



College of Education
UNIVERSITY of FLORIDA



Engaging K-12 Students in
Integrated STEM via
3D Digitization, 3D Printing
and Paleontology



AUTHOR (S)

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LESSON TITLE

What were the needs of dinosaurs?

GRADE LEVEL

1st

TIME FRAME

3 to 4 45-minute periods

DRIVING QUESTION

How can we determine the needs of prehistoric animals?

LEARNING GOALS

- Students will investigate teeth to look for patterns in shape of teeth. They will identify structure and functions of the teeth.
- Students will compare the scale of teeth from different organisms.
- Students will use text features to locate key information in a text.
- Students will design a plan to ensure that the needs of an animal are all met.

COLLABORATIONS

Students will work in teams to practice being paleontologists. Students will be given sentence stems to help them share their scientific thinking and challenge the scientific thinking of their

peers. Sentence stems are a communication technique that allow students to effectively formulate a response to another's statement/claim.

Example Student A: "Animals that eat meat have pointed/sharp teeth and animals that eat plants have flatter teeth that aren't as sharp."

As a scaffolding tool, students have the opportunity to respond with developed sentences whether they agree, disagree, need clarification, can provide further explanation, or want to add to an initial statement/claim. Example Student Responses:

Agree: "That answer makes the most sense because..."

Disagree: "I thought something different because..."

Clarification: "Can you explain why" & "I'm still not sure about"

Explanation: "I found out that..."

Add to: "Another reason why this makes sense is..." & "I'd like to add that..."

Most of the work will be done in small groups. There will be opportunities for groups to share out with the rest of the class. This allows for students to hear and evaluate ideas of students in other groups. This way, they will be exposed to different thinking and support each other.

STEM INTEGRATION

Describe the science, math, engineering, and technology knowledge and skills this activity helps develop.

Math: Students will practice measuring with non-standard measurement. Students will practice comparing sizes of teeth relative to each other.

Science: Students will identify the needs of living things, specifically, prehistoric animals.

Engineering: Students will design a plan to ensure that the needs of a prehistoric animal are met.

Technology: Students will understand how 3D print technology helps us to enhance our learning.

ASSESSMENT

How will your assessment incorporate student understanding of the 3 dimensions of learning: disciplinary core ideas, crosscutting concepts, and scientific/engineering practices?

a) Formative assessments: Questioning will be used to assess student thinking throughout the lesson. Teacher will be assessing to students for their ability to share logical scientific reasoning regarding what the teeth may tell us about what the animal ate. Questioning will probe to see if students can find features on the teeth to justify their thinking. Groups will be assessed on matching of teeth to the correct food items.

b) Summative assessment(s): Students will create a model to show how they will meet the needs of one prehistoric animal.

ANCHORING EVENT & PROCEDURE

Students will complete a mini fossil dig. The teacher will need to prep a tray with sand, sediment ('dirt'), rocks and the printed fossils as well as portions of toy fossils. Students will practice carefully excavating the fossils and recording the fossils they find in a lab book.

DAY 1: Engage

Students will be told that they are going to take on the role of a paleontologist. A paleontologist is a scientist who studies prehistoric animals. Students will listen to a read aloud of the book "Dinosaur Dig" by Susan H. Gray. Students will be directed and guided to pay attention to the steps that go into finding, excavating, and preparing fossils for study and display.

Next students will move to table groups where they will go on a mini fossil dig. They will be reminded of how the paleontologists in the book were very careful. The class will discuss the different tools that the paleontologists used in the book and why each tool is used. Students will choose an appropriate item to dig with from tools provided (possible items include: toothpicks, cotton swabs, paper clips, paint brushes, etc.) As they discover fossils, they will draw an image of the fossil they discovered and label their drawing with the body part that they believe they have found. When students have finished, they will have an opportunity to share with the class something that they found during their dig.

Day 2: Explore

Students will be given an opportunity to brainstorm some questions that they have about the animals whose bones they found. The teacher will record the questions that are given. Some questions should begin to address the needs of the prehistoric animal. Guide students to consider how the animals needs would have been met (water, food, shelter, air).

Take a picture walk through the story "How Does a Dinosaur Eat His Food?" by Jane Yolen. Students will be guided to wonder what dinosaurs really ate. They should consider what bone might help us to learn what the dinosaur actually ate.

Discuss the idea that scientists have never seen any of these animals alive. No people were alive when the animals were. We have to look at clues in the fossils to make guesses about the animals. Students are going to use teeth to determine what the prehistoric animal might have actually eaten.

Students will work in groups of 3-4 to make observations of full-size replicas of fossilized teeth. Each tooth is from a different prehistoric animal. None of the animals that these teeth belong to are still alive today. Students will first receive a few minutes to observe and handle the teeth at their table. Students will be asked to look closely at the teeth to make observations about how the teeth look and feel. Students should talk with their teammates about what features they observe. Students will be directed to look closely to note similarities and differences in the teeth they receive. The teacher will circulate from group to group asking students to share what they have noticed about the teeth. Students may begin to speculate as

to what dinosaurs might have eaten. They should tell what they think the tooth was used to eat and give evidence for why they believe that is the food of the dinosaur. (A sharp tooth might have been used to cut through things. Flatter teeth might have been used to chew vegetation).

Student groups will receive scrambled pictures of the foods eaten by each prehistoric animal (printable versions of this found in the resources section at the end of the lesson plan). Groups will be asked to place the tooth with the picture that they think is correct. The teacher will circulate to ask students to share their reasons for matching the teeth to the picture they have matched them too. What did they see on the tooth to make them think this is the right food for the teeth? What features are evident?

DAY 3: Explain

The teacher will return to whole group discussion. The teacher will choose one tooth and ask students to share what they think that animal might have eaten. The teacher will ask students to give evidence to support their thinking. Then the teacher will ask students to share if they agree or disagree with their classmate and justify why. This will be done for 2-3 teeth. Students will be told that one way that scientists can figure out what dinosaurs ate is to look at the teeth of animals that are still alive today. Sometimes an animal that is still alive today has teeth that look like those that belonged to extinct animals. When this happens, we believe that the prehistoric animal probably ate something similar to the animal that is still alive today. As a whole group, the teeth will be matched to a modern day relative.

Students will be told that paleontologists are able to infer at what prehistoric animals ate if they know what a similar animal in the present day still eats. Each student group will be assigned one prehistoric animal. They will research the present day relative to see if they can determine what the prehistoric animal needed to eat and to make any other inferences about what else it might have needed. Students will research using leveled books about their current day relative. They can also use online databases like pebblego (<https://www.pebblego.com>). They will receive a brief lesson on using the index and table of contents to quickly find information. As students research, they will write down information that they learn.

Students will be asked to explain what new information they have gained from the information about the modern animal that helped them to better understand the food that belonged to the animal whose teeth they have.

Math Extension

Students will be told that one thing paleontologists do with fossils that they find is to measure the fossil to see how big the animal may have been. They will compare the size of their fossil with the bone of a related animal that are still alive today. The teacher will model how to use inchworms or centimeter cubes to measure the length and height of a tooth.

Students will receive a mat to help them to measure their modern tooth and their prehistoric tooth. Each group will be assigned one set of teeth to measure. Students will record their measurements on their mat. Then they will tell which tooth has larger measurements, their prehistoric tooth or the modern relative. Once finished measuring, students will be able to compare their group's results with the other groups results for the same fossils. Students

should discuss if their measurements were the same and will determine what might cause any inconsistencies in their measurements.

Students will also be able to share with groups who had different fossils than their own. They will need to tell what they learned from their measurements. Students should try to envision the overall size of the prehistoric organism and the teacher may lead a group discussion about the actual size of the prehistoric animals. This can be used to consider how much food and space an animal might have needed.

DAY 4: Extend

Students will work in small groups to design a plan to care for one of the prehistoric animals. Students will be asked to imagine that the animal that they have a tooth for is still alive today. What would its needs be? Students will be asked to create a model to show what they would give the animal in order to meet its needs. This can be done on a large size construction paper. Students can draw the features needed for their animal or cut and paste shapes. They will be provided various art supplies to create the home for their animal. They should think about all of the needs of the animal – space, water, food, shelter, air. How will they make sure all of the needs are met for their animal? Students will work in pairs and will spend about 25 minutes designing a home for their prehistoric animal. Next, students will have a chance to share their habitat and explain why they gave their animal the things they did. Students groups will share with one to two other groups to explain their models. Students will be encouraged to ask questions of about the work of their peers and to provide positive feedback and constructive input.

STANDARDS

NEXT GENERATION SCIENCE STANDARDS (NGSS)

Insert your performance expectation here:

Use observations to describe patterns of what plants and animals (including humans) need to survive. K-LS1-1

Science Practices	Connection to the Lesson
<p>Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1)</p> <p>Scientists look for patterns and order when making observations about the world. (K-LS1-1)</p>	<p>Students will be comparing teeth of different animals to look for patterns connecting the shape of the teeth to the food the animals eat.</p>
Disciplinary Core Ideas	Connection to the Lesson
<p>All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. (K-LS1-1)</p>	<p>Students will determine what food prehistoric animals would have eaten and will explain the importance of food to the animal’s survival.</p>
Crosscutting Concepts	Connection to the Lesson

Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1)	Students will observe the teeth closely and use the pattern between modern and prehistoric animals as evidence to know what the prehistoric animals might have eaten.
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CCSS STANDARDS

[CCSS.MATH.CONTENT.1.MD.A.1](#)

Order three objects by length; compare the lengths of two objects indirectly by using a third object.

[CCSS.MATH.CONTENT.1.MD.A.2](#)

Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. *Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps*

[CCSS.ELA-LITERACY.RI.1.5](#)

Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text.

RESOURCES & MATERIALS

Literature:

“Dinosaur Dig” by Susan H. Gray & “How Does a Dinosaur Eat His Food?” by Jane Yolen

3D files for printing:

Prehistoric Fossil Horse Tooth

https://www.morphosource.org/Detail/MediaDetail/Show/media_id/5794

Modern Horse Tooth

https://www.morphosource.org/Detail/SpecimenDetail/show/specimen_id/1751

Megalodon Shark Tooth

https://www.morphosource.org/Detail/SpecimenDetail/Show/specimen_id/1843

Great White

Scale the Megalodon tooth file to 45% of original size.

Saber-Tooth Cat

https://www.morphosource.org/Detail/MediaDetail/Show/media_id/19933

Lion Tooth

https://www.morphosource.org/Detail/SpecimenDetail/Show/specimen_id/1877

Prehistoric Fossil Pig Tooth

3D File: https://www.morphosource.org/Detail/MediaDetail/Show/media_id/6143

Photos: <http://www.thefossilforum.com/index.php?/gallery/image/22015-pig-teeth-mandible/&browse=1>

Modern Pig Teeth & Skull

<https://sketchfab.com/3d-models/pig-skull-vcu-3d-1188-c7f4e277f08947a498609d1d4c6ccdf>

“Spear-Tooth Whale” or *Dorudon atrox*

https://umorf.ummp.lsa.umich.edu/wp/specimen-data/?Model_ID=1308

For this species, editing software was used to crop one individual tooth from the mandible

Orca (Killer Whale) Tooth

https://www.morphosource.org/Detail/MediaDetail/Show/media_id/12791

Prehistoric Antelope Tooth

<https://africanfossils.org/fauna/knmer-62044>

Modern Antelope Tooth

3D File: <https://sketchfab.com/3d-models/imnh-r-897-pronghorn-antelope-cranium-e666d0a2d14a450aa679353ea9f60264>

Photos: <http://bonesandnature.blogspot.com/2017/02/antilocapra-americana.html>

Example of Scrambled Food Source Pictures:



KEY ACADEMIC AND/OR SCIENTIFIC LANGUAGE

Prehistoric – relating to or denoting the period before written records.

Extinct – a species that is no longer living

Modern – something that is still living or could be seen present day

Paleontology – The study of ancient life, on the basis of fossil remains.

Paleontologist – a person who studies ancient life

Habitat – the natural home or environment of an animal, plant, or other organism

Fossil – the remains of prehistoric plant or animal

PRIOR KNOWLEDGE

Prior to this lesson students will know the needs of animals (food, shelter, air, water). Students will already know that dinosaurs existed many years ago, but they are extinct. Students will know that fossils are dinosaur bones that have been found by scientist.