http://school.discovery.com/lessonplans/programs/tlc-dinosaurs/

TITLE OF LESSON PLAN:
Discovering Dinosaurs

PROBLEM TO BE ADDRESSED:
What is the nature of scientific theories and how do they impact our understanding of the dinosaurs?

LENGTH OF LESSON:
One to Two class periods

GRADE LEVEL:
3-4

SUBJECT AREA:
Earth Science

CREDIT:
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OBJECTIVES:
Students will:

1. explain that scientists have theories about what dinosaurs were like but that they don't really know for sure

2. describe how evidence is used to try to determine what a dinosaur looked like and how it behaved

3. use evidence to support a theory about dinosaurs

4. explain that when two scientists disagree about a theory, they can still both be practicing good science

MATERIALS:
For this lesson, you will need:

chart paper

markers

copies of What Remains? worksheet

copies of Dinosaur Footprints worksheet

copies of What Happened Here? worksheet

PROCEDURE:
1. Explain to students that they are going to learn about how scientists use evidence left by the dinosaurs to tell what dinosaurs looked like and how they behaved. Let students know that they will be trying to decide some things about dinosaurs from what dinosaurs left behind.

2. Ask the members of the class to raise their hands if they have ever seen a re-creation of a dinosaur in a movie or on television. Ask them to name some movies in which they have seen these things. You can also ask them to name some places where they have seen or could see dinosaur skeletons or models.

3. Next, ask the members of the class to raise their hands if they have ever seen a real live dinosaur—not a dinosaur in a movie or in a museum. Ask them if anyone in the world has ever seen a living dinosaur. Ask them what remains of dinosaurs that lived millions of years ago.

4. Explain to students that dinosaurs lived so long ago that no human being has ever seen a real one, which means that the best we can do is have theories about what they looked like and how they behaved. Tell them that scientists who study dinosaurs are called paleontologists (write this word on the chalkboard) and that some theories that paleontologists have had about dinosaurs have been proven wrong. For example, in the movie *Jurassic Park*, giant sauropods (plant eaters) are seen standing on their hind legs to eat leaves off of tall trees, but many scientists do not believe that sauropods ever did that!

5. Distribute copies of the "What Remains?" blackline master to your students. Remind students that skeletons are the only remains we actually have of dinosaurs. Ask them to figure out which parts of the drawing the artist would have had to make up.

6. Explain to students that scientists use clues to develop theories about dinosaurs. Tell them about fossils (write this word on the board as well), and explain that fossils include dinosaur bones, dinosaur footprints, dinosaur teeth, and even dinosaur eggs.

7. Distribute copies of the "Dinosaur Footprints" blackline master to your students. Explain that paleontologists can use footprints to learn about what dinosaurs looked like and how they behaved. Explain that the blackline master contains two sets of footprints from two different dinosaurs. Ask your students to choose partners and work together to write a sentence about what each set of footprints reveals about each dinosaur, as well as a sentence about how the two dinosaurs are different from each other. Make sure that students explain what characteristics of each footprint led them to their conclusions.

8. Bring the class together again and ask students to share what they have written. Guide students to provide evidence to support their theories about what each dinosaur might have looked like (this is an important part of the evaluation). Explain that scientists must always rely on evidence when making important conclusions.

9. Distribute copies of the "What Happened Here?" blackline master to students. Ask them to look at the picture and try to decide what they think might have happened to the dinosaurs whose footprints they are examining. (They can work with the same partners.) Have your students write what they think happened and support their ideas with evidence from the picture. (Again, this is an important part of the evaluation.) Students will have roughly 10 minutes to decide what happened and write out a few sentences. Different students may have different ideas about what they think happened—there is no "correct answer." It is important only that students can point to evidence from the tracks to support their ideas.

10. Bring the whole class together again; then invite pairs of students to tell what they think happened to the dinosaurs. They must be able to point out which elements of the picture led them to their conclusions. If students disagree with each other, remind them that scientists disagree all the time, and that the important thing is to respect each other's theories. The only measure of a good theory is the evidence that supports it.

ADAPTATIONS:

Distribute copies of the What Remains? blackline master with the complete dinosaur picture hidden. Ask your students to use the skeleton picture to guess what the whole dinosaur looked like with its muscles and skin; then ask them to draw their ideas. Remind them that they can't draw just any dinosaur—the one they draw should be shaped the same as the skeleton in the picture. You can evaluate students based on whether they attempt to draw the dinosaur whose skeleton you have shown them or some other dinosaur or monster instead.

Guide students through the activity described previously, but extend the lesson by asking students to view actual photographs of dinosaur footprints and skeletons. From these pictures alone, students should draw what they think the relevant dinosaurs looked like. You may also ask them to research a particular dinosaur or fossil find. If possible, they should read and compare what two different scientists say about the same dinosaur. Because the evidence is scarce, scientists rarely agree on what dinosaurs looked or acted like.

DISCUSSION QUESTIONS:

1. What parts of a dinosaur's body would be useful for defense from a predator?

2. How do scientists know which dinosaurs were predators and which were prey? What evidence do they have?

3. What evidence would scientists use to figure out whether a dinosaur moved slowly or quickly?

4. What parts of a dinosaur's remains would tell a scientist whether the dinosaur lived in water or on land?

5. What body parts would a dinosaur need to survive in water?

6. Some scientists think that pterosaurs walked on all fours. Other scientists think that they walked upright. Using pictures of pterosaurs and pterosaur skeletons, decide which idea you think is right. Use what you see in the pictures to support your choice.

EVALUATION:

For each of the activities, students should be evaluated on how well they can support their conclusions about dinosaurs and dinosaur behavior. For each claim (e.g., “I think this dinosaur ran quickly”), students must be able to point to some part of the picture that supports their idea.

EXTENSION:

Making a Fossil

Have your students collect seeds or pinecones, then press them into a medium of plaster of paris to make their own plant “fossils.” If shells are available (or strong animal bones that have been thoroughly cleaned), they can also be used to make impressions. When their work is complete, have students attempt to identify the plants and animals that each other's fossils were made from.

Flying Animals

Start a class book on flying animals. Have your students research interesting ways in which animals are able to move through the air. Compare what we know about flying animals today to what is known about the pterosaurs.

Walk or Swim?

Have students study pictures of animals—some that live in water and some that live on land. Students should determine which parts of the animals' bodies enable them to move in their natural environment. Ask them how they could determine whether an animal lives in water or on land if they observed it outside of its natural environment. In addition, ask them how these animals' bodies compare to those of similar dinosaurs.

What Did They Really Look Like?

Locate two different pictures of the same species of dinosaur on the Internet or in two encyclopedias. Ask students to compare the two pictures to see what different artists thought the dinosaur once looked like. (Such pictures are rarely, if ever, exactly the same. Head shape, body stance, and many other features can be different, depending on how the artist interpreted the fossil remains.) Have your students make a list of the similar and different features.

SUGGESTED READINGS:

The Tiniest Giants: Discovering Dinosaur Eggs

Lowell Dingus and Luis M. Chiappe. Doubleday, 1999

On a trip to Argentina to look for fossils of birds, a team of American paleontologists found a vast dinosaur nesting ground instead—with hundreds of fossilized dinosaur eggs. They also found the first embryo fossil of a sauropod, a giant, plant-eating dinosaur. Read all about their exciting discovery as it unfolded!

Dinosaur Worlds: New Dinosaurs, New Discoveries

Don Lessem. Boyds Mills Press, 1996.

Learn about the rise and fall of the dinosaurs through the exploration of 16 different dinosaur habitats throughout the world. Information on ancient plant life is included as well as scientific theories explaining why the dinosaurs died out.

WEB LINKS:

Something about Pliosaurs
Something about Pliosaurs is a good starting place for a search. It features links to the Web pages of several scientists who are actually digging and researching these fossils.
http://www.oceansofkansas.com/pliosaur.html

Anning's Plesiosaurs
Anning's Plesiosaurs contains three excellent photographs of plesiosaur skeletons suitable for the exercise described in this lesson in which students use photographs to hypothesize what an animal would have actually looked like.
http://www.ucmp.berkeley.edu/history/plesio.html

Oceans of Kansas Paleontology
The Oceans of Kansas site contains links to many dinosaur digs and research projects going on in Kansas, as well as excellent photographs, graphics, and text geared for the layperson.
http://www.oceansofkansas.com/contents.html

Ichnology
The Dinosaur Trace Fossils site describes the study of dinosaur tracks, tooth marks, eggs, gastroliths, and coprolites.
http://www.emory.edu/GEOSCIENCE/HTML/Dinotraces.htm

Mill Canyon Dinosaur Trail
Learning Family in Moab, Utah shows an active fossil site and describes student dinosaur-digging activities with photographs.
http://www.learningfamily.net/reiser/9809-nathisttour/6_moab.htm

At Dinosaur State Park
The site for Dinosaur State Park, located in Rocky Hill, Connecticut, tells about an active dinosaur dig. It features many other dinosaur-related links.
http://www.dinosaurstatepark.org/inside.html

VOCABULARY:

adaptation
Adjustment to environmental conditions; modification of an organism or its parts that makes it more fit for existence under the conditions of its environment.
Context:
Over millions of years, some dinosaurs' bodies experienced adaptations that helped them survive.

fossil
A remnant, impression, or trace of an organism of past geologic ages that has been preserved in the Earth's crust.
Context:
When they went to the museum, Jane and Bill saw dinosaur fossils that had been dug up and brought there from Arizona.

ichthyosaur
Any of an order of extinct marine reptiles of the Mesozoic specialized for aquatic life by a streamlined body with a long snout, limbs reduced to small fins for steering, and a large lunate caudal fin.
Context:
The ichthyosaurs of the Mesozoic lived almost entirely in the ocean, even though they breathed air.

predator
One that preys, destroys, or devours; an animal that lives by predation.
Context:
Scientists think that *Allosaurus* was a predator who killed and ate other smaller dinosaurs.
prey
An animal taken by a predator as food.
Context:
Although it was quick, *Camptosaurus* often became the prey of other larger dinosaurs and was eaten by them.

pterosaur
Any of an order of extinct flying reptiles existing from the Late Triassic throughout the Jurassic and most of the Cretaceous and having a featherless wing membrane extending from the side of the body along the arm to the end of the greatly elongated fourth digit.
Context:
Launching itself from the face of the cliff, the pterosaur swooped down over the water in search of fish to catch and eat.

ACADEMIC STANDARDS (You will match your lesson to as many Indiana Academic Standards 2000 for Science and your area of expertise if other than Science – rather than the National Science Standards and Benchmarks as shown on the Discovery web site.)

Science Indicators: (copy and paste these from the Standards)
Third Grade:
3.1.2 Participate in different types of guided scientific investigations such as observing objects and events and collecting specimens for analysis.

3.1.5 Demonstrate the ability to work cooperatively while respecting the ideas of others and communicating one's own conclusions about findings.

3.2.7 Ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask the same question.

3.3.7 Identify and explain some effects human activities have on weather.

3.4.2 Explain that features used for grouping depend on the purpose of the grouping.

3.5.2 Observe that and describe how some measurements are likely to be slightly different, even if what is being measured stays the same.

3.6.2 Investigate how and describe that something may not work if some of its parts are missing.

Fourth Grade:
4.1.3 Explain that clear communication is an essential part of doing science since it enables scientists to inform others about their work, to expose their ideas to evaluation by other scientists, and to allow scientists to stay informed about scientific discoveries around the world.

4.2.2 State the purpose, orally or in writing, of each step in a computation.

4.3.3 Identify salt as the major difference between fresh and ocean waters.

4.5.3 Illustrate how length can be thought of as unit lengths joined together, area* as a collection of unit squares, and volume* as a set of unit cubes.

4.5.4 Demonstrate how graphical displays of numbers may make it possible to spot patterns that are not otherwise obvious, such as comparative size and trends.

*area: a measure of the size of a two-dimensional region
*volume: a measure of the size of a three-dimensional object

4.5.5 Explain how reasoning can be distorted by strong feelings.

4.6.3 Recognize that and describe how changes made to a model can help predict how the real thing can be altered.