

DINOMECHANICS

Teacher Resource Guide

Program Overview

TOPIC: Dinosaur families and the scientific method.

THEME: Students explore the mechanics of how dinosaurs moved by comparing them to modern animals using measuring, mathematics, and the dinosaur skeletons found in *Dinosaur Hall*.

PROGRAM DESCRIPTION: Working in groups, students use the scientific method to compare dinosaurs to modern animals by collecting and analyzing data from specimens in *Dinosaur Hall*. They record their data on an iPad and perform various calculations. A discussion afterwards allows them to share their findings with the group and introduces the topics of error in data collection, assumptions, consensus in the scientific community, and specific challenges in palaeontology.

AUDIENCE: Grades 6 - 9

DURATION: 60 Minutes

LOCATION: *Dinosaur Hall*

GROUP SIZE: 15 - 30

Curriculum Connections

Grade 6 Science: Scientific Explanations

Math: Standard Algorithms

Grade 7 Science: Planet Earth

Math: Numbers, Patterns and Relations (Variables and Equations), Shape and Space (Measurement), Statistics and Probability (Data Analysis)

Language Arts: General Outcomes

Grade 8 Science: Cells and Systems

Math: Numbers, Statistics and Probability (Data Analysis)

Language Arts: General Outcomes

Grade 9 Science: Biological Diversity

Math: Numbers, Statistics and Probability (Data Analysis)

Language Arts: General Outcomes

Program Objectives

Students will be able to:

1. Describe how palaeontologists infer behaviours of extinct species, by comparing a dinosaur family to modern functional analogues.
2. Draw conclusions based on the data they have collected to answer a scientific question.
3. Think critically about and discuss their methodology (e.g., errors, assumptions, simplifications).
4. Recognize and describe the scientific method.

Suggested Pre-Visit Activity

1. PROGRAM TERMINOLOGY

Here are some terms you may want to discuss with your class before you attend this program. These terms will help the students with the program activities.

Scientific Method: the systematic process used by scientists for testing hypotheses by collecting and analyzing data, to understand the natural world.

Biomechanics: the study of the structure and movement of living organisms; how animals move.

Analogue: something that is similar or comparable to something else in structure, function, origin, etc.

Family: the taxonomic rank of a group of related organisms. In zoology (including palaeontology), family names end in “-idae,” but often have a different collective name (e.g., species belonging to the family Ceratopsidae are informally called ceratopsians).

2. LEAD DISCUSSIONS/RESEARCH INTO TOPICS SUCH AS:

Brainstorm: Bringing the past to life. Palaeontologists (scientists who study ancient life based on the fossil record) often have limited data to work with (i.e., often only the hard parts fossilize, and fossil records are incomplete). How might palaeontologists be able to figure out the life histories of extinct animals, such as what they ate, how they lived, how they moved, what killed them, etc.?

Post-Program Activity

1. KEY TERMS

Taphonomy: The study of the processes—burial, decay, and preservation—that affect animal and plant remains as they become fossilized.

Preservation potential: The probability of something becoming preserved in the fossil record.

2. LEAD DISCUSSIONS ON THE FOLLOWING TOPICS

More questions. Answering one question in science often leads to several more. What are some additional things you'd like to find out about your dinosaur family, or other questions that came up as you were conducting your research? How would you design a scientific study to answer your new question(s)?

"Scientists say/studies show..." Having experienced the simplification, assumptions, and potential for error that are part of conducting a scientific study, how much confidence do you have in media reports that claim, "scientists say..." or "studies show..."? Discuss the importance of critical thinking and understanding how science is conducted.

Consensus in the scientific community (or lack thereof)

Standing on the shoulders of giants. What are some advantages of using a standardized process (the scientific method) for studying and understanding the world? Can you think of any limitations?

Looking ahead. In a million years, what evidence might exist to inform future scientists about the life histories and behaviours of species living today? (Prompt students to think outside of the fossil box: e.g., taxidermy specimens, photographs, videos and documentaries, scientific papers, etc.)

Preservation Potential: Which of the following would have a high preservation potential?

Low preservation potential?

teeth, hair/fur, bones, soft tissue (e.g., eyes, muscles, brains, organs, skin), scales, feathers, large animals, small animals, leaves, wood, pollen, eggs, DNA, blood, insect exoskeletons, gastroliths, trackways

What conditions would affect the preservation of fossils? (Answers: climate, pH, depositional environment, pressure, time, original size and condition)

3. ONLINE RESOURCES

Articles about dinosaur behaviour and locomotion

<http://www.theguardian.com/science/lost-worlds/2014/may/01/how-do-we-know-what-we-know-about-dinosaur-behaviour>

<http://www.theguardian.com/science/lost-worlds/2014/mar/20/did-losing-their-tails-make-birds-cock-o-the-walk>

Up-to-date information on all aspects of science, including geology and palaeontology

<http://www.sciencedaily.com>

The Scientific Method

http://www.biology4kids.com/files/studies_scimethod.html

<https://explorable.com/what-is-the-scientific-method>

Limitations of the scientific method

<http://science.howstuffworks.com/innovation/scientific-experiments/scientific-method10.htm> http://www.biology.ie/docs/WEB_SM.pdf

Note: Links were last accessed February 2020.

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