



Stackable Instructionally- embedded Portable Science (SIPS) Assessments Project

Grade 8 Science

Unit 3 Instructionally-embedded Assessment Task Specification Tool:

“Building a Tree of Life”

Understanding Earth History and the Origin of Species

July 2023

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Grade 8	Unit 3	Instructional Segment 2	Task Title: Building a Tree of Life
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Unit 3: Understanding Earth History and the Origin of Species

Anchor Phenomenon	Problematization/Investigative Strategy for the Unit
<p>In this unit, the anchoring phenomenon is based on the shared experience the class will have of selecting from an online database of fossils found in their area (https://paleobiodb.org/navigator/). Students select a particular organism to think about throughout the unit by zooming into a region/state of interest on the map and selecting an interesting organism. The teacher can problematize this for students by setting up the general questions, “What do you notice about these organisms? What do you wonder about them?” Details for this anchor phenomenon activity appear in <i>Fossils Around Us</i> in Segment 1.</p>	<p>If we want to understand our organism of choice, we need to research its origin through fossil records. We need to understand why some of the species are now extinct from the variation in the current species and fossil records. What was it about their environment that caused them to change? What might have enabled them to survive better than other organisms? We would also need to investigate the expression of genes within the organism. Were there possible mutations that might have occurred that enhanced their survival?</p>

Segment 2 Overview

By engaging in the practices of obtaining, evaluating, and communicating information, analyzing and interpreting data, and constructing explanations about patterns, students look for patterns in fossil records through the identification of gross anatomical similarities and differences. Several times during this segment, students complete specific steps related to the investigation of their individual research project that are addressed in each lesson. At the end of the segment, students apply the methods they have learned to support inferences about evolutionary relationships related to their individual research topic. Students are both formally and informally assessed on identifying patterns in fossil records to make inferences about evolutionary relationships.

Assessments for this segment focus on students' ability to analyze and interpret data and construct explanations about patterns in fossil records. Students are formally assessed on how they can find and use evidence of evolution to group organisms into in/out groups based on different characteristics. An example of a characteristic they could use is the presence or absence of analogous, homologous, and vestigial structures. Using these groupings and information gathered from resources related to their fossil organism, students create a visual representation through a cladogram with clear labels and a scientific explanation that justifies their choices using evidence and reasoning.

Lesson Title(s)	Lesson Description(s)
Building a Tree of Life	<p>In the lesson, "Building a Tree of Life", students are introduced to cladograms, then conduct and review research to build a cladogram relating to the organisms they have chosen to research for their projects. To support student understanding, the teacher begins by sharing examples such as Cladogram V.1 or Cladogram V.2, which are some modern and fossil ancestors of whales (or other teacher-selected fossils from earlier in the unit). Students look for similarities and differences between the species represented on the cladograms and develop a class definition of what a cladogram is and what should be included in it.</p> <p><u>What Students Figure Out</u></p> <ol style="list-style-type: none"> There are anatomical similarities and differences between organisms that are alive today and organisms from the fossil record (SEP: Analyzing and Interpreting Data, CCC: Patterns). Similarities and differences help us to make inferences about organisms from the fossil record (SEP: Constructing Explanations, CCC: Patterns).

Formal Assessment Title	Assessment Description
Building a Tree of Life	<p>In this assessment, students examine both living and extinct relatives of their identified fossil organisms to find evidence of evolution and group their organisms into in/out groups based on different characteristics. An example of a characteristic they could use is the presence or absence of analogous, homologous, and vestigial structures. Using these groupings and information gathered from resources related to their fossil organism, students create a visual representation through a cladogram with clear labels and a scientific explanation that justifies their choices using evidence and reasoning.</p>

NGSS PE(s) Code(s) & Description(s)
<p>MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]</p>
<p>MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]</p>
AG(s) Code(s) & Description(s)
<p>A6. Compare, integrate, and evaluate sources of information from print resources and articles to solve a problem related to patterns presented in fossil records.</p>
<p>A9. Develop an explanation about what caused the similarities and differences between organisms today and organisms from fossil records.</p>

Evidence Statement(s)

- Develop an explanation about what caused the similarities and differences between organisms today and organisms from fossil records.
 - Explain how organisms that share anatomical features are likely closely related while recognizing that structures can be used for the same purpose, but structural differences show they are not closely related (wings of birds vs. insects).
 - Use changes over time in the fossil record to infer lines of descent based on shared features.
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Phenomenon or Phenomenon-rooted Design Problem

- Present-day organisms can share many anatomical structures with similar organisms as well as distantly related organisms. For example, the upper arm bones of mammals are similar even if those limbs have different functions, as well as how the wing of a bird and an insect both allow for flight but are entirely different structures. This is also true of extinct organisms that we can gather evidence about from the fossil record. These similarities as well as differences can be used to show evolutionary relationships between organisms throughout time.
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General Scenario Description

Students are introduced to a list of present-day organisms and adaptations they have that make them successful in their environments (this may occur at the beginning of Instructional Segment 1 or 2 before this point). Students investigate an example of how anatomical adaptations can be used to describe evolutionary relationships between these organisms in the present day and then use the fossil record to explore relationships to extinct organisms. They choose an organism to create a visual representation of through a cladogram with clear labels to show evidence of evolution. Students then describe how their organism is related to present-day organisms as well as those from the fossil record.

Chain of Sensemaking

- Using a presentation of two similarly appearing organisms, students will describe characteristics of these organisms to begin to explore relatedness based on anatomical features.
 - Students are presented with a comparison of anatomical features (i.e., the forelimb) of four living organisms to identify and describe any similarities and differences.
 - Students identify and describe homologous versus analogous structures between living organisms and any extinct organisms.
 - Students develop an initial model to show how the present-day organisms may be related based on these structures as well as how they may be related to extinct organisms.
 - Students identify a group of organisms of their choosing to gather more information/research.
 - Students construct a cladogram of their chosen group of organisms and explain their groupings and how the cladogram can be used to show lines of evolutionary descent.
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Work Products

- Fill-in-the-blank
 - Short response
 - Cladogram
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Application of Universal Design for Learning-based Guidelines to Promote Accessibility (<https://udlguidelines.cast.org/>)

Multiple Means of Engagement	Multiple Means of Representation	Multiple Means of Action & Expression
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Context or content <input checked="" type="checkbox"/> Age appropriate <input checked="" type="checkbox"/> Appropriate for different groups <input checked="" type="checkbox"/> Makes sense of complex ideas in creative ways <input checked="" type="checkbox"/> Vary the degree of challenge or complexity within prompts 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Provide visual diagrams and charts <input checked="" type="checkbox"/> Make explicit links between information provided in texts and any accompanying representation of that information in illustrations, equations, charts, or diagrams <input checked="" type="checkbox"/> Activate relevant prior knowledge <input type="checkbox"/> Bridge concepts with relevant and simple analogies and limited use of metaphors <input checked="" type="checkbox"/> Highlight or emphasize key elements in text, graphics, diagrams, formulas <input type="checkbox"/> Use outlines, graphic organizers, unit organizer routines, concept organizer routines, and concept mastery routines to emphasize key ideas and relationships <input checked="" type="checkbox"/> Give explicit prompts for each step in a sequential process 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Solve problems using a variety of strategies <input checked="" type="checkbox"/> Sentence starters <input checked="" type="checkbox"/> Embed prompts to “show and explain your work”

Targeted PE(s) Code(s) and Alternate Conception(s)

- **NGSS PE: MS-LS4-1.** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]
 - **Common Alternate Conceptions**
 - The geographic distribution of species
 - Changes in the size and function of anatomical structures over time
 - Evidence of mass extinctions
 - Evidence for the emergence and extinction of species
 - Evidence for the increasing diversity and complexity of organisms
 - Use of vertical location in strata to determine relative ages of different fossils
- **NGSS PE: MS-LS4-2.** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]

○ **Common Alternate Conceptions**

- Species that are similar can share a common ancestor, but species that have no apparent, obvious, or superficial similarities cannot share a common ancestor.
- Plants and animals cannot share a common ancestor.
- Humans do not share a common ancestor with other living organisms.

Unit 1 Vocabulary

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|-------------------------|------------------|
| • Analogous structures | • Fossil Records |
| • Homologous structures | • Cladogram |
| • Geological time | • Adaptation |
| • Evolution | • Extinction |
| • Trait | • Species |
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