals may interact with other organisms for food in a variety of ways. (from *Benchmarks for Science Literacy*, 5D/M2a).

Key Idea

Animals may interact with other organisms for food in a variety of ways. (from *Benchmarks for Science Literacy*, 5D/M2a)

What Students are Expected to Know

- Most animals have multiple sources of food, but some are completely dependent on one or a few species of organisms for food.
- Animals can obtain food from other organisms either by killing and eating them or by feeding off of them without killing them.
- An animal that kills and eats another living animal is called a predator, and the animal that it kills and eats is called its prey.
- Students are not expected to know the terms *producer*, *consumer*, *parasite*, or *host*. Nor are they expected to know how organisms such as plants, which do not depend on other organisms for food, produce their own food.

Ideas Students Have

- "Feed on" means to physically swallow. A consumed organism is eliminated (Reiner & Eilam, 2001).
- A food chain is seen as a bead chain that can [always] be rejoined if one bead is lost. If a population in a food chain is lost, another organism will [always] take its place [in that environment] or its predator will [always] find another food source (Reiner & Eilam, 2001).
- The relative size of an organism determines what it eats. For instance, smaller organisms are incapable of eating other or larger animals, so they eat plants (Gallegos et al., 1994; Reiner & Eilam, 2001).
- Predators are always big and ferocious (Gallegos et al., 1994).
- Prey are always smaller and weaker (or more passive) than predators (Gallegos et al., 1994).

Implications for Instruction

- It may be helpful to ask students to keep track of predator/prey relationships or feeding relationships that they see in the National Geographic video by writing them down as they watch.
- It may also be useful to ask students to write down their general impressions of the organisms involved in the interactions prior to watching the National Geographic video.
- Students should be introduced to multiple strategies for predation that include active hunting vs. trapping, organisms hunting alone vs. groups of organisms working together, etc.
- Students should be shown a variety of predator/prey interactions and exposed to organisms that illustrate different types of predators and prey that fit and defy the stereotypes.

This work is funded by the National Science Foundation grant "Supporting the Next Generation of Curriculum Materials" (NSF ESI-0103678).

Evidence of Predator/Prey Interactions

What is an Owl Pellet?

An owl pellet is undigestable material—fur, feathers, and bones—that an owl regurgitates after it has consumed its prey.

http://www.cnr.vt.edu/forsite/owlpellet/josh/josh1.HTM

This is a video clip of a Snowy Owl regurgitating an owl pellet.
© Nick Bonomo 2000
http://www.ctbirding.org/images/snowy-pellet.mpg

About these examples:

- Photo and definition of an owl pellet, and a video clip of a Snowy Owl regurgitating a pellet, provide evidence of the kinds of organisms eaten by owls.
- Data from a student's science class project provide evidence of what owls eat.
- Photo or video clip showing owls actually eating other organisms is needed to complete the sequence of phenomena.

http://teams.lacoe.edu/documentation/classrooms/judi/ecosystems/student/student.html

Dissecting Owl Pellets
Cassie
Buena Vista School
Palmdale, CA

Cassie's purpose for this experiment was to find out what barn owls eat.

Purpose and Hypothesis: I think that I will be able to find out what owls eat by looking at what is inside the owl pellets.

Analysis of Data: I took apart ten barn owl pellets. I found bones of voles and rats. I found more vole bones than any other kind of bones. The littlest pellet I checked had the bones of only one vole. The biggest pellet had bones from six voles. Most pellets had two or three animals in them.

How much did the owl eat?

Pellet Number	Skulls	Jaw Sets	Number of Prey
1	1	1	1
2	2	3	3
3	3	3	3
4	2	2	2
5	1	2	2
6	2	2	2
7	4	4	4
8	2	2	2
9	6	6	6
10	2	2	2

What I found in the Owl Pellets

Pellet Number	Rat	Vole
1		1
2		3
3		3
4		2
5		2
6	1	1
7	1	3
8		2
9		5
10		7
TOTAL	2	25

Dependence on Many & Few Species for Food

American black bears have many sources of food, including clover, dandelions, berries, acorns, fish, and insect larvae. They occasionally eat other animals and have been known to search for food in human garbage.

http://www.americanbear.org/faq.htm

Giant panda bears depend on bamboo for food. Over 99% of their diet is made up of bamboo.

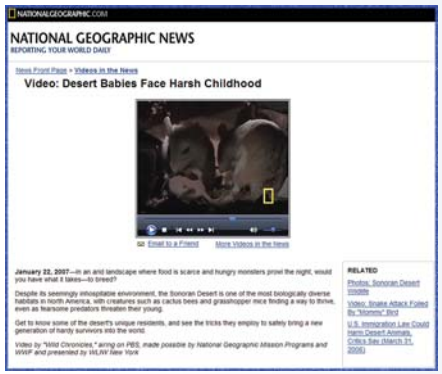
http://www.giant-panda.com/

About these examples:

- Additional evidence may be needed to convince students that the giant panda bear is dependent on bamboo.
- Photos and descriptions show that American black bears have several sources of food, but their relatives, the giant panda bears, have essentially one source of food.

Sources of pictures for American Black Bear: http://encarta.msn.com/media_701506518/American_Black_Bear.html, http://www.se.gov.sk.ca/media/Saskatchewan%20Environmentnewsline/Living_with_Bears.htm, http://www.alaskan-adventures.com/alaska-black-bear.htm, http://www.hickerphoto.com/black-bear-6490-mousepad.htm

Feeding Interactions



http://news.nationalgeographic.com/news/2007/01/070122-desert-video.html

About this example:

- Video highlights several predator/prey relationships, including a bird catching and eating a bee and a grasshopper mouse killing and eating a giant centipede.
- Video can be used to address several of the common misconceptions that students have about predator/prey and other feeding relationships.

Ideas Students Have	How the Video Addresses Students' Ideas
"Feed on" means to physically swallow. A consumed organism is eliminated (Reiner & Eilam, 2001).	• The video shows a cactus bee collecting pollen from a cactus flower and the bee larvae feeding on the pollen. The plant, and even the flower itself, is not consumed in its entirety.
Predators are always big and ferocious (Gallegos, Jerezano, & Flores, 1994). Students associate the word "predator" with a stereotypically large, ferocious animal such as a lion. They do not recognize that a predator is defined by the act of killing and eating another animal, not by its relative size or perceived ferocity.	• The video shows a grasshopper mouse, typically 2-3 inches tall, killing and eating a 10-inch giant centipede. • The video also shows a small bird as a predator eating a bee.
Prey organisms are always smaller and weaker (or more passive) than predators (Gallegos et al., 1994). Students associate the word "prey" with animals that they consider to be small, weak, and incapable of defending themselves. They do not recognize that a prey organism is defined by the act of being killed and eaten.	• The video shows a large, comparatively menacing giant centipede being killed and eaten by a grasshopper mouse.

Guiding Student Observation: To ensure that students make the expected observations, it may be helpful to have them write descriptions of feeding relationships that they see as they watch the video.

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