Club Z!
In-Home Tutoring Services

Educator's Guide

CONTENTS

Paleontology is not just about the *past*....

It's about the *past*.....

When we look at a fossil, we are trying to reconstruct an environment. We are trying to learn more about the type of world that this organism lived in. Although there may be a ton of clues to unlocking this secret past, we still end up with many more unanswered than answered questions. We may learn the approximate size of this creature, we may learn what it could have eaten to survive, but we have no idea about the specifics, or if our guesses are even correct. Did it live in a thick jungle, or a sparse wasteland? Did it have stripes like a zebra, or spots like a leopard? One of the newest ideas about dinosaurs is that they were feathered! Can you imagine? One thing that helps us to imagine these fascinating animals is looking at the creatures we share the Earth with today.

the *present*.....

Looking at the creatures that are living today, we can make some educated guesses as to some of the dinosaurs' behavior. Such as when we look at birds, we see that they have beautifully colored plumage that they use to attract a mate. Is this what the dinosaurs used their feathers for? When we look at a great elephant seal, he uses his flap of a nose to make a thundering roar that scares away potential rivals and at the same time, attracts a mate. Is this what the dinos did? We have made relationships between carnivores, herbivores, omnivores, and the dinosaurs…but was T-Rex a scavenger? Or was he simply opportunistic? These secrets may not be shown in this century, but in the next…

and the *future*!

We are using some revolutionary technology to reveal the secrets of the dinosaurs. CAT scans that show the innards of the skeletons, Light Detection and Ranging equipment (LiDAR) to develop a three-dimensional topographical map of the area where dinosaurs died, and disciplines ranging from computer science to organic chemistry and physics -- to investigate every aspect of the finds using state-of-the-art tools. We can reconstruct a dinosaur on a computer and see it's use of locomotion, determining that we were incorrect as to the guesses that we formed based solely on it's skeleton. Who knows what we will be wrong about tomorrow?

D is for Dinosaur: A Day of Activities

Grade Level Pre-K

Objectives:

1. The students will encounter a 'dig-site' like a paleontologist.
2. The students will learn that the Earth has different layers.
3. The students will learn about the tools of a paleontologist.
4. The students will learn how fossils become trapped in the Earth.
5. The students will gain the concept that science is about asking questions.
6. The students will experience different textures.
7. The students will practice fine motor skills.
8. The students will be exposed to the concept of the food chain.

National Science Education Standards:

- **NS.K-4.1 Science as Inquiry**
- **NS.K-4.4 Earth & Space Science**
- **NA-Visual Arts.K-4.1 Understanding and Applying Media, Techniques and Processes**

Discussion Questions:

When discussing the following questions, stress that the heart of science is asking questions. All of the knowledge we have is because someone asked why? and how?

-What is a dinosaur?

-What is a fossil?

-How do you think fossils are made?

Opening Activity: Make a simple Graph

Would a Dinosaur be a good pet?

Have the children vote if a dinosaur would be a good pet. Record the results on a graph. What is the result? Discuss with the children why a dinosaur might not make the best pet i.e. dangerous, eat a lot of food, they don't like humans, they might hurt us.

Sand Table Activity: Learn about fossils and tools of the trade

Be a Paleontologist!

Materials:

1. Pack of small plastic dinosaurs
2. Sand Table
3. small paint brushes
4. small shovels
5. magnifying glasses
6. other "prehistoric" items
7. water

Procedure:

- Mix all items (small plastic dinosaurs, and any other "prehistoric" items you wish) in the sand table. Try to make "layers" of materials. **You can also purchase a small dinosaur model, take it apart, and place it in your "rock" so the students are able to "piece it together"-- just like a paleontologist.**

  To better demonstrate how fossils are made, add water after the students have played for a bit and then make depressions in the wet sand.
- Explain to students the characteristics of fossils. Some examples:
-
- 1. The organisms have simply become rock over time. This is why only the hardest part of most organisms become fossilized—the skeletons.
- 2. You can have fossils of all organisms—including plants and sealife.
- 3. Tough shells allowed eggs to become fossilized.
- 4. The environment had to be just perfect for the fossils to form.
- 5. Fossils can tell us a lot about the environment of the dinosaurs.

Circle Time Game: Visual Recognition

Where O Where did the Dinosaur Go?

Materials:

1. dinosaur and sabalite templates
2. thick cardboard, such as a cereal box
3. glue

Procedure:

- Make enough copies of the templates to be suitable for the number of students playing. Cut out and glue the templates onto both sides of the pieces of cardboard. Cut the cardboard to fit. **Remember to make sure you have the same number of copies of the images so that the game works** Just follow the memory game rules.

- When the sabalite palm is turned over, use it as an opportunity to begin a discussion about dinosaur nutrition, the food chain -- or "energy chain" -- and how it is important for them to eat the correct foods to gain the energy they need.

  Ask some questions such as:

- 1. What does this plant look like?
- 2. Is this plant still around?
- 3. Which dinosaur do you think ate this plant?
- 4. What do you think the other dinosaurs ate?

Craft Table Time: Polishing Fine Motor Skills

Loopysaurus!

Materials:

1. Colored Posterboard
2. Yarn
3. Hole-punch
4. Tape

Procedure:

- Before this activity, determine how much yarn is needed for the particular size and type dinosaur you will be using. Tape the ends of the yarn to keep them from fraying (this should also cut down on the level of frustration of the students). Cut colored posterboard into a dinosaur shapes and punch holes around the edges. Then let the students lace yarn or a shoestring into the cards.

Craft Table Time: Polishing Fine Motor Skills, Sequencing

Food Chain….Chain

Materials:

1. paper
2. coloring tools
3. food chain template
4. stapler or tape

Procedure:

- Before this activity, make copies of the templates for the students. As the students color their sheets, discuss some of the following:
- 1. What does this plant look like?
- 2. Is this plant still around?
- 3. Which dinosaur do you think ate this plant?
- 4. What do you think the other dinosaur ate?
- 5. Where did the plant get it's energy?

  Cut out then tape or staple the chain pieces together to make a decoration for your bulletin board!

Snack Time: Measuring

Dino Delite

Materials:

1. ¼ cup dirt (cocoa)
2. ½ cup swamp water (milk with green food coloring)
3. 2 cup crushed bones (sugar)
4. ½ cup fat (butter)
5. 2 cup dead grass (uncooked oatmeal)
6. ½ cup squashed bugs (peanut butter)

Procedure:

Mix cocoa & milk. Add sugar and butter. Boil about 3 min. Add peanut butter and oatmeal and stir until melted. Remove from heat and stir until mixture begins to thicken, Drop by tablespoonful onto waxed paper cool, eat and enjoy.

Snack Time: Earth Science

Chocolate Volcano!

Materials:

1. chocolate pudding
2. sugar cones
3. gummi dinos
4. red, yellow, orange icing
5. plastic bowls and spoons

Procedure:

Before beginning this activity, find out what the students know about volcanoes. Ask questions such as:

- 1. What is a volcano?
- 2. Why do they erupt?
- 3. Do you think that there were volcanoes here with the dinosaurs?
- 4. What do you think happened to the dinos when the volcanoes erupted?

Place sugar cone upside-down in the chocolate pudding, dribble icing on top, and bury the gummy dinosaurs in the pudding. Enjoy!

Arts & Crafts: Textures

Cereal Dino

Materials:

1. pencils
2. cereal
3. posteroard
4. white craft glue
5. tempera paint
6. newspapers
7. cotton swab, cotton balls, or paintbrushes

Procedure:

Cover your work area with newspaper. Draw a dinosaur outline on poster board. Cut the dinosaur out of the poster board. Dab a small amount of glue onto the dino. Place cereal on the glue (as much as you like.) Let glue dry for a few hours or overnight. Use a cotton swab as a paint brush and paint your dino. Let paint dry.

Evaluation:

1. The students have encountered a 'dig-site' like a paleontologist.
2. The students know that the Earth has different layers.
3. The students understand that a paleontologist uses special tools.
4. The students know that fossils become trapped in the Earth.
5. The students will have gained the concept that science is about asking questions.
6. The students experienced different textures.
7. The students practiced fine motor skills.
8. The students understand that there is a food chain.

Maiasaura Dino Egg Hunt

Grade Level Pre-K - 3

Objectives:

1. The students will use this activity as a springboard into the fundamental characteristics of a fossil and the field of paleontology.
2. The students will understand that dinosaurs hatched from eggs and some dinosaur mothers stayed and cared for their young.
3. The students will pose questions, the first step of inquiry science.
4. The students will review colors.
5. The students will review counting and addition.

National Science Education Standards:

- **NS.K-4.1/NS.5-8.1 Science as Inquiry**
- **NS.K-4.3/NS.5-8.3 Life Science**
- **NS.K-4.4/NS.5-8.4 Earth & Space Science**
- **NA-Visual Arts.K-4.1 Understanding and Applying Media, Techniques and Processes**

Discussion Questions:

-What is a fossil?

-How do we find fossils?

-Where do we find fossils?-What other types of animals hatch from eggs?

-What color do you think dinosaurs were?

-Where would a mother dinosaur hide her eggs to protect them?

-Did you know that Maisaura dinosaur mothers stayed with and cared for their young? Her name means 'good mother lizard'.

Materials:

2½ cups dirt
2 ½ cups flour
1 cup of sand
1 ½ cups of salt
water
food coloring
small plastic toy dinosaurs
hammer

Procedure:

1. Four days before the lesson, make the 'eggs'
   - Mix all the dry ingredients together: flour, dirt, salt, and sand.
   - Gradually stir in enough water so that the mixture holds together.
   - Shape handfuls of dough around the small plastic dinosaurs and form into egg shapes. Add the food coloring as you shape the eggs. Make random numbers of each color.
   - Allow four days to dry
2. Discuss how Maiasaura dinosaurs stayed with their nest and cared for their young. Discuss where a dinosaur may have hidden their eggs to protect them. Tell the students that you have hidden some eggs and they get to find them!
3. When all of the eggs have been found, take them back into the classroom and sort them by color. Then, count how many of each color there are.
4. Allow the students to break open the eggs, or for younger audiences, the teacher will break them for the students.

Evaluation:

- The students will get a basic understanding of what a fossil is and how we find them.
- The students will be able to recognize that dinosaurs hatched from eggs.
- The students will understand some dinosaurs actually stayed with their young and cared for them.

Reflection & Extension:

Students should visit their previous answers to the discussion questions. Were they correct in their assumptions? This activity is a fun way to get students thinking about fossils and dinosaur behavior.

A great extension lesson would be to have the students draw their family as dinosaurs—what kind of dinosaur would you want to be?

Nest Robbers!

Grade Level Pre-K – 5

Objectives:

1. The students will gain an understanding that some dinosaurs were egg robbers.
2. The students will understand that dinosaurs hatched from eggs and some dinosaur mothers stayed and cared for their young.
3. The students will pose questions, the first step of inquiry science.
4. The students will work together as a team to achieve a goal.

National Science Education Standards:

- **NS.K-4.1/NS.5-8.1 Science as Inquiry**
- **NS.K-4.3/NS.5-8.3 Life Science**
- **NS.K-4.4/NS.5-8.4 Earth & Space Science**
- **Physical Education Team Play**

Discussion Questions:

-What other types of animals hatch from eggs?

-What other types of animals like to steal eggs?

-Where would a mother dinosaur hide her eggs to protect them?

-Did you know that Maisaura dinosaur mothers stayed with and cared for their young? We know this because we found fossils of clusters of nests with the mothers protecting their young. We call this "Egg Mountain"• . Maiasaura means "good mother lizard".

Materials:

- 4 wooden benches
- 20 tennis balls
- 4 hula hoops

Procedure:

Introduction:

Step 1:
Place the benches in a square formation, leaving a gap at each corner. The gap should be wide enough for an "egg stealer" to enter the square and steal a tennis ball (egg) placed in one of the hula hoops (nest) placed on the floor in the middle of the square.

Step 2:
The students sit on the benches and the rules are explained:

- The two dinosaurs in the middle are not allowed to leave the square to attack• the egg robbers.
- Only one egg can be stolen each time an egg robber makes it to the nest.
- The stolen eggs are taken to a designated area at the other end of the area.
- If the nesting dinosaurs touch the egg robbers, the egg robber has to go sit down.

Presentation:

Step 3:
Explain rules. Check for understanding. Select dinosaurs to guard eggs. Count to ten and let the game begin.
Step 4:
Make sure that students play fairly. After a good number of "eggs" are stolen, announce that you will count to ten and then the game stops.
Step 5:
All students sit on the benches again. Clarify unclear points. Choose new dinosaurs and the game begins again.

Conclusion:

Step 6:
Students sit on benches again. Ask questions: Did you enjoy the game? What did you learn about dinosaurs? **Health tie-in** How were you able to do all of that physical activity? Energy. Where do you get energy? From food. Dinosaurs had to get energy from food, as well. That is why the egg-robbers would eat the eggs—lots of energy!

Evaluation:

1. The students will get a basic understanding that there were egg-robbing dinosaurs and recognize other creatures that are living today that have the same habits.
2. The students will be able to recognize that dinosaurs hatched from eggs.
3. The students will understand some dinosaurs actually stayed with their young and cared for them.

Reflection & Extension:

Students should visit their previous answers to the discussion questions. Were they correct in their assumptions? This activity is a fun way to get students thinking about fossils and dinosaur behavior.

Make a Dinosaur Egg

Grade Level (Pre-K - 8)

Objectives:

1. The students will have an experience with a different type of an egg.
2. The students will understand more about reptiles.
3. The students will understand that reptiles (dinosaurs) did not hatch from eggs with hard shells, like those of chickens.
4. The students will learn about a chemical process.
5. The students will learn more about the environment that the dinosaurs lived in.

National Science Education Standards:

- **NS.K-4.1/NS.5-8.1 Science as Inquiry**
- **NS.K-4.3/NS.5-6.3 Life Science**
- **NS.K-4.4/NS.5-6.4 Earth & Space Science**

Discussion Questions:

-What other animals hatch from eggs?

-Did dinosaurs bury their eggs like crocodiles and turtles?

-What type of environment does an egg need to hatch?

Materials:

- *The Fossil Factory* by Niles, Douglas, and Gregory Eldredge
- 6 raw chicken eggs
- 6 hardboiled chicken eggs
- 12 glasses of vinegar
- 12 glasses of water
- A spoon
- Newspaper to cover table
- Paper to draw on
- Drawing utensils

Procedure:

1. A week before the lesson, place the hardboiled eggs in the vinegar. Make certain that they are fully submerged. The vinegar will dissolve the shell.

2. One day before the lesson, place the 12 eggs in 12 cups of vinegar. Make sure the egg is fully submerged.
3. Explain to students about characteristics of reptiles and reptile eggs.
    1. Reptiles emerge from their eggs fully shaped.
    2. A reptile egg has a tough, leathery shell with a built in food supply.
    3. Tough shells allowed eggs to become fossilized.
    4. Some reptiles not only have thick shells on their babies, they are on themselves as well. (Discuss class pet - turtle)
4. During center time, take one egg out of vinegar with a spoon.
    1. Let the students GENTLY squeeze the egg to find out how it feels. (Raw egg will break if squeezed too hard)
    2. Discuss how it feels.
    3. Discuss what you see.
    4. Store in a glass of water if it is to be used again.
    5. Have children write and draw a picture about the experience that they just had.

Evaluation:

1. The students will be able to discuss that different animals come from different types of eggs
2. The students will be able to tell the difference between some reptiles and some other animals.
3. The students will communicate their new knowledge about dinosaur eggs in the writing and drawing.

Reflection & Extension:

Anticipate problems of eggs breaking before each child has a turn to feel the "reptile" egg. To compensate for this, we added a few hardboiled eggs to the materials list

Another good extension activity would be to talk about other kinds of eggs. For example, you could discuss soft and squishy amphibian eggs.

Just How Big *Were* The Dinosaurs?

Grade Level K-6

Objectives:

- 1. The students will have a hands-on experience learning about true dimensions.
- 2. The students will utilize their numerical measurement skills.
- 3. The students will reinforce the concepts about what dinosaurs were, how they lived, and how they affected their surroundings.
- 4. The students will ask a question about a creature and work toward answering that question.
- 5. The students will evaluate how and why the dinosaurs were able to grow so large.

National Science Education Standards:

- **NS.K-4.1/NS.5-8.1 Science as Inquiry**

Discussion Questions:

-Which dinos lived during the Cretaceous?

-What was the environment like during the Cretaceous?

-How and why do you think the dinosaurs grew so large? (volcanoes were extremely active, creating an environment high in carbon dioxide to create a rich, lush, warm environment in which the plants would greatly multiply and in turn the dinosaurs could flourish.)

-What plants were alive during the Cretaceous? *(hardy conifers--and this is when the flowering plants came onto the prehistoric scene which, by expediting the reproduction process, allowed for the plant environment to quickly recover after being grazed, as opposed to the conifers which took years to grow back what the dinosaurs had eaten.) How did this encourage the dinosaur population to grow?*

-How much do you think they had to eat to grow so large?

-How do you think this affected their environment?

Materials:

- string
- a yard stick
- Dinosaur measurements: Brachiosaurus-25 yards; Tyrannosaurus-15 yards; Stegosaurus-7 yards; Compsognathus-1/2 yard; 13 yards for Tyrannosaurus Rex; Triceratops 10 yards in length

Procedure:

1. Have children measure out a dinosaur's length using yardsticks.
2. Stretch a string the length of the dinosaurs.
3. Direct the students to lie head-to-toe the entire length of the dinosaurs.
    - How many students did it take?
    - Which dinosaur was the largest?
    - Which dinosaur was the smallest?

Evaluation:

- The students will be able to recognize that the dinosaurs were much larger in real life than you would have thought.
- The students will be able to recognize that as the dinosaurs' environment changed, it allowed them to grow very large.
- The students will be able to recognize how volatile the Earth was during the Cretaceous.

Reflection & Extension:

A great extension lesson would be to find a true measurement of a dinosaur feet print. We ask the children to guess how many of our feet prints would it take to fill up the dinosaurs foot print. Then we would trace the children foot and place them in the dinosaurs foot print.

Another really great extension idea is to get a helium balloon (most larger grocery stores that carry them will donate for a science project) and measure out lengths of fishing wire or line that correspond with the heights of various types of dinosaurs. You have to use the fishing line as yarn gets too heavy. Take your students out on the playground and let the balloon go after you've tied the length of fish line to it. The students will be amazed at how far up it goes into the sky.

Dinorama!

Grade Level K-6

Objectives:

- 1. The students will go beyond a simple diorama to develop an 'ecosystem in a box'.
- 2. The students will learn that the surface and environment of the Earth was much different.
- 3. The students will learn about volcanoes and the important role they played in the Cretaceous.
- 4. The students will learn which dinosaurs lived during the Cretaceous.
- 5. The students will learn about what plants were around during the Cretaceous.
- 6. The students will learn that some creatures are still around today…and have not changed much.
- 7. The students will recognize that it takes more than just animals to make an ecosystem—it takes everything in the environment including the plants and atmosphere.

National Science Education Standards:

- **NS.K-4.1/NS.5-8.1 Science as Inquiry**
- **NS.K-4.3/NS.5-8.3 Life Science**
- **NS.K-4.4/NS.5-8.4 Earth & Space Science**
- **NSS-Geography.K-12.2 Places and Regions**
- **NA-Visual Arts.K-4.1 Understanding and Applying Media, Techniques and Processes**

Discussion Questions:

-Which dinos lived during the Cretaceous?

-What was the environment like during the Cretaceous?

-Why were volcanoes so important? (creating an environment high in carbon dioxide to create a rich, lush, warm environment in which the plants would greatly multiply and in turn the dinosaurs could flourish)

-What plants were alive during the Cretaceous? *(hardy conifers--and this is when the flowering plants came onto the prehistoric scene which, by expediting the reproduction process, allowed for the plant environment to quickly recover after being grazed, as opposed to the conifers which took years to grow back what the dinosaurs had eaten.) How did this encourage the dinosaur population to grow?*

-What animal is still alive today? (Crocodile) Why do you think they have not changed very much?

Materials:

- paper and a printer (stiff paper works best - colored paper is great for this project)
- a shoe box or slightly larger box
- crayons and/or markers
- paste (a glue stick works well)
- scissors
- *optional:* glitter (for great lava!), cotton puffs (for clouds), thin cardboard to glue to the back of the animals if your paper is very flimsy (old cereal boxes work well)
- tape, thread, pipe cleaners
- dinosaur and plant templates

Procedure:

1. It is *extremely* important to discuss the plants and animals that lived during the Cretaceous before this activity to establish a foundation of basic facts from which the students can pull from to create their 'ecosystem in a box'.
2. Copy the templates found at the back of this book and have the children cut them out.
3. Explain to students the characteristics of the Cretaceous Period:
    - 1. It was a warm, lush environment with lots of vegetation.
    - 2. This is when the giants lived—apatosaurus, T Rex, triceratops, and others.
    - 3. The most common plants were conifers, but flowering plants would come on the scene and flourish in the carbon-dioxide rich atmosphere.
    - 4. The tectonic plates of the Earth were in movement making a very

volatile environment and constant volcanic activity.

- 5. Fossils can tell us a lot about the environment of the dinosaurs.

4. Allow the students to use their imagination, ask questions, and inquire about the environment of the Cretaceous Period.

Evaluation:

- The students will be able to recognize that an ecosystem is more than just the animals that live within it.
- The students will be able to recognize that some creatures did not have to change their structure to continue to survive.
- The students will be able to recognize how volatile the Earth was during the Cretaceous.

Reflection & Extension:

Students should visit their previous answers to the discussion questions. Were they correct in their assumptions? This activity is a tried and true method to allow students to think bigger than just animals—they will begin to think globally.

A great extension lesson is to have the students create a multiple table—if one plant can sustain 2 plant-eaters (herbivores), and they in turn can sustain 10 meat-eaters (carnivores), what would happen when if you had two plants? Three plants? Etc.

Making Fossil Casts

Grade Level (1-6)

Objectives:

1. The students will create a fossil mold and cast.
2. The students will learn what a fossil is and how it is formed.
3. The students will understand what a paleontologist foes when he makes a cast.
4. The students will understand how the non-living parts of an organism forms a fossil.
5. The students will understand that the Earth is made up of many layers.

National Science Education Standards:

- **NS.K-4.1/NS.5-8.1 Science as Inquiry**
- **NS.K-4.3/NS.5-6.3 Life Science**
- **NS.K-4.4/NS.5-6.4 Earth & Space Science**

Discussion Questions:

-What is a fossil? Fossils are not always the actual remains of the living organisms. Many fossils are just copies called imprints, molds or casts. Imprints are impressions made by organisms in soft mud that were preserved when the mud solidified. Imprints can be traces of an animal's activity, rather than its actual remains. The hardened tracks of animals or the burrows of prehistoric worms in solidified mud are examples of fossil imprints.

-What is a mold? Molds are made when organisms are totally or partially buried in mud that hardens into rock. Over time ground water may dissolve the organisms, leaving cavities shaped like their bodies. Both imprints and molds are mirror images of the organisms.

-What is a cast? If a mold was later filled with mud or mineral material, the hardened filling is called a cast. It is a reproduction that has the same outer shape as the organism. A cast looks like the organism itself, not like its imprint. Paleontologists make casts of fossil molds by filling them with liquids, such as plaster, that harden.

Materials:

Modeling clay about the size of a large walnut (Should be about twice the size of the seashell or other object to be cast)
Paper plate
Small seashell (may be purchased at a craft store) or another distinctively shaped object
Petroleum jelly, such as Vaseline
7 ounce paper cup
Plastic spoon
Plaster of Paris (available from craft store or hardware store)
Tap water

Procedure:

1. Place 4 spoonfuls of dry plaster of Paris in each cup.
2. Squeeze the clay until it is pliable.
3. Place the clay on the paper plate.
4. Coat one side of the seashell with petroleum jelly.
5. Press the lubricated side of the shell into the clay.
6. Carefully remove the shell from the clay.
7. Observe the imprint of the shell in the clay. Compare the imprint in the clay with the shape and texture of the outside of the shell.
8. Place two spoonfuls of water in each cup and stir until smooth.
9. Pour the plaster mixture into the shell imprint in the clay. Note: Throw the cup and spoon away and do not wash any plaster down the sink as it can clog the drain.
10. Allow the plaster to harden. This will take about 20 minutes.
11. Gently separate the clay from the plaster.
12. Compare the shape and texture of the outside shell with the shape and texture of the outside of the plaster cast.

Evaluation:

1. The students will know what a fossil is and how it is formed.
2. The students will understand what a paleontologist does when he makes a cast.
3. The students will understand how the non-living parts of an organism forms a fossil.
4. The students will understand that the Earth is made up of many layers.

Reflection & Extension:

The imprint in the clay and the plaster cast are both examples of how fossils form. Pressing the shell into the clay represents burying the shell in mud. In nature, the mud would have hardened into rock around the shell. Removing the shell from the clay represents how the shell dissolves over long periods of time, leaving a cavity called a mold in the rock. The mold produced is a mirror-image imprint of the shell's outside surface. In nature, this mold would have been filled with sediment, or small particles or rock and minerals that are deposited by water, wind, or ice that hardened into rock. The Plaster of Paris, like sediment, hardened – but in a much shorter period of time. The plaster is a replacement of the shell and is called a cast.

I'm a Paleontologist!

Grade Level 3-8

Objectives:

1. The students will encounter a 'dig-site' like a paleontologist.
2. The students will learn that the Earth has different layers.
3. The students will learn about the tools of a paleontologist.
4. The students will learn how fossils become trapped in the Earth.

National Science Education Standards:

- **NS.K-4.1/NS.5-8.1 Science as Inquiry**
- **NS.K-4.4/NS.5-8.4 Earth & Space Science**
- **NS.K-4.5/NS.5-8.5 Science and Technology**
- **NSS-Geography.K-12.2 Places and Regions**

Discussion Questions:

-What do you think you will find?

-When did paleontology begin? Who was the first paleontologist?

No one knows exactly when humans first became interested in fossils, but some Neanderthal graves have been found with fossils, perhaps used for decorative or religious purposes. In some early civilizations, fossils were used as jewelry and regarded as curiosities, but generally not well understood. Although a few early Greek and Roman philosophers correctly recognized fossils as the remains of past life forms, this was the exception rather than the rule. The philosopher Aristotle (384-322 BC) believed living things could arise spontaneously from rocks or mud, or from "seeds of life" therein, and that fossils were the incomplete examples or failures of this process.

Similar misconceptions persisted for many centuries. During the Middle Ages (about 500-1450) fossils were variously regarded as works of the devil, direct creations in rock by God, the results of *vis plastica* or "molding forces" in rocks, or simply "sports of nature." In Europe, fossil bones were widely believed to be the remains of animals and humans that had perished during Noah's Flood. In China, fossil bones and teeth were often collected as "dragon bones" and used as medicinal cure-alls. In some areas of China they are still sold as such today.

One of the first scholars to express a relatively modern view of fossils was the famous engineer and artist Leonardo da Vinci (1452-1519). He understood that marine fossils were remains of ancient life forms, and that they provided evidence that ancient seas once covered areas that are now dry land.

In 1664 the science of geology took a step forward when Danish scholar Nicolaus Steno developed the concept of superposition, which holds that the lowest strata (rock layers) in any one place were deposited first, and therefore were the oldest. Meanwhile, a growing number of naturalists, such as Britain's John Ray (1627-1705), began to recognize fossils as the remains of once-living things, and to study them more closely. However, the great age of fossils and the earth itself was not widely appreciated, and many people (including many scholars) still believed that most fossils were remains of Noah's Flood or other catastrophe's that took place only a few thousand years ago (such concepts, known as Flood geology or catastrophism, are still held by many "young-earth" creationists).

During the 1700's, also known as the "Age of Enlightenment," fossil collecting became popular among professionals and laymen alike. Georges Cuvier (the "father of paleontology") and William Smith (the "father of English geology") described and mapped a number of European rock formations, and showed that rock strata in different areas could be recognized and correlated on the basis of fossil content. Other scientists began to classify and describe fossils in a detailed and consistent manner.

-How could a CAT scan help a paleontologist?

-How is a fossil formed?

Materials:

Pack of small plastic dinosaurs
small trashcan
three boxes of Plaster of Paris
3 cups of sand
water
blackened chicken bones
other “prehistoric” items
Newspaper to cover table
goggles
small hammer (teacher’s use)
screwdriver (teacher’s use)
paintbrushes
toothpicks

Procedure:

1. Three days before the lesson, mix all ingredients (Plaster of Paris, water, sand, small plastic dinosaurs, blackened chicken bones, and any other "prehistoric" items you wish) in the small trashcan. Try to make "layers" of materials. **You can also purchase a small dinosaur model, take it apart, and place it in your "rock" so the students are able to "piece it together"-- just like a paleontologist.**
2. Let dry for three days. In those three days, discuss the different layers of the Earth.
3. Explain to students the characteristics of fossils.
    1. The organisms have simply become rock over time. This is why only the hardest part of most organisms become fossilized—the skeletons.
    2. You can have fossils of all organisms—including plants and sealife.
    3. Tough shells allowed eggs to become fossilized.
    4. The environment had to be just perfect for the fossils to form.
    5. Fossils can tell us a lot about the environment of the dinosaurs.
4. After three days, remove the 'rock' from the trashcan and discuss the layers that are discernable. You may need to break the big rock into smaller pieces and split the student into teams.
5. Let the students take the paintbrushes and toothpicks to excavate the rock.
6. Discuss what you see.
7. Use the data sheet found at the end of this packet for the students to record their findings.

Evaluation:

- The students will be able to discuss that different layers hold different items.
- The students will be able to understand some of the difficulties of unearthing fossils.
- The students will realize that technology is a great improvement on how paleontologists work.

Reflection & Extension:

Students should visit their previous answers to the discussion questions. Were they correct in their assumptions? Even though this is a very simplistic method of conveying what a paleontologist does, it will be a fun activity that will inspire them to think about being at a dig site.

A great extension lesson would be to have the students write a letter to their parents from a dig site. They should discuss what the weather is like, what they have found, how they found it, etc. On a map of the United States, show where the fossil hotspots are and allow the students to pick at which dig site they would choose to be located. Have them explain why in their letter.

TRICERATOPS

Herbivore (plant-eater)
Meaning: Triceratops means "three-horned face"
Pronounced: try-SER-a-tops
Named By: Othniel Marsh
When Named: 1889
Length: 30 feet (9 m) long
Height: 7 ft (2 m) tall at the hips
Weight: up to 6-12 tons
Lived: Late Cretaceous Period, about 72-65 million years ago
Where it has been found: Fossils have been found in western Canada and the western United States, North America.
What has been Found: About 50 Triceratops skulls and some partial skeletons have been found.
Who Found the First Fossil and When: The first Triceratops skull was found in 1888 by John Bell Hatcher.

TYRANNOSAURUS REX

Carnivore (meat-eater) - T. rex ate large dinosaurs, like Triceratops
Meaning: Tyrannosaurus rex means "tyrant lizard king"
Pronounced: tie-RAN-o-**SAWR**-us rex
Named By: Henry Fairfield Osborn
When Named: 1905
Length: 40 feet (12.4 m) long
Height: 15 to 20 feet (4.6 to 6 m) tall
Weight: 5 to 7 tons
Lived: Late Cretaceous Period, about 85-65 million years ago
Where it has been found: Fossils have been found in the USA (Montana, Texas, Wyoming, Utah), Canada (Alberta, Saskathchewan), and east Asia (Mongolia).
What was Found: About 30 incomplete T. rex fossils have been found. One T. rex footprint has been found, in an undisclosed location in New Mexico, USA. Fossilized dung has also been found.
Who Found the Fossils: The first T. rex was first found by Barnum Brown in 1902.
Where: The first T. rex was found in Hell Creek, Montana, USA, North America.

EDMONTOSAURUS

Herbivore (plant-eater) - Edmontosaurus probably ate low-lying plants like cycads, conifers, and ginkgos.
Meaning: Edmontosaurus means "Edmonton Lizard" named for the Edmonton Rock Formation in Edmonton, Alberta, Canada
Pronounced: ed-MON-to-**SAWR**-us
Named By: Lawrence Lambe
When Named: 1917
Length: 42 ft (13 m) long
Height: 10 ft (3 m) tall at the hips
Weight: 3-3.5 tons
Lived: Cretaceous Period, about 73 to 65 million years ago
Where it has been found: Fossils have been found in western North America, including Montana, USA, and Alberta, Canada.
Where: Several fossils (including skulls) have been found. Two mummified Edmontosaurus fossils were found in Wyoming.

VELOCIRAPTOR

Carnivore (meat-eater)
Meaning: Velociraptor means "speedy thief"
Pronounced: vuh-LOSS-ih-**RAP**-tor
Named By: Henry F. Osborn
When Named: 1924
Length: 5 to 6 feet (1.5-2 m) long
Height: 3 ft (1 m) tall at the hips
Weight: 15 to 33 pounds (7 to 15 kg)
Lived: Late Cretaceous Period about 85 - 80 million years ago
What has been Found: About a dozen Velociraptor fossils have been found, including one who died in a battle to the death with Protoceratops and two hatchling Velociraptor skulls that were found near an oviraptorid nest in Mongolia (the eggs may have been a meal).
Who Found the Fossils: Velociraptor was first found by H. F. Osborn.
Where: The first Velociraptor was found in Mongolia in 1924.

NAME_____ DATE_____

Name a dinosaur that lived during the Cretaceous Period that was a plant-eater and had three horns.

LETTER CODE

O = 1	C = 2
I = 3	A = 4
E = 5	R = 6
P = 7	S = 8

T= 9

Math Problem	7 +2	3 +3	2 +1	1 +1	3 +2	2 +4	2 +2	6 +3	0 +1	5 +2	4 +4
MATH ANSWER											
LETTER ANSWER											

Name _____ Date _____

Dinosaur Vocabulary Match

Directions: Match the vocabulary words on the left with the definitions on the right.

herbivore	the scientific study of life in past geologic periods through examination of animal and plant fossils.
predator	an animal that feeds on plants.
prey	the remains or trace of a living organism from an earlier geologic age, embedded in earth or rock.
carnivore	the inner framework of bones and cartilage in vertebrate animals, which supports and protects the softer body parts, or the hard external shell of invertebrates and some vertebrates.
skeleton	one of various extinct reptiles that lived approximately l00 million years ago and included the largest land creatures.
paleontology	no longer existing, as an animal species.
extinct	a flesh-eating animal, esp. a meat-eating mammal. (Cf. herbivore.)
fossil	an animal that eats the flesh of others
prehistoric	of, pertaining to, or existing in a time prior to written history.
dinosaur	the object of a hunt or pursuit, usu. one animal caught and eaten by another.

NAME_____ DATE_____

WHAT IF I WAS A DINOSAUR?

1. Choose a type of dinosaur. Pretend you are this dinosaur for the remaining questions.	_____ **Dinosaur's Name**
2. Where do live?	_____ _____ _____
3. What do you eat?	_____ _____ _____
4. What eats you?	_____ _____ _____
5. What physical features did your species have that made you better suited for your environment?	_____

NAME_____ DATE_____

What is a Habitat?

Unscramble the words below. The clues underneath the blanks will help you find the four things an animal needs to survive.

_____ _____ _____ _____

O F O D

Clue: When your stomach is growling, it is telling you that you need some of this because you are hungry

_____ _____ _____ _____ _____

E R W T A

Clue: Your body is mostly made of this and it is the best thing for you when you are thirsty.

_____ _____ _____ _____ _____ _____ _____

R E S H L E T

Clue: If you were on a hike and got caught in a storm, you would try to find this.

_____ _____ _____ _____ _____

C E S A P

Clue: It means an area to be, and it is where the stars live.

GLOSSARY

Biped
Any creature that walks on two legs.

Bones
A hard tissue that forms most of the skeleton of animal and humans. Bones fossilize well .

Carnivore
An animal that eats other animals. (meat-eater)

Ceratopsians
A group of dinosaurs that lived in the Cretaceous period, ceratopsians were herbivorous, ornithischian, and had beaks and bony head frills. The triceratops is part of the ceratopsian family.

Chisel
A metal tool which can be used to chip away at the rock containing fossils.

Coal
A carbonized matter used as fuel, an ember.

Cold blooded
Animals rely upon the temperature to regulate their body temperature. Many reptiles are cold blooded and many dinosaurs may have been cold-blooded.

Cretaceous period
A geological period of the Mesozoic Era, between about 135 and 65 million years ago. The Cretaceous period marks the end of the dinosaurs and many other species of animals and plants.

Dinosaur
Now extinct, dinosaurs were large, land-dwelling reptiles that roamed the Earth during the Mesozoic Era. The word dinosaur means "terrible lizard."

Eggs
Some animals hatch from eggs, even dinosaurs. A nutritive material (yolk) and a protective membrane surround animal eggs. A jelly coating protects amphibian eggs and shells protect bird eggs.

Extinct
When an animal species dies out this is known as extinction. Dinosaurs have become extinct.

Fossils
The remains or traces of a plant or animal that lived in the past, usually preserved in sedimentary rock. Fossils have been found on every continent on Earth.

Frill
The bony "crown" on the head of a ceratopsian dinosaur, like a Triceratops.

Habitat
A habitat is a space (which includes food, water and shelter) suitable for the survival and reproduction of an organism.

Herbivores
Herbivores are animals that eat plants. Most dinosaurs were herbivorous (plant-eating).

Lava
Molten rock which reaches the Earth's surface through erupting volcanoes.

Nest
Some dinosaurs laid their eggs and raised their young in nests. Some fossilized nests have been found, including those of the plant-eating dinosaur Maiasaura.

Omnivores
Animals that eat both animals and plants.

Pachycephalosaurs
A group of dinosaurs from the late Cretaceous period that were herbivorous, bipedal, ornithischian and had very thick skulls. The word pachycephalosaur means "thick-headed lizard".

Paleontology
The branch of biology that studies the forms of life that existed in former geologic periods, chiefly by studying fossils. "Paleo" means old or ancient. "Ontology" is the study of existence ("onto-" means existence, "-logy" is the study of something).

Paleontologist
A scientist who studies paleontology, the forms of life that existed in former geologic periods, chiefly by studying fossils. "Paleo" means old or ancient. "Ontology" is the study of existence ("onto-" means existence, "-logy" is the study of something). This "-ist" at the end means a person who is involved in the field.

Predator
An animal that hunts and kills other animals for food.

Prehistoric
The time before people began recording history in writing. This time varies from culture to culture.

Prey
An animal is prey when another animal hunts and kills it for food.

Sediment
Any material deposited by wind or water, like rocks and sand.

Sedimentary rock
Rock that has formed from sediment. Most fossils are found in exposed sedimentary rock.

Shale
A type of rock that is formed from clay that has been pressed into thin sheets.

Shovel
A flattened scoop with a handle for digging. Used when digging dinosaur fossils.

Skeleton
The bony framework of an animal's body. Dinosaur skeletons were made of bones and cartilage.

Skull
The bony structure of the head that encloses the brain and supports the jaws.

Theropods
A group of carnivorous, bipedal, saurischian dinosaurs that were fast-moving and intelligent. The word theropod means "beast-footed". This group were predecessors of the bird. Two examples of theropods are the velociraptor and the tyrannosaurus rex.

Volcano
An eruption of the Earth's crust. When a volcano erupts, it spews out lava and gases from deep inside the Earth. The Cretaceous Period was a time of high volcanic activity.

Warm blooded
Animals generate their own body heat to maintain their body temperature. Birds and mammals are warm blooded.

References

Barrett, Paul, et al. National Geographic Dinosaurs. National Geographic Press, 2001.

Holtz, Lara T., et al. Big Book of Dinosaurs. DK Publishing, 1994.

Holtz, Thomas R. Jr Dr. Dinosaurs: The Most Complete. Up-to-Date Encyclopedia for Dinosaur Lovers of All Ages. Random House Publishing, 2007.

Kuban, Glen. "A Brief History of Paleontology" excerpt from *Introduction to Fossil Collecting,* 1994-2000.

Glossary:
- www.kaboose.com

Web Resources:
- www.teach-nology.com

www.ublib.buffalo.edu

www.preschooleducation.com

www.ucmp.berkeley.edu

http://paleobiology.si.edu

www.museumoftherockies.org

http://dsc.discovery.com