Archaeology
High School Lesson Plan

Topic Scientific inquiry

Grade Levels 9-12

Overview

QUEST *Archaeology* explores the process of discovering ancient civilizations more than 11,000 years old through uncovering pottery remnants, examining bones, and investigating soils. Following the trail of archaeologists as they dig in Cornwall, Vermont, this episode depicts the painstaking process of reconstructing tiny pieces of the past into a story of our history.

Introduction

In this lesson, students will examine the *process* of science in an effort to better understand how observations lead to investigations. Students will watch QUEST *Archaeology* to learn about the process a group of archaeologists went through to conduct their investigation. Students will then research a question they have come up with themselves. In so doing, they will propose a method of inquiry for exploring their hypothesis.

Time Allotment

Five 45-minute class periods.

Accessing Prior Knowledge

Students should be familiar with the process of conducting a scientific investigation.

Concepts to Clarify

When experimenting, students tend to look for data that confirm their prior ideas. They often do not see experimentation as a method for testing new ideas, but rather as a method for trying things or producing a desired outcome.

Students also have difficulty knowing when it is appropriate to make inferences. They will often make an inference based on only one observation. Also, even though high school students may be able to see that a variable can sometimes have the opposite effect from the one intended, they can have difficulty recognizing that a variable may have no effect at all.

QUEST: Investigating Our World is a regional public television series seen on Maine Public Broadcasting Network, Vermont Public Television, and New Hampshire Public Television

Maine Public Broadcasting Network · New Hampshire Public Television · Vermont Public Television · PBS

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CONNECTIONS TO THE STANDARDS

National Science Education Standards	Benchmarks for Science Literacy	Maine Learning Results	New Hampshire Curriculum Framework	Vermont Learning Standards
Science as Inquiry (9-12) Abilities necessary to do scientific inquiry: – Identify questions and concepts that guide scientific investigations. – Design and conduct scientific investigations. – Use technology and mathematics to improve investigations and communications. – Formulate and revise scientific explanations and models using logic and evidence. – Recognize and analyze alternative explanations and models.	**Scientific Inquiry** (9-12) – Hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). – There are different traditions in science about what is investigated and how, but they all have in common certain basic beliefs about the value of evidence, logic, and good arguments. And, there is agreement that progress in all fields of science depends on intelligence, hard work, imagination, and even chance.	**Science and Technology: Inquiry and Problem Solving** (9-12) Verify, evaluate, and use results in a purposeful way. This includes analyzing and interpreting data, making predictions based on observed patterns, testing solutions against the original problem conditions, and formulating additional questions.	**Science, Technology and Society** Students will demonstrate an increasing understanding of how the scientific enterprise operates. Students will be able to: Formulate questions and use appropriate concepts to guide scientific investigations and to solve real-world problems.	**Scientific Method** (9-12) Students use scientific methods to describe, investigate, and explain phenomena and raise questions. 7.1.aaa. Students frame questions that can be investigated using scientific methods and knowledge, including manipulating variables and predicting outcomes for untested hypotheses using scientific principles.

Materials Needed

- TV with VCR
- QUEST *Archaeology* video
- Overhead projector or chart paper with markers
- Copies of each of the following reproducible handouts:
  - Student Handout 1: Exploring Archaeology
  - Student Handout 2: Cornwall, Vermont, Archaeological Inquiry
  - Student Handout 3: Conducting a Scientific Inquiry
  - Student Handout 4: *QUEST* at Home: Exploring Your Regional History

1. Introducing the Concepts

Activity 1

In this introductory activity, students will explore the questions of what we know about early climates and human cultures in New England, and how we know it. They will learn how the landscape of the region has changed over the millennia and how people have acquired this knowledge.

Step 1

Divide the class into groups of three students each. Direct each group to brainstorm sentence statements for all that they know about the early climate and cultures of the northern New England region. For instance, elicit from students that northern New England was once covered with ice during a glacial period, and that Abenaki Indian tribes were spread throughout the region after this glacial period.

Step 2

Once the groups have brainstormed their statement lists, have a class discussion so that groups can all share their ideas. Record students' statements in a concept map on the board, an overhead, or chart paper. For each concept presented, help students determine whether it links to any others, and if so, how. If a concept seems to stand alone, try to determine why. Explore the possibility with students that some items might actually link together by time (for example, one might precede another chronologically) or through a relationship. For example, one concept (Indians living in the area) and another concept (deer also lived in the area) could be linked because the Indians hunted the deer. Encourage students to connect what they know about the geologic history of the area to the animal species that might have been living in the region. Have them think about Native American populations and how they lived, what their shelters were like, what they ate, and so on.

Step 3

Once you have recorded students' current ideas on this subject, ask if they have further questions about

the geologic or cultural history of northern New England. First, ask students to work individually and write three questions they have. Then, in their teams of three, have students share their questions. Finally, have each group select one question that interests all three group members. Post these questions on the board, overhead, or chart paper.

2. Exploring the Concepts

Activity 2

In the next activity, students will watch the QUEST *Archaeology* video. They will take notes on the questions being investigated by archaeologists, the techniques these professionals are using, and their results.

Step 1

Distribute copies of Student Handout 1 (Exploring Archaeology). Review the handout with students, and tell them that they will be completing the handout while watching the QUEST *Archaeology* video.

Show the first half of the video, stopping at the section on the Atlatl competition. **Note:** You may need to pause the video periodically so that students have adequate time to record their notes.

Step 2

Have students regroup in their teams of three to discuss their answers and pool the information they noted from the video. Then, discuss the answers as a whole class. Be sure that everyone has a complete set of answers to the questions on Student Handout 1.

3. Developing the Concepts

Activity 3

Using the information they have gathered from the video, students will analyze their notes to see how they reflect the components of a scientific inquiry. They will then refer back to the questions they came up with in Activity 1, refine these questions, and describe how they would begin to answer them.

Step 1

Have students work in their teams to analyze the information they gathered from the video. Tell them that they will be using this information to identify how the study of the Cornwall, Vermont, archaeology site reflects the components of a scientific inquiry.

Distribute copies of Student Handout 2 (Cornwall, Vermont, Archaeological Inquiry). Review the handout with the class and clarify as needed. Allow time for all groups to complete their handouts.

Step 2

When all groups have completed Student Handout 2, discuss their responses as a whole class.
Note: The National Science Education standards outline five components of inquiry which are those on Student Handout 2. The fifth component is "Formulate and revise scientific explanations and models using logic and evidence." Possible alternative explanations for the evidence found were not discussed in the video. Have students work in teams to brainstorm any alternative ideas about paleo cultures that they could justify using the evidence presented in the video. Or, have them explore the internet or do research to see if other archaeologists have presented alternative ideas about paleo Indians in New England.

Step 3

Ask student teams to reflect back on the questions they raised in Activity 1. Discuss whether they learned enough new information from the video to answer any portion of their questions. Direct each team to refine their question if they feel it is necessary.

Step 4

Explain that student teams will now be designing their own scientific inquiries. Each team's inquiry will be based on the key question they have just reviewed and revised. Tell students that each team will be responsible for completing a detailed description of their investigation, showing how each component reflects methods of scientific inquiry.

Direct each team to decide how they would determine what is already known about their topic in preparation for this task. Each group member should be assigned a research topic to investigate as homework.

4. Synthesizing and Applying the Concepts

Activity 4

In the following activity, students will use the background research they have conducted on their team's question to help design an inquiry to answer that question.

Step 1

Direct students to rejoin their teams and share their research findings. Distribute copies of Student Handout 3 (Conducting a Scientific Inquiry). Review the handout with the class; then give teams time to complete the table. Tell students that this handout will serve as an organizing tool for their next assignment.

Step 2

When all groups have completed Student Handout 3, tell the class that each team will now be working on a final project. This project will entail preparing a presentation about the team's chosen question and related work. Each team's presentation must include the following:

- What the team's question was;
- What research the team conducted on the topic;
- How the team proposes to answer their question through scientific inquiry.

Explain that teams can choose a number of methods for presenting their work: as a poster, a mock funding proposal, or a PowerPoint presentation. Assign a due date for groups to present to their classmates.

Step 3

Have students share their presentations in class and discuss each other's projects.

5. Extending the Concepts

QUEST at Home

After watching the QUEST *Archaeology* video, students and their families will explore cultural changes over time in their own region. They will conduct research on this topic using Web sites that link them to historic maps of northern New England, background on Native American tribes in the area, and state and local historical societies.

Step 1

Distribute copies of Student Handout 4 (Exploring Your Regional History). Review the handout with the class, and clarify as needed. Set a due date for students to return to class with their findings. Be sure that students have access to the Web sites listed on the handout so that they can conduct the needed research.

Step 2

On the appointed day, have students share their findings with the class. Discuss the rich cultural heritage of the northern New England region.

Community Connections

- Historic landmarks are sites that have been designated by a town, city or state as having historic significance. These residences and businesses are then preserved by their owners to reflect their cultural heritage. Many of the owners of these sites are local historians and restoration experts. Invite one of these individuals to your class to discuss the role of a particular building in the history of your area. Ask this presenter to discuss the story of this building's protection and preservation.

- Native Americans live throughout northern New England. Members of New England's First Nations are adept at sharing their cultural values, their tribal histories, and the culture of their ancestors. Invite a member of a regional tribe to visit the class to discuss his or her heritage.

- Regional archaeology associations and university faculty members are often investigating sites in your area.

These individuals can be invited to talk about their research. Some may even be looking for volunteers to help conduct the research. Share this with your students so that some might consider participating and bringing their experiences back to the classroom.

Career Opportunities

- Archaeologists conduct field studies to understand ancient cultures. They often have expert knowledge about the implements, housing, and clothing used by these cultures.

- Paleobotanists study ancient plant communities. Often they do their research by examining pollen samples found in sediments of wetlands. The pollen can actually date back to thousands of years ago, and can serve to identify what species were in the plant community at that time.

- Geologists are experts in reading the landscape of soils and rocks to determine the geologic history of an area. From the landscape, geologists can identify what kinds of events made mountains, lakes, bogs, and other physical formations in the region.

- Anthropologists study human cultures. They work to determine the beliefs, ceremonies, and practices of cultures. They can examine both current and historic cultures.

- Historians may be authors investigating a person or time in history in preparation for writing a book. Or, they may be teachers at the middle-school, high-school, or college level, who may or may not be doing research as well. Amateur (self-taught) historians may be working for local historical societies, which can be found in most communities.

- Genealogists investigate families by tracing the family name back in time with the help of historic documents. Genealogists often find out when this particular family came to America and where they came from.

- Living history actors/actresses depict historic figures, usually at special historic sites or in theatres. Many such actors and actresses work together to help convey to visitors a historic period of significance.

Cornwall, Vermont, Archaeological Inquiry

The following table lists the basic stages of a scientific inquiry in the left column. Analyze what you learned about the Vermont archaeological study. For each listed stage of scientific inquiry, identify in the right column the corresponding part of the Vermont inquiry.

Component of Scientific Inquiry	Cornwall Vermont Archaeology Study
1. Identify questions and concepts that guide scientific investigations.	
2. Design and conduct scientific investigations.	
3. Use technology and mathematics to improve investigations and communications.	
4. Formulate and revise scientific explanations and models using logic and evidence.	
5. Recognize and analyze alternative explanations and models.	

Exploring Archaeology

Directions: Record your answers to the following questions while watching the QUEST *Archaeology* video.

1. What time period are the archaeologists investigating?

2. Where is the site they are examining?

3. What questions are the archaeologists interested in answering?

4. How do they know when Paleo Indians came to northern New England?

5. How did the first Paleo Indians get to this area?

6. From which animal did the first bone come that the archaeologist discovered near Lake Champlain? What did this bone reveal about the site?

7. How could scientists determine the age of the bones that were found?

8. What does soil tell an archaeologist about an area? How do archaeologists examine soil?

9. What did archaeologists find out about the site in Vermont from its soil type, soil layers, and soil color?

10. How do scientists examine an archaeological site? What types of things are they looking for?

11. What were some of the animals hunted by Paleo Indians? What tools did the hunters use?

Conducting a Scientific Inquiry

The following table lists the components of a scientific inquiry in the left column. Use what you have learned about your research question to complete the rest of the table. You will do this by listing the other components of an inquiry that you would need to do in order to answer your question.

Component of Inquiry	Your Archaeology Study
1. What questions are you working to answer? What science concepts will guide your scientific investigations? What is your hypothesis about the answer to you question and the statement you hope to prove correct through investigation?	
2. How would you design and conduct your scientific investigation(s)?	
3. How have you used, or will you use, technology and mathematics to improve your investigations and communications?	
4. From what data will you formulate and revise your scientific explanations and models using logic and evidence?	
5. How will you find, recognize, and analyze alternative explanations and models?	

Exploring Your Regional History

You're on a Quest!

After viewing QUEST *Archaeology*, explore some Web sites (see Resources) that have information about the history and culture of your area. You may also want to consult some historians or other professionals in your town or city to conduct your research. As a final product, you can create a scrapbook of the "personalized community history" of your region. In this scrapbook you can put copies of facts, maps, and pictures that you have collected during your research. Be sure to include family members and friends in this project!

1. Begin by looking at some maps of your area. In particular, view some historic topographical maps. Identify what has changed since the time these maps were made; also identify what remains the same. What new roads have been put in, and which (if any) have been removed? Can you see how many houses were located along main streets then? Tour the area now, and count how many more houses there are.

2. Look at what is known about the paleoecology of your region. See how the environment has changed over the past 12,000 years or more.

3. Examine a map of Native American cultures in your region. Which tribe, or tribes, settled in your area? Research how these Native Americans lived, what each tribe's houses were like, how the tribe hunted, and what types of clothing and tools they used. Do any of these tribes still live in your area?

4. Look for more recent historic sites in your region. Who lived there and why are they famous? Go visit a site. Find out what was happening in the world at the time that the structure was occupied.

5. Find some descriptions of your community's history. Does your town or city have a historical society or association? Does this institution keep artifacts of the ancient cultures that lived in your area? Are there resources you might be able to look at or read?

6. Talk with one of the families who has lived in your area for many generations. Explore their family history by asking some of the following questions:

   - Where did your family come from? When did they arrive in this area?
   - What are some stories about this area that have been handed down from generation to generation?
   - How has your family's way of life changed over the generations?
   - Do you have any pictures of the area from an earlier time period?

If you are able to look at old photographs or other artwork, try to show how people dressed differently in earlier times.

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Resources

Map Collection (1500-2004): *http://memory.loc.gov/ammem/gmdhtml/gmdhome.html*
This is a collection of historic maps, listed by state.

Historic USGS Maps of New England: *http://docs.unh.edu/nhtopos/nhtopos.htm*
These USGS topographical maps from the early 1900s present viewable and downloadable images.

17th-Century Colonial New England Native American Indians: *http://www.17thc.us/index.php?id=14*
This site gives a comprehensive overview of Native Americans tribes in New England.

North American Indian Tribes Northeast: *http://www.accessgenealogy.com/native/indianlocation.htm*
You can find a complete list, by state, of Indian tribes in Maine, New Hampshire, and Vermont.

Late Glacial Paleoecology of New England: *http://www.bio.umass.edu/biology/conn.river/palecol.html*
This site offers background information on the paleo-environment of New England.

Prehistory in New England: *http://www.bio.umass.edu/biology/conn.river/prehis.html*
A discussion of prehistoric populations in the Connecticut River Valley is available here.

Vermont Archaeological Society: *http://www.vtarchaeology.org/*
This site can provide background on archaeological sites in Vermont, field work opportunities, and educational resources.

Vermont Community History: *http://www.vermonthistory.org/community/index.htm*
This site describes community history projects done throughout Vermont by community members. It is interesting both because of the information it provides and because it offers a model to follow for investigating your own community.

Local Historical Societies of Vermont: *http://www.vermonthistory.org/lhs/addison.htm#Addison*
This site provides contact information for historical societies in Vermont.

Maine Archaeology Society: *http://www.mainearchsociety.org/*
This site offers background information on archaeological sites in Maine, field work opportunities, and educational resources.

New Hampshire Archaeology Society: *http://www.nhas.org/meetings.htm*
This site contains background information on archaeological sites in New Hampshire, field work opportunities, and educational resources.

New Hampshire Historical Society: *http://www.nhhistory.org/*
Background information on New Hampshire is available here.

A Brief History of New Hampshire: *http://www.nh.gov/nhinfo/history.html*
A government almanac that gives an overview of New Hampshire's history is found here.

The Story of Maine: *http://www.mainepbs.org/hometsom/hometsom.html*
This Public Television site contains background information related to a television series about Maine.

History of Lake Champlain: *http://www.historiclakes.org/contents.htm*
Background on the Lake Champlain region is located here.