

Topic: Darwin's Finch Adaptations Lab

Summary: Students participate in an activity that demonstrates how natural selection works by mimicking adaptations of Darwin's finches.

Goals & Objectives: Students will be able to explain how natural selection works. Students will be able to record, analyze data, and graph of their results.

NGSS Standards: HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

Time Length: 90 minutes

Materials:

- Plastic knives – spoons – forks, 5 each
- Tape
- Paper cups one for each student
- Brown Beans
- Grass field outside, at least 20 feet by 10 feet
- Graph paper
- 5 colored pencils

Lab Setup:

- Students / TA count 100 beans and place each color in one cup.
- Students / TA also count in groups of 50 beans and put in separate cups. These cups will be used for the second – fourth generations. Have 5 cups of 50.
- Place the empty paper cup, one per person, on an easy access table.
- Place the tools, on the table also. There will be five groups. Example, if you have 30 students, there will be six students per group. That means you need six knives, six long pieces of tape, six spoons, and six forks.

Procedures:

1. Have students pick their partners in 2 minutes for a total of five groups. Remind students that the group size needs to equal. Randomly assign each group a beak adaptation (fork, spoon, knife, taped thumb, and hand). The purpose of taping the thumb is to remove the use of the opposable thumb.

2. When you ready to go outside, tell the students where they will be going and then escort them outside. Once you get to the location, find a place where students can write data, preferably next to a blacktop. If no hard surface is available, have students write down the data in the classroom after the lab. Have students be in their groups and place their papers in this location and have them line up with their cups and tools.

3. Spread out the beans equally by throwing them randomly in the air in a 20 x 10 foot area. Say “go” when the students are to start. The students then pick up the bean with their tool and putting the beans in their cups. Say “stop” after 2-4 minutes. The students then go back to where their papers are and get in their groups. They then count their beans and tell you the total of beans. If the students can write on their papers, say aloud all the data for that generation for the students to record.

4. Calculate how many of each seed were eaten. Subtract that number from 100 to give you the number of beans left in the grass. Pretend all the beans in the grass reproduce and have one offspring. Distribute an additional number of beans, equal to the number left in the grass, random in the same area as before.

<i>Beans</i>	1st Generation					Color
	Knife	Spoon	Fork	Taped	Hand	Total
<i>Brown</i>						- 100 =

For the 2nd through 4th generations double the remaining seeds left in the grass each time. The lowest bean amount adaptation becomes extinct each generation. Place a zero in their column when they do not participate.

<i>Beans</i>	2nd Generation					Color
	Knife	Spoon	Fork	Taped	Hand	Total - Previous Survivors
<i>Brown</i>						

<i>Beans</i>	3rd Generation					Color
	Knife	Spoon	Fork	Taped	Hand	Total - Previous Survivors
<i>Brown</i>						

<i>Beans</i>	4th Generation					Color
	Knife	Spoon	Fork	Taped	Hand	Total - Previous Survivors
<i>Brown</i>						

5. The lab will end when there is one type of adaptation left and the rest have become extinct. This will demonstrate to students which adaptation was best suited for the environment.

6. Students will staple the graph the back and turn in the lab at the end of the period.

Accommodations: Students who are not able to participate can only record the data and not participate in the picking of the beans. Students with an IEP can take the handout home if they need extra time. They can also graph only their group's data and not the other four groups.

Evaluation:

The data tables and hypothesis are worth 2 points. The graph is worth a total of 9 points with each part worth 3 points: title and labels, correct values, completed graph. The analysis questions are worth 14 points, two for each question. The conclusion is worth 5 points. This assignment is worth a total of 30 points.

Beak Adaptation Lab

Problem Statement: You are going to mimic how the variations of Darwin's finches compete for the same food source. Pretend that the brown colored beans are seeds for the birds. Natural selection happens when a population changes in response to their environment.

Hypothesis: See Handout

Materials:

Plastic forks	Plastic knives	Plastic spoons
Brown beans	Paper cups	Tape
Grass field	5 Colored pencils	Graph paper

Procedures:

1) There will be five groups with equal number of students. The five groups will represent different beak adaptations of Darwin's finches. Determine who are your partners and then the teacher will tell your group which adaptation your group will have.

Circle your beak adaptation

Knife Spoon Fork Taped Thumb Hand

2) Bring your handout, pencil, cup, and tool and go outside with your group following your teacher's directions. Once you arrive to the grass area to conduct your experiment, wait where the teacher tells you.

3) The teacher will tell you when to start collecting beans. You should have only your tool and cup in your hands. You may use only your tool to put the beans into you cup. One hand is using the tool and the other hand must hold the cup. Once the teacher says time's up, you must stop collecting beans and head back to you paper.

4) Combine our beans with your partner's beans and count the number of beans. Record the data in the 1st generation of the data table below. Remove all the beans and do not count them again. Share your data with the teacher and the record all the data from all the groups.

5) The group with lowest number of total beans dies off and becomes extinct. They will sit out for the rest of the generations.

6) The surviving beans in the grass will reproduce and double their population. The teacher will distribute the offspring beans in the grass to double their population.

7) You will repeat steps 3-8 for the second, third and fourth generations, with each generation one extinction. Mark zeroes for non-participating extinct finches.

Beak Adaptation Lab

Problem Statement: You are going to mimic how the variations of Darwin's finches compete for the same food sources. Pretend that the brown colored beans are seeds for the birds. Natural selection happens when a population changes in response to their environment.

Hypothesis: If I had the _____ adaptation, then I would be the most fit for survival in the grass environment.

Materials and Procedures: See teacher

Data:

		1st Generation					
<i>Beans</i>		Knife	Spoon	Fork	Taped	Hand	Total
<i>Brown</i>							- 100 =

		2nd Generation					
<i>Beans</i>		Knife	Spoon	Fork	Taped	Hand	Total - Previous Survivors
<i>Brown</i>							

		3rd Generation					
<i>Beans</i>		Knife	Spoon	Fork	Taped	Hand	Total - Previous Survivors
<i>Brown</i>							

		4th Generation					
<i>Beans</i>		Knife	Spoon	Fork	Taped	Hand	Total - Previous Survivors
<i>Brown</i>							

Graphing:

Create *one* line graph with the generations on the x-axis and the total number of beans on the y-axis. Use a legend and colored pencils to graph all of the five-beaked adaptations.

Analysis:

1) Independent variable: _____ Dependent variable: _____

Constants: _____

2) Which finch became extinct first and explain why it was not the adapted for survival?

3) Which finch was best adapted for survival? _____

4) Why was the brown beans (seeds) well adapted in the grass environment? _____

5) If white or red beans (seeds) were introduced into the grass, which seeds would you think would be eaten the most? _____ Explain why? _____

6) Would the length of the grass affect which adaptation was better suited for the collecting beans? If so, explain which adaptation would most be affected for short or long grass. _____

7) In this lab we had only one environment, the _____. Four adaptations became extinct in that environment, but on the Galapagos Islands, there were many surviving species of finches. How might the finches in this lab avoid extinction due to competition? _____

Conclusion: Explain about natural selection leads to adaptation of populations using the following terms: population, environment, competition, fittest, adaptation, and selection.
