The Great Fossil Find

Contributors

Terry Lester, Jr.
Graduate Student
Georgia Southern University, GA

Yvonne Arnsdorff
Partner Teacher
Effingham County High, GA

Intended Audience

<table>
<thead>
<tr>
<th>K-4</th>
<th>5-8</th>
<th>9-12</th>
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Activity Characteristics

<table>
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<tr>
<th>Classroom Setting</th>
<th>Requires special equipment</th>
<th>Uses hands-on manipulatives</th>
<th>Requires mathematical skills</th>
<th>Can be performed individually</th>
<th>Requires group work</th>
<th>Requires more than one (45 min class) period</th>
<th>Appropriate for special needs student</th>
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Introduction

Description

During this activity, the students will become familiar with process of investigation and discovery and how it relates to the evolutionary theory.

Abstract

Science involves the gathering of knowledge in a testable and repeatable format. Evolution is a theory in science that has been around since the 19th century. This activity addresses how theories are accepted and/or rejected and how evidence works in scientific reasoning.

Core Themes Addressed

<table>
<thead>
<tr>
<th>Microbial Cell Biology</th>
<th>Microbial Genetics</th>
<th>Microorganisms and Humans</th>
<th>Microorganisms and the Environment</th>
<th>Microbial Evolution and Diversity</th>
<th>Other –Evolutionary Theory</th>
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Keywords

Evolution, hypothesis, theory, law, Charles Darwin

Learning Objectives

At completion of this activity, learner will

1. Identify reasons for scientific collaboration
2. Develop a working hypothesis
3. Explain how fossil records can be used as evidence of evolution
National Science Education Standards Addressed

**Standard A: Science as Inquiry**
- Abilities necessary to do scientific inquiry

**Standard C: Life Science**
- Biological evolution

**Standard G: History and nature of science**
- Nature of scientific knowledge
Teacher Handout

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Student Prior Knowledge

Students should be familiar with the works of paleontologists and fossil evidence. Students should also have been introduced to the steps of scientific investigation (hypothesis, predictions, results, etc.).

Teacher Background Information

Class Time

This activity will require a minimum of one-50 minute class period

1. Introductory lecture (5-7min)
2. Gather material (5min)
3. Each field observation day (5min; 25min total)
4. Clean-up (5min)
5. Worksheet and Discussion (10min)

Teacher Preparation Time

This lesson will require approximately 2 hours of preparation time.

1. Print fossil sheet and cut out each fossil. You will need 1 sheet for every 4 students.
2. Store each fossil set in a separate envelope. Each group will be subdivided into “Group A” and “Group B” with 3 mailing envelopes each.
3. Print Resource Manual and Student Worksheet

Safety Precautions

None

Materials and Equipment

1. Envelopes with fossils.
2. Powerpoint or handout with Narrative
3. 1 Skeletal Resource Manual per team
4. Student Worksheet
5. Narrative as follows:

**The Great Fossil Find**

[READ TO STUDENTS]

Today, you and your partner(s) will set out on a voyage to the Islands of Waikiki, Hawaii (Wah-key-key). After spending the entire day tanning and playing beach volleyball, you find four well preserved fossils.

(Withdraw four fossil bones from your envelope. Make sure you take them out without looking at the ones remaining in the envelope!)

It is too late in the day to continue with the dig, so you return to camp with your find.

Day 1. That night in camp, after dinner, you and your colleagues begin to assemble the 4 bones you found earlier. Since the bones were all found together in an undisturbed layer, you assume that they are all from the same animal. You spend the rest of the evening trying different arrangements of the bones in hopes of identifying the animal before you get tired. (Take 3-5 minutes to try various combinations.)

As the night wears on, you get weary and decide to retire and begin anew in the morning. (Before you go to bed, jot down on your worksheet the type of animal you think it might be.)

Day 2. You wake up to a beautiful Hawaiian morning and you hurry back out to the dig site. The rock layers that hold your fossils are very hard and only give up three more specimens. (Withdraw 3 more bones from the envelope).

As the day ends you make your way back to camp for another try at assembling the mystery animal. (Use the next 3-5 minutes to incorporate your new finds in your fossil reconstruction.)
It's getting late, and you are getting weary. Maybe tomorrow you will find the answer to the puzzle. (Be sure to record on your worksheet your latest suspicion of the type of animal suspected.)

Day 3. The next morning is hot. You can tell that summer is just around the corner and you know that this will be the last day of the digging. This is your last chance to find more fossils of the mystery animal. Just as the day is about to end, one of the members of your team finds 3 final bones.

(Withdraw 3 more bones from the envelope. Use the next 3-5 minutes to incorporate these latest finds. Record what you think it is now.)

Day 4. Back in the lab, you meet up with some Paleontologist friends. They tell you they have spent the summer working in a different location but with the same geological period. You show them the skeleton you found, and they tell you they have a similar one, but it looks like they have some different bones that you don’t have.

(Take the next 3-5 minutes to compare your findings with those of a team near you, looking for clues that might help you in your reconstruction, and possibly even suggest an entirely different animal than your earlier ideas. Apply these latest clues to the assembly of your skeleton as best you can. Record the type of animal suspected now. Be as specific as you can.)

Day 5. In the library at school you find a Skeletal Resource Manual with drawings of the skeletons of some existing animals. You notice some interesting similarities between some of the drawings and your unknown fossil

(Use the drawings to assist you in your final assembly of the fossil skeleton. Record your final interpretation)

Answer the questions on your worksheet. When done, be sure to return all of the "fossil bones" to the envelope.
Methods

1. Place the envelopes with fossils, "Resource Manuals", and worksheets near each team.

2. Remind students of the exciting field trip they will be taking to their dig site. At this time, also make sure students are aware that they SHOULD NOT open any envelopes until the day of the fossil find labeled on the envelope.

3. Read the narrative from the powerpoint presentation.

4. After the story, have each team/group return envelopes, Resource Manuals, and skeletons to appropriate location.

5. Allow students to complete individual worksheets

6. Begin a discussion by asking students what animal they discovered during their fossil hunt.

Tips/Suggestions

1. If Audio/Video equipment is not available, copy and paste narrative into a text document.

2. Make sure subgroups (e.g. 1a and 1b) are working near each other, but not looking at the other group’s fossils.

3. Piecing together the fossils requires a lot of bench space.

References

This activity was modified from “The Great Fossil Find” by Evolution and Nature of Science Institutes. Webpage sponsored by Indiana University. Last accessed February 20, 2013.

Extension/Additional Resources

Answers to Student Handouts

Listed below are the answers for questions 8-10 of student’s worksheet. Other questions are asking for student’s feedback on teamwork and scientific investigation.

8. From looking at the resource manual, what could you say about how and where this animal lived?

ANS. probably on land, perhaps able to fly.

9. Is it possible for scientists to do studies about things that happened millions of years ago? Explain.

ANS. Yes. All sorts of clues, from fossil bones, pollen, leaves, ripple marks in sandstone, volcanic rocks, etc., scientists can do an amazingly accurate reconstruction of life and activity in the distant past.

10. What are some reasons for collaboration amongst scientists?

*Answer may vary*
Introduction

Evolution is a biological theory that states populations show descent with modification and change in the genetic composition from generation to generation. This is a theory that integrates many areas of science, such as ecology, geology, physics, and chemistry.

Student Background Knowledge

Science is the organization of knowledge that attempts to explain natural phenomena. Scientists use an investigation and discovery method that leads to scientific “Truth”. This truth is never known for sure, but it is the most likely explanation to a scientific question. Scientists form their tentative explanations as hypotheses.

Vocabulary

Evolution: descent with modification; a change in the genetic composition of a population from generation to generation

Charles Darwin: father of evolutionary biology; wrote The Origin of Species

Hypothesis: tentative explanation of a phenomenon

Safety Considerations

None

Materials Checklist

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
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<tbody>
<tr>
<td>3</td>
<td>Envelopes with fossils (per subgroup)</td>
</tr>
<tr>
<td>1</td>
<td>Resource Manual (per group)</td>
</tr>
<tr>
<td>1</td>
<td>Student Worksheet (per individual)</td>
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</tbody>
</table>
Procedure

1. Form groups of 4-5 students.
2. Divide your initial group into two subgroups.
3. One subgroup retrieves material for group “A,” while other subgroup retrieves material for group “B.” **Note: DO NOT open envelopes until teacher instructs you.**
4. Listen carefully to teacher’s narrative.
5. After the study, place “fossils” back into envelopes and return to teacher.
6. Complete worksheet (individually).
Student Worksheet

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Name________________ Date____________ Period__________

Each person in your group must complete this worksheet individually.

1. What assumptions did you make at the beginning of the activity that made it more difficult for you to assemble your final interpretation of the fossils?

2. Did the discovery of new bones cause any conflict within your group? Why or why not?

3. Did any of your group members resist changing their interpretation in light of the new information? Why did they do this?

4. What information did you get from another group? How did it influence your assumptions?
5. Did the information in the resource book confirm your group’s ideas, or did it cause you to rework your arrangement of the fossil parts? Explain how.

6. Do you think this scenario is typical of how scientists create and revise hypotheses?

7. What does your experience with this scenario tell you about the work of scientists?

8. From looking at the resource manual, what could you say about how and where this animal lived?

9. How is it possible for scientists to do studies about things that happened millions of years ago?

10. What are some reasons for collaboration amongst scientists?
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Please complete the table below and turn in ONE for your entire group.

<table>
<thead>
<tr>
<th></th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
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<tbody>
<tr>
<td>What do your fossils look like?</td>
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<tr>
<td>What type of animal do you think it is?</td>
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<tr>
<td>What about the fossils makes you think that?</td>
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SKELETAL RESOURCE MANUAL
FISH (Perch)

SALAMANDER (Necturus)

FROG
CAT

RABBIT