BIO 101: Mechanisms of Evolution

Department of Biological Sciences, SJSU

Time estimate to complete this assignment: 75 minutes.

Overview

This assignment will walk you through the mechanisms of evolution. It is your job to read the assigned chapters from the Beak of the Finch and have answered the reading questions. The reading questions are there to help you achieve the basic objectives listed below.

Learning Objectives

Basic objectives (pre-class)
1. Identify main characters of the chapter and link them to their observations.
2. Determine the unique features of the island, Daphne Major, and finches.
3. Define natural selection and evolution.

Advanced objectives (in class)
1. Formulate and state hypotheses to explain observations of given scenarios.
2. Evaluate methods to study hypotheses.
3. Determine if sets of "if/then" statements make valid and logical predictions.

Pre-Class Individual Activities:

1. **Read:** Chapters 1-4
2. **Answer:** Chapter questions provided via Google Quiz modules

In-Class Group Activities:

Form book clubs and go highlighted questions in lecture.

1. Students will form groups of 4 each; and then discuss question (next).
2. Instructor will post one question at a time.
3. Each club will have a set amount of time to discuss and answer the question on the screen.
4. After completing task, class will discuss results and ask any questions.

Post-Class Individual Activities:

The tasks (linked to Advanced LOs 1–4) include:

1. Students will apply their knowledge to evaluate Darwin's 4 criteria for evolution by natural selection.
2. They will answer questions that require them to connect observations from the Beak of the Finch to Darwin's 4 criteria.

Lesson Plan

Lesson: Beak of the Finch: Darwin's beaks (Chapter 4)

Timeframe: Note how long will it for take the learner to complete all of the activities from pre-class to post-class activities.

Read chapter 1: (14pgs) 30-60 min. Answer reading questions: 15-20 min. Class activities: 75 min.

Materials needed: Describe what items will be needed to complete the in-class activities.

iClicker registration and device.
Paper for notes. Pen or pencil for writing.

Will be using Picture Prompt and teams to decide by consensus to identify characters and concepts from reading.

Objectives: List out the basic objectives tied to pre-class activities and the advanced objectives tied to inclass and post-class activities.

Basic:
1. Identify main characters of the chapter and link them to their observations.

2. Determine the unique features of the island, Daphne Major, and finches.

3. Define natural selection and evolution.

Advanced:
1. Formulate and state hypotheses to explain observations of given scenarios.

2. Evaluate methods to study hypotheses.

3. Determine if sets of "if/then" statements make valid and logical predictions.

Background to the Lesson: Note the typical composition of learners in the class, how this lesson fits into the course design/schedule, prerequisite knowledge required, and typical challenges that learners face with this content area.

The typical learners of this class will be from a variety of backgrounds, but advanced undergraduate level. They will require reading comprehension; the guided reading questions are designed to help student focus on main ideas. No other requirements are necessary.

Introduction to Lesson: Describe the purpose of this content area for learners and an overview of the activities and resources for the flipped lesson.

The purpose is to get into the scientists' minds as they go through the process of discovery by following along on their personal journeys. The Beak of the Finch is an account of a now a famous multi-decade study that was the first to demonstrate Darwin's theory of evolution by natural selection in a field population of finches. The students will be introduced to the biology and natural history of the bird species in the Galapagos archipelago in this lesson. For the activity, they will decide the associations of adaptations shown in class and determine their own designs of studies for testing hypotheses. "What would you do?"

Procedure [Time needed, include additional steps if needed].

Pre-Class Individual Space Activities and Resources: Outline the major steps for the preparatory activities and be sure to tie the steps to the basic learning objectives you have noted above. Note resources required for learner preparation.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: Assign chapter 4 to read. Chapters 1-3 read prior week.	Introduce learners to scientists, field, and observations. Build context. Improve reading comprehension skills.	45-60min	Identify main characters, observations from the field.
Step 2: Answer questions on Google survey.	Guide learners to important points and events in reading. Questions prepare students for concepts that will be discussed in class.	15-30 min	Establishes the factual information, i.e., scientists' names, criteria for evolution.
Step 3:			
Step 4:			

Step 5:			

In-Class Group Space Activities and Resources. Outline the major steps for the in-class activities and be sure to tie the steps to the advanced learning objectives you have noted above. Also note any resources needed/developed to provide effective active learning activities within class.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: *Discussion row --* Learners will be assigned into groups of 5 to sit in the front row. Game show format with clickers for rest of class, while team in front convenes to answer question.	Get students to organize.	5 min	
Step 2: Series of questions will be given via powerpoint for team members to answer. They get points.	To review and apply information gained from reading(s).	30 min	Make a link between observations and hypotheses.
Step 3: As a team, students will be assigned a scenario. They are to read the scenario as a group and state formal hypotheses for their observations. Briefly describe general approach for testing hypotheses.	Evaluate biological scenarios through a scientific lens.	10 min	State scientific hypotheses.

Steps	Purpose	Estimated Time	Learning Objective
Step 4: The scenarios will be displayed on screen to the class, and each group will present their hypotheses.	Present to rest of class for group critique and consensus.	30 min	Evaluate hypotheses and methods.

Post-Class Individual Space Activities and Resources. Outline the major steps for the post-class activities and be sure to tie the steps to the advanced learning objectives you have noted above. Also note any resources learners will need to complete any post-class activities assigned after the group space activities.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: Write out predictions for each hypothesis presented in class for each scenario.	Get learner to think through each scenario on their own**.**	30-45 min	Evaluate logic of predictions.
Step 2: Discuss each prediction. Are these logical and testable?	Apply logic and scientific approach.		Determine validity of predictions.

Evaluation:

Analysis. In this section, note what you think will work, and what challenges you think you may face in implementation.

I think that this lesson would work if the class is not too large. If each team for Discussion Row activity takes 5 minutes, then only there can be 6 teams at most. In a large class size, some students would be left out if teams were limited to ~5 students max. That's ok, however, because there will be continued opportunities.

The challenge will be in getting students to stay up to date with reading. The chapters are not independent, and the story and concepts build from day 1. The other challenge will be to complete activities within allotted time. Students will also be stumped at first – and be shy to speak up with their ideas. The lack of determinism in answering these types of questions will be unsettling to some students.

Connections to Future Lessons. In this section, note how you think this lesson plan connects to your next topics in the course.

In future lessons, we will apply these same core concepts to other scenarios and case studies. For example, they will continue to evaluate hypotheses for elaborate display rituals of species, evolution of aging and senescence, parasitism, cancer, human evolution, and communication systems across a variety of modalities.