THE DALLAS WORLD AQUARIUM

Pre-Field Trip Lesson Plan: Scientifically Exploring Animal Adaptations

Goal: Students will gain an understanding of the difference between structural and behavioral adaptations and discover how different beaks help birds specialize in eating different foods.

Objectives:

1. Students will be able to, in their own words, provide an accurate explanation of the difference between a structural adaptation (something the animal is born with) and a behavioral adaptation (something the animal learns or does).

2. Students will make and test predictions relating to beak shape differences and how they allow birds to specialize in eating different food items.

Science TEKS: 3rd Grade – 3.1.A, 3.1.E, 3.3.B, 3.3.C, 3.12.C, 3.13.A

(1) Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;
(E) collect observations and measurements as evidence.

(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and
(C) listen actively to others' explanations to identify relevant evidence and engage respectfully in scientific discussion.

(12) Organisms and environments. The student describes patterns, cycles, systems, and relationships within environments. The student is expected to:

(C) describe how natural changes to the environment such as floods and droughts cause some organisms to thrive and others to perish or move to new locations.

(13) Organisms and environments. The student knows that organisms undergo similar life processes and have structures that function to help them survive within their environments. The student is expected to:

(A) explore and explain how external structures and functions of animals such as the neck of a giraffe or webbed feet on a duck enable them to survive in their environment.

4th Grade – 4.1.A, 4.1.E, 4.3.B, 4.3.C, 4.5.B, 4.13.B

(1) Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(E) collect observations and measurements as evidence.

(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) listen actively to others' explanations to identify relevant evidence and engage respectfully in scientific discussion.

(5) Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines. The student is expected to:

(B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems.

(13) Organisms and environments. The student knows that organisms undergo similar life processes and have structures that function to help them survive within their environments. The student is expected to:

(B) differentiate between inherited and acquired physical traits of organisms.

5th Grade – 5.1.A, 5.1.E, 5.3.B, 5.3.C, 5.5.B, 5.13.A

(1) Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(E) collect observations and measurements as evidence.

(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) listen actively to others' explanations to identify relevant evidence and engage respectfully in scientific discussion.

(5) Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines. The student is expected to:

(B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems.

(13) Organisms and environments. The student knows that organisms undergo similar life processes and have structures and behaviors that help them survive within their environments. The student is expected to:

(A) analyze the structures and functions of different species to identify how organisms survive in the same environment.

Materials:

Beaks*:

- Tablespoons
- Salad tongs
- Clothespins
- Toothpicks
- Pliers

Food Items*:

- Marbles
- Uncooked macaroni
- Rubber bands
- Gummy worms
- Crayons

Support Materials:

- Paper plates (Large)
- Tote bags

Worksheets:

- Different Bird Beaks at the Dallas World Aquarium sheet and Answer Key
- Bird Beak Experiment worksheet

**Similar items can be substituted if those listed above are not available.*

Setup:

1. Arrange student desks into groups of five.

2. Gather items that will serve as bird beaks. Obtain one tote bag for each desk grouping and place one of each beak type into each of the tote bags.

3. Set out five plates. Place a pile of marbles on one plate. Then, place piles of each of the remaining food items (uncooked macaroni, rubber bands, gummy worms, and crayons) on each of the four remaining plates. Repeat for each of the desk groupings.

4. Count out enough paper plates so there is one for each student.

5. Place the food item plates and the other paper plates aside until it is time to start the activity.

Introduction/ Background:

1. In preparation for our field trip to the Dallas World Aquarium, we are going to learn about animal adaptations. Adaptations are features that allow an organism to be successful in its environment. Specifically, we will learn about two types of adaptations – STRUCTURAL adaptations and BEHAVIORAL adaptations.

2. Structural adaptations are physical features of an animal. In animals, these include things such as bird beaks, fur, and coloration.

3. Ask the students to think of structural adaptations that humans have. Allow them to share their ideas.

Examples: walking on two legs, opposable thumbs, hair to protect head/brain, nose hairs to keep allergens out, vocal cords that allow us to make elaborate sounds to communicate.

4. Behavioral adaptations are things that animals do to survive. Animal examples include bird songs, whale migration, and hibernation.

5. Ask the students to think of behavioral adaptations that humans have. Allow them to share their ideas.

Examples: building homes for shelter, facial expressions, making clothes and using blankets for cold weather, building wells for water, weaving and using nets for fishing.

6. Adaptations happen over time and are usually the result of an accidental MUTATION of a gene. Sometimes, this mutation can help an animal to be better able to survive than other members of the species.

7. For example, imagine a bird is born with a mutation that gives it a longer beak. The longer beak allows the bird to catch more food with less effort than the other birds. If this successful bird reproduces, the offspring might also have long beaks.

8. Over time, the more successful, long-beaked birds will survive better than the ones with shorter beaks. More and more long-beaked birds will appear in that species. With time, the entire species will have longer beaks.

9. Beak shape is a great example of a structural adaptation. Different beaks allow birds to eat different kinds of food. Some birds eat fruit. Some eat meat. Some eat seeds. Others drink nectar.

10. Different birds have vastly different beaks. Some are short, some are long and pointy. Some are very large. Some have a hook on the end, others do not. These differences are perfect examples of how different beaks evolved to help different bird species successfully find food where they live.

11. At the Dallas World Aquarium, there are many birds with many different beak shapes and sizes. Distribute a "Different Bird Beaks at the Dallas World Aquarium" sheet to each student (or display it on the SmartBoard or similar).

12. Go through each bird on the list (or selected birds if time is limited). Ask students to guess what that bird eats based on what its beak looks like and why. Use the answer key to tell the students what that bird eats after they made their guesses.

13. To demonstrate how different beak adaptations help birds find and eat food in their respective habitats, we are going to do an experiment.

Directions:

1. Give each student a paper plate and place the five plates with food items in the center of each desk grouping. Tell the students not to touch anything for now.

2. Explain to the students that the paper plate represents their "stomach", and that the items located on the tray represent food.

3. Explain that each student will receive and use an object that serves as a bird beak to gather food. Different students will have different items, each representing a different kind of bird beak.

4. Tell the students that they will take turns trying their beak on each of the food items. The goal is to obtain food and drop it onto the paper plate stomach. Explain that they can only use one hand to operate their beak. The other hand must go behind the back. They will have only 15 seconds for each food item.

5. Hand a tote bag containing beaks to one student in each desk grouping. Have that student reach inside and pick a beak, then pass the bag to the student on the right. Repeat the process until each student has a beak.

6. Distribute the data sheet ("Bird Beak Experiment"). Ask the students to look (but don't touch) the food items on the table and complete part 1 of the data sheet ("Make Predictions").

7. Ask each student to take the food item plate closest to them (being careful not to spill) and place it behind their stomach plate.

8. Tell the students that when you say "start", they will have 15 seconds to collect food. After 15 seconds is up, they should count the number of pieces of food on their plate, record the number on Part 2 of the data sheet ("Collect Data"), then put the food items back on the food plate.

9. After the first round, ask the students to pass their food item plate to the student to their right. The process begins again and continues until each student has tried their beak on each food item.

10. Once finished, collect the plates, food, and beaks and place aside. Invite students to help when appropriate.

Wrap-Up/ Discussion:

1. Tell the class that we will use the class data to determine the kind of food with which each beak did best. Put Part 3 of the data sheet ("Class Data") on the SmartBoard.

2. Ask the students with the tablespoons to raise their hands. Ask the students to report how many of the marbles they were able to obtain with their beak. Add their numbers together and write it in the proper square on the "Class Data" grid. Repeat with the other four food items.

3. Repeat the process with each of the other four beaks.

4. Have the class look at the chart. Start with the marbles. Ask the students to identify which beak was most effective with the marbles and why. What characteristics of the beak made it the best for marbles? What beak(s) were least effective with marbles? What characteristics made those beaks not fit for obtaining marbles?

4. Repeat for each of the food items. When finished, ask the students to complete part 4 of the worksheet ("Results and Summary"). Collect the worksheets at the end.

Assessment:

Comprehension of concepts will be evaluated through observations of student participation in lesson discussions and the activity, as well as the answers to the questions in part 4 of the Bird Beak Experiment worksheet.

Modifications:

- To limit the spread of germs (such as the COVID-19 virus), you could have the students wear masks and gloves for the activity as they will be in close proximity to and handling objects held by other students.

- For students with motor impairment (or if using one hand to operate a beak is too challenging), you can allow students to use both hands. You could also substitute objects/items that are easier to handle or allow a partner to help with beak and food manipulation.

- For students with visual impairment, you could allow the student to handle each beak and touch each food item (be careful with items that are sharp) and make predictions as to which beaks would work best with which food items.

Extension Activities:

1. "Eureka! I found a new species of fish!" activity

   Students play marine biologist as they "discover" a never-before-seen species of fish. Students create their own unique fish, describe its appearance and where it lives, and identify adaptations that help their fish to survive and thrive. Students fill out a checklist, answer questions, and create an illustration of their fish to share with the class. *Worksheet included.*

2. Ocean Camouflage and Plant Camouflage coloring sheets –

Some animals blend in with their environment, making it difficult for predators to find them. This helpful adaptation is called camouflage. Students use crayons, colored pencils, or markers to color one of two Dallas World Aquarium animals with excellent camouflage (leafy seadragons and sunbitterns) along with their environment. Students are encouraged to be creative with their color choices, but the goal is to ensure the animals blend into the background. *Coloring sheets included.*