Lesson Plan for "Evolution and Natural Selection"

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Introduction/Background Info

Evolution scientists study the way that animals have come to have certain physical characteristics in today's modern day and age. Things like camouflage, mating preferences, and environmental adaptation aid natural selection, which directs the flow of evolution. "Natural selection" follows the law of survival of the fittest, which is the idea that only animals with the "fittest" traits/characteristics will be able to "survive" until they can mate and pass on their genes in the form of offspring. Eventually, since only the "fittest" traits have been passed down, the animal will have adapted to its necessary living conditions. For example, let us consider the adaptation of the peppered moth. These moths, which were common across Britain, were originally white with black spots, with a few black moths. The moths that were white with black spots camouflaged with the native trees, and the black moths stood out and were more easily spotted by birds and other predators, which is why there were much fewer of them. Eventually, however, after the industrialization of Britain, people started noticing more black moths than white moths. What induced this population change? Evolution scientists were able to figure out the cause: after industrialization, there were large amounts of black soot, smoke, and pollution in the urban areas. In these areas, the black moths blended in with the environment better than the white moths! So, the predators had an easier time picking out the white moths with black spots, and eventually the population became mostly black moths.

Evolution scientists answer questions similar to the one described above by looking at physical evidence and traits of animals, conducting experiments and doing research, and analyzing history. They are interested in answering the questions "why" and "what." Why did the population of peppered moths in Britain turn from mostly white to mostly black, and what caused this change? Questions like these and their answers help us understand how animals today evolved from their ancestors and enable us to envision what life may have been like in the past.

Student Objectives

- Understand the concept of natural selection
- Recognize the vast number of things that can influence evolution
- Appreciate that all our traits and characteristics have been carefully selected by evolution

Topics

Natural selection – "the process whereby organisms better adapted to their environment tend to survive and produce more offspring" (Google Dictionary)
Evolution – "the process by which different kinds of living organisms are thought to have developed and diversified from earlier forms during the history of the earth" (Google Dictionary)
Survival of the Fittest - animals with the "fittest" traits/characteristics will be able to "survive" until they can mate and pass on their genes

Overview of Lesson Process

Introduce the concept of evolution and natural selection (5 minutes)
Talk about examples of adaptation and natural selection in history (5 minutes)
Introduce Phase 1 (Camouflage: Adapting to the Colors of Our Environment) (20 minutes)
Introduce Phase 2 (Why do we have two eyes?) (15 minutes)
Wrap up discussion (5 minutes)
Clean Up (10 minutes)

Materials

Red Colored Paper, 50 sheets	$3.99
Yellow Colored Paper, 50 sheets	$3.99
Green Colored Paper, 50 sheets	$3.99
Tape	$2.99
Newspaper	$0.00
Children's Scissors, set of 12	$8.49
Total	**$23.45**

Procedures

Note: This lesson plan consists of two activities, Phase 1 and Phase 2.

Phase 1: Camouflage: Adapting to the Colors of Our Environment

Camouflage is the method by which animals use their body color or pattern to "blend in" with their environment. Disguising themselves prevents them from being spotted by predators, and therefore helps them survive long enough to produce offspring and pass on their traits and characteristics.

This experiment simulates the effect that camouflage has on natural selection. In this experiment, the classroom is the "environment" or "habitat" and the students are "predators."

1. Hand out 1/3 of the class red colored paper, 1/3 of the class yellow colored paper, and 1/3 of the class green colored paper. Make sure each student has only one piece of colored paper and cuts out only one butterfly.
2. Ask each student to cut out a butterfly from their piece of colored paper. (This can be done easily by folding the paper in half and then cutting out "half" of a butterfly body, and then opening the paper up to a symmetrical butterfly.) Make sure you know how many red, yellow, and green butterflies have been created and that an equal amount of each has been created.
3. Collect all of the butterflies and ask the students to put their heads down and close their eyes while you set up the "environment."
4. Explain that you are creating an "environment" where the classroom is the habitat, the butterflies around the room are the prey, and the students are the predators.
5. Put up the red, yellow, and green butterflies around the classroom using tape. Be sure to put some in very obvious places (perhaps against a white wall or black chalkboard) and some in

very non conspicuous places, such as against red, yellow, or green wallpaper. Have the students open their eyes.

6. Hand out tally sheets (attached below), and give the students 30 seconds to tally down how many red, yellow, and green butterflies they see, making sure to emphasize that they only count each butterfly once!
7. Make a classroom group tally on the white/chalk board at the front of the room with the categories "Red," "Yellow," and "Green." Go around the classroom, asking each student to tell you which color butterfly they recorded the most, and put a tally in that category. (For example, if a student says "I saw red flies the most!" you would put a tally in your red category). After you have gone around the room, the group tally will have a category(s) that has the most number of tallies.
8. Explain that the butterfly color that has the most number of tallies is the least adapted to the environment, as the predators (or the students) were able to spot them the most! Therefore, according to natural selection, they will die and be unable to produce more offspring of the same color and the population will shift towards the color of the butterfly that was undetected by the predators. This is how camouflage works in environment adaptation!

Phase 2: Why do we have two eyes?

Natural selection works with more than just camouflage and protecting the animals against predators. Natural selection can help animals see better, smell better, or hear better by changing some physical characteristics. For example, elephants have big ears so that they can hear better, ducks have webbed feet so that they can move in the water better, and humans have thumbs so that we can hold and touch things better than other animals.

Have you ever wondered why all the animals you know of have two eyes? Why aren't we all Cyclops with just one eye? Why have we been naturally selected to have two eyes? Today we will discover why evolution deemed it necessary to have two eyes.

1. Divide the students into pairs.
2. Have one student be designated as the "Thrower" and the other as the "Catcher," and provide the pairs with paper balls made from newspaper.
3. Ask the Thrower to "underhand" throw the ball to the Catcher standing 6 footsteps away. The Catcher must attempt to catch the ball with only one hand and with both eyes open. Repeat thrice, and record findings in tally sheet.
4. Now ask the Thrower to "underhand" throw the ball to the Catcher standing 4 footsteps away. This time, the Catcher must attempt to catch the ball with only one hand and with only one eye open. Repeat thrice, and record findings in tally sheet.
5. Make a group tally on the white/black board at the front of the room. Ask each pair which experiment was more "successful" – catching the ball with one eye open or both eyes open.
6. The group tally should say that catching the ball with both eyes was more successful than with one eye. Here is where you explain "depth of perception."

Depth of perception is what all animals need in order to analyze objects. Most of the time, we are engaging the speed, distance, and size of an object all at once. For example, when someone throws a

football and you are trying to catch it, you are gauging how fast the football is flying through the air, how big it is, how heavy it will be, and where it will land. Having two eyes allows you to unconsciously do all of these things at once by what we call "depth of perception." That's why it was so much easier for the class to catch the ball with both eyes open than with just one eye open. For animals, depth of perception helps them catch their prey or run away from an approaching predator and assess their surrounding environment.

Resources

http://evolution.berkeley.edu/evosite/evo101/IIIENaturalSelection.shtml
http://ncse.com/files/pub/evolution/Evolution--Futuyma--chap11.pdf

Evolution and Natural Selection: Activity Tally Sheets

Camouflage: Adapting to the Colors of Our Environment

	RED	YELLOW	GREEN
Total number of butterflies seen			

Which butterfly color did you see the most? _____

Why do we have two eyes?

Mark an X if the Catcher missed the ball, and a √ (check) if the Catcher caught the ball.

	One eye open	Both eyes open
Trial 1		
Trial 2		
Trial 3		
Total Number of √s		

Which method – one eye open or both eyes open – was most successful? _____