



UBC
Botanical
Garden

Educational
Resource
For Teachers

Evolution Project: **Science 10 + Life Science 11**

2024

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GENERAL INFORMATION

Post-Visit Project
Grades 10, 11 – Science, Life Science
Mukul Rishi
June 2nd, 2023

Evolution Project Science 10 + Life Science 11

Overview

After an immersive garden experience through a UBC Botanical Garden tour, students will be enabled to witness firsthand the principles of evolution and natural selection. The tour will provide the students with a solid understanding of evolution and lay the groundwork for their projects. Following the tour, students will be given the task of either selecting a specific species from The Garden or choosing any species from the wild and creating a project focusing on its evolutionary history.

Content

Students will understand:

Science 10:

1. Mechanisms for the diversity of life and its impact on evolution
 - Natural selection
 - Adaptive radiation (a rapid increase in the number of species with a common ancestor)
 - Selection pressure (e.g., adaptation and extinction, invasive species)
 - Adaptations (physical or behavioral feature of an animal that helps them better survive in their environment)

Curricular Competencies

Students will be able to:

Science 10:

1. Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest.
2. Use knowledge of scientific concepts to draw conclusions that are consistent with evidence.
3. Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations.

- Extinctions (a widespread and rapid decrease in the biodiversity on Earth)

Life Science 11:

1. Microevolution
 - change within a species that occurs over time in a population
 - adaptation to changing environments
 - changes in DNA
 - mutations, population genetics
 - natural selection
 - mechanisms of gradual change
2. Macroevolution
 - major evolutionary changes over long periods of time
 - origin of new species

Life Science 11:

1. Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest.
2. Use knowledge of scientific concepts to draw conclusions that are consistent with evidence.
3. Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations.

Big Ideas

Science 10: DNA is the basis for the diversity of living things.

Life Science 11: Evolution occurs at the population level.

Objectives

This project aims to scaffold the learning and foster the curiosity developed at UBCBG about speciation, natural selection, and the evolution of plants.

Through this project, students will demonstrate comprehension of the concept of evolution and its significance in the context of the selected species, as well as explain key evolutionary principles such as natural selection, adaptation, and genetic variation.

This project allows students to explore the topic of evolution lead by their own inquiry and interests. Giving students the freedom to choose their own organism to study and method of presenting their project promotes creativity and engagement in their learning. Students also practice proficiency in conducting scientific research, including gathering and evaluating information from

Core Competencies

Personal & Social Awareness

This lesson focuses on developing and reflecting on students' personal and social awareness.

Students will demonstrate personal responsibility by independently conducting research, managing their time effectively, and adhering to ethical standards in academic inquiry and citation practices.

They will collaborate with peers, teachers, and potentially external experts to share knowledge, exchange ideas, and provide constructive feedback, promoting teamwork and cooperation.

Through their exploration of evolutionary concepts and their application to real-world examples, students will develop an understanding of their role as responsible stewards of the natural world, recognizing the interconnectedness of life and the importance of biodiversity conservation.

multiple sources, as well as effectively communicate complex scientific concepts to a diverse audience.

This project encourages an awareness of the environmental impacts of climate change, human behaviours and environmental influences on the evolutionary history of plants and other organisms, promoting environmental stewardship in students.

Cross-curricular + Trans-disciplinary Connections and Critical Questions

1. History/Social Studies: Investigate the historical and cultural perspectives on evolution and natural selection.
 - a. How have different societies viewed these concepts over time?
 - b. Are there any societal implications or controversies surrounding the teaching of evolution?
2. Environmental Studies: Explore the role of biodiversity in ecosystems and the impact of human activities on natural selection and evolution.
 - a. How do factors like habitat destruction, pollution, and climate change influence the evolutionary trajectory of species?
3. Geography: Investigate how geographical factors influence the distribution and evolution of species.
 - a. How do biogeographical patterns contribute to our understanding of evolutionary history?

Equity and Diversity

Throughout this lesson and project, be mindful of the diverse perspectives and knowledge students bring to the subject. Encourage students to share their insights and understandings, promoting a rich dialogue that deepens learning for everyone. The project component of this lesson plan is intentionally flexible, allowing students to

First Peoples' Principles of Learning

Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).

Students will research further into organisms located in their community as well as learn more about their history and evolution. Students will also work in pairs

choose a focus that is personally meaningful and reflective of their interests and cultural backgrounds.

or groups to learn and complete this project.

ASSESSMENT

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Assessment Description

Before the Tour:

When registering for a tour with the Garden, ask in the notes for a focus on evolution, speciation, selective pressures, and adaptations.

After the Tour:

Upon completing the Garden tour, the students will be given the task of either selecting a specific species from the Garden, or choosing any species from the wild, and creating a project focusing on its evolutionary history. They will have the freedom to choose any organism that piqued their interest during the tour. However, you can also provide a list of organisms they encountered during the tour as options to narrow down their selection.

To promote creativity, the project can be presented in various formats, including a brochure, presentation, video, painting, or any other medium that allows them to effectively communicate their findings. This flexibility encourages students to showcase their understanding of the species' evolutionary journey in a way that aligns with their individual interests and skills.

Below is a checklist that outlines the major information expected to be included in their project. This serves as a guideline for the students to follow as they are researching for their species. The checklist can easily be edited depending on the specific needs and objectives of the class. Here are also some guiding questions that you can offer the students as they are starting on their projects.

- What are the most recent ancestors of your selected species?
 - What are some behavioral changes that your species has developed in recent history?
How do these changes help their survival?
 - Have there been any significant environmental changes in recent history that have pushed your species to evolve?
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Attached is an example rubric that outlines the evaluation criteria for the project, including specific curricular competencies that align with the learning goals of the assignment. You can customize the rubric to fit your specific requirements and expectations.

Example Assessment Checklist

Content	Completed?
An overview of the concept of evolution and its significance to the selected species	
A detailed description of the selected species, including its common name, scientific name, and classification.	
Describe the habitat and geographical distribution of the species.	
Discuss the species' closest relatives and notable evolutionary relationships.	
Identify the selective pressures that have influenced the evolution of the species.	
Provide examples of specific adaptations that have helped the species survive and reproduce.	
Discuss the role of genetic variation in evolution.	
Highlight any specific genetic adaptations or variations that have occurred in the species.	
Investigate whether the selected species has undergone speciation events or is currently in the process of speciation.	
Summarize the key findings and insights gained from studying the selected species' evolution.	
Provide a list of the sources and references consulted during the research process, using appropriate citation format (APA).	

Example Assessment Rubric for Grade 11

Curriculum Competencies	4 (Extending)	3 (Proficient)	2 (Developing)	1 (Emerging)
Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest	The student possesses a deep and clear understanding of their chosen species and is comfortable answering follow up questions	The student possesses a good understanding of their chosen species and is comfortable answering follow up questions	The student possesses an adequate understanding of their chosen species and can sometimes answer follow up questions	The student possesses a surface level understanding of their chosen species
Use knowledge of scientific concepts to draw conclusions that are consistent with evidence	The student makes detailed conclusions which lead to a better understanding of the material leading to further research and appropriate follow up	The student is able to make clear conclusions which lead to a better understanding of the material leading to further research	The student is able to make basic conclusions and can initiate further research	The student is able to make basic conclusions from research
Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations	The projects contain all of the checklist items that are described in great detail. The students' project is easy to follow, and conclusions are clearly stated	The projects contain all of the checklist items that are described in detail. The students' project is easy to follow, and conclusions are stated	The projects contain most of the checklist items that are described in some detail. The students' project is straightforward to understand	The projects contain some of the checklist items that are described in low detail. The students' project is difficult to understand at times.