The University of Texas at Austin
Environmental Science Institute

Observable Characteristics and Evolutionary Reasons for Shared Attributes in Animals

Lesson Plan for Grades: Elementary to Middle School (5th grade, can be used for older/younger grades with slight modifications)
Length of Lesson: 50 minutes

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Subject area/course:

- Science

Materials:

- Student Handouts (1 per student), and enough pencils for all students
- Variable number of collections of small animal figures: similar to the plastic animals shown in the below picture (enough so that there should be at least 10 animals (no more than 15) per group of 2-3 students) Total number of collections depends on classroom size.
- Access to white board/chalk board or doc cam along with appropriate writing utensils

TEKS/SEs:

§112.16. Science, Grade 5, Beginning with School Year 2010-2011.

(2) Scientific investigation and reasoning. The student uses scientific methods during laboratory and outdoor investigations. The student is expected to:

- (C) collect information by detailed observations and accurate measuring;
- (D) analyze and interpret information to construct reasonable explanations from direct (observable) and indirect (inferred) evidence;

§112.18. Science, Grade 6, Beginning with School Year 2010-2011.

(2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:

- (E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

Lesson objective(s): Students will be able to (SWBAT):

- Compare and contrast different animals from a set, based off physical and observable characteristics
- Organize animals with similar attributes into separate categories
- Present possible reasons for why particular animals have similar characteristics and how they may be advantageous for those animals

Differentiation strategies to meet diverse learner needs:

- The teacher should ask students whether they prefer to read or watch videos to learn about concepts; then have students learn in their preferred learning style. However, the teacher may assign students certain methods to improve their skills. For example, if a student prefers reading, teachers may have them watch a video and take notes to improve their listening skills.
- ELL students and students with learning disabilities should have multiple forms of instruction including visual and written instruction sheets as well as a verbal instruction and demonstration.

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ENGAGEMENT (5 minutes)

- "Today we're going to be evolutionary biologists!"

- Main concept questions: "What do evolutionary biologists study? Lets break it down, first looking at the biologist part and then adding the evolutionary part to the career, to get an idea."

- Possible Student Guiding Questions that Should be asked by the Teacher:
  1. What does biology mean?
     - *study of living things*
  2. What does evolution mean?
     - *the process of how things change over time*

- *Expected Student Responses to main concept questions:*
  1. *Biologists study life.*
  2. *Biologists study humans and what happens when you get sick.*
  3. *Biologists study animals.*
  4. *Evolutionary biologists study living animals and how animals have changed over long periods of time (evolution).*
  5. *Biologists study plants.*

- "Evolutionary biologists study how life and living animals have evolved and are currently evolving over large periods of time."

TRANSITION: "Now, we're going to be doing a fun activity where all of you will be evolutionary biologists!"

EXPLORATION (15 minutes)

- "Ok everyone! I will place you in groups of 2-3 students and you will be working together with your group members to come up with some observations, group characteristics, and assumptions for the small set of animal figures you will be handed out. I will pass along a Handout to each of you, and you will follow the directions on the handout to come up with your responses."
- "Think about the following questions (which will be written on the board, or under the doc cam, and try to find a way to answer them through your presentations."
  - "How do animal characteristics help tell us more about the animal?"
  - "What types of characteristics are the most useful for giving us an idea on the animal's past and present evolutionary behavior?"
- The exploration activity or activities will be described *in detail* in pages behind this table if necessary, as well as in the directions on the Student Handout.
  - The activity or activities should produce a shared common experience for the students.
  - Teachers should allow for student-directed learning during this time, but should also be highly engaged while students are performing activities, asking questions of the students one-on-one or while they are working in groups (see example questions under Evaluation)

TRANSITION: "Ok everyone! Let's begin presenting our research from our observations."

EXPLANATION (15 minutes)

- The teacher will call the groups to present their responses and findings. The students will all

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present as evolutionary biologists, explaining how they decided on the group characteristics, and what made them decide on the assumptions they came up with. The presentations will be student-directed and will be process-focused, rather than result-focused. The teacher will state that there is no "singular, correct" way to organize the groups or come up with assumptions, rather it is the process that is significant, as it can be repeated over and over again, providing new information through repetition and new data collection. The students will conclude their presentations by sharing their responses to the 2 higher order-thinking questions (that were given prior to the Exploration activity). The other students will ask questions if they have any, or elaborate on alternative ways the grouping could have been done.

- Some higher order thinking questions, which teachers will use to **solicit *student* explanations** and help them to justify their explanations are listed below:
  1. "How do animal characteristics help tell us more about the animal?"
  2. "What types of characteristics are the most useful for giving us an idea on the animal's past and present evolutionary behavior?"

TRANSITION: "Alright, now let's connect what we did with how it relates to humans."

ELABORATION (10 minutes)

- Students will be introduced to the concept of collecting qualitative data and what is an anthropologist. The teacher will ask questions like:
  1. "What do you call what characteristics we came up for Question 1?"
  2. "How does what we did in looking at animal characteristics and assumptions relate to human characteristics and assumptions?"
  3. "What do we call people who study humans and human behavior?"
     - *Qualitative data* is data that is observational and not quantitative (ex: we observe that dogs and cats have 4 legs, versus we measure that dogs run faster than cats (distance over time).
     - *Anthropology* is the study of human behavior, so anthropologists study human behavior
     - *Evolutionary biology* (which we learned about today, relates with anthropology in that what we observe about animals, can be important for how we can study humans (specifically human evolution).
- "Looking at animals and how they behave under typical and atypical circumstances can provide clues as to how humans would react or behave (evolutionarily) when faced with similar circumstances."

TRANSITION: "Now that we have finished this activity, please turn in your student handouts to me, as well as your animal figures and borrowed pencils."

EVALUATION (throughout entire lesson and 5 minutes at end)

- The teacher will walk around the classroom during the exploration portion of the lesson, and ask critical questions regarding how students can find atypical characteristics that animals have (for example, looking at the example from the student handout: bats and dolphins use echolocation).
- Teachers also assess student responses from the Handout that will be collected at the end of the lesson as well as how students shared their responses during the Explanation portion of the lesson (the presentations).

SOURCES AND RESOURCES

- **Dr. Rebecca Lewis's *Hot Science – Cool Talks #108,* "Friendship and Female Power in the Lemurs of Madagascar",** www.hotsciencecooltalks.org

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EXPLORATION ACTIVITY

Purpose: To be able to observe characteristics of each of the animals, organize them into groups based off shared characteristics, and come up with assumptions regarding why these group characteristics are advantageous for these animals (assumptions that tie into evolution)

Materials: Student Handout, pencil, 10-15 animal figurines

Safety Information: Animal figurines present a choking hazard.

Procedure:

1. Teacher will assign groups of 2-3 students and give each group 10-15 animal figurines, and pencils, and Student Handouts (under that section of this lesson plan).
2. Each group will follow along the directions on the Handout.
3. As the groups work on the activity, the teacher will walk around the groups providing guidance on procedure, asking critical questions (see Evaluation), and assessing student participation for group work (see rubric).
4. The last 2 minutes, students will come up with a way for how they will present some or all of their findings to the rest of the class. All students MUST participate in group work as well as the presentation for full credit (see rubric).

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STUDENT HANDOUT:

Name:

Group Member Names:

1. For each of the animals you get, write down what the animal is, along with 5 noticeable characteristics or observations (from prior knowledge) that describe each animal.

   Make sure at least 2 of the characteristics are based off observation of the plastic figurines and find characteristics that don't fit all of the animals you are give (the observations should be somewhat unique so that it fits some of the animals, not one or all).

Animals with Their Characteristics (with first row done as an example):

Animal	Characteristic #1	Characteristic #2	Characteristic #3	Characteristic #4	Characteristic #5
Dog	*4 legs*	*Has fur*	*Has a tail*	*Has canines*	*Can swim*

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2. Now, looking at the characteristics, find similar characteristics that are shared between different animals, placing them in groups based on characteristics.

   If an animal has multiple similar characteristics, then write it for <u>all</u> the group characteristics it can fit under. Each animal has to fit into <u>at least one</u> group, and each group has to have <u>at least 2</u> animals (but NOT all of them).

Group Characteristics and the Animals that fit in those groups:

1	2	3	4	5	6
Has 4 legs	**Can Swim**				
Dog	Dog*				
Cat	Penguin				

*Column 1-2 done as examples (Dog appears in 2 groups)

- **Extra Space provided below if needed:**

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3. Based off the groups made in Question 2, come up with at least 2-3 assumptions per group of reasons for why these animals may have evolved to have these traits.

   How are these group traits advantageous for these animals?

Assumptions Per Group (first column done as an example)

Trait #1	Trait #2	Trait #3	Trait #4	Trait #5	Trait #6
Has 4 Legs					
So that the animals can cover more ground on land faster					
So that these animals can have stability when walking on uneven land					
So that these animals can escape predators by being able to run faster					

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INDIVIDUAL STUDENT RUBRIC FOR ASSESSMENTS:

A. Observational Characteristics:

1	2	3	4
Student has 2 or fewer characteristics for 1 or more of the animals.	Student has 3 characteristics for **each** of the animals. Characteristics are NOT unique to the animal.	Student has 4 characteristics for **each** of the animals. ALL characteristics are unique to the animal.	Student has 5 characteristics for **each** of the animals. ALL characteristics are unique to the animal.

B. Group Characteristics:

1	2	3	4
One or more of the animals is NOT placed into a group. One or more group has less than 2 animals. One or more group has ALL animals in it.	One or more of the groups DOES NOT use a characteristic that was found in Question 1. None of the animals that share multiple group characteristics are placed in each of those groups.	**All** animals are placed into a group. All groups have at **least 2 animals.** At least 1 of the animals that can be placed in multiple groups, is not placed correctly.	**All** animals are placed into a group. All groups have **at least 2** animals. **All** animals that can be placed in multiple groups, are placed so.

C. Assumptions:

1	2	3	4
At least 1 group does not have any assumptions. The assumptions are **not** unique from each other (per group).	At **least one group** does not have **more than 1** assumption. At least 1 of the assumptions is incorrect or does not relate to the group characteristics.	**Each** group has 2-3 assumptions. ALL of the assumptions are correct **and** relate to group characteristics. None of the assumptions relate to how the group characteristic may be advantageous (evolutionarily speaking).	**Each** group has 2-3 assumptions. All of the assumptions are correct AND relate to group characteristics. **At least 1** of the assumptions relate to how the group characteristic may be advantageous (evolutionarily speaking).

D. Group Work and Presentation:

1	2	3	4
Student distracts the group and prevents the group from working on the handout. Student DOES NOT work on the activity. Student disrupts the group or class during the lesson.	Student DOES NOT participate in the Exploration part of the lesson AND DOES NOT speak during the presentation for the Explanation part of the lesson.	Student EITHER participates in the Exploration part of the lesson OR speaks during the presentation for the Explanation part of the lesson.	Student participates in the Exploration part of the lesson AND speaks during the presentation for the Explanation part of the lesson.