

Investigating Great Houses

Math, social studies, science, language arts

SKILLS.....Knowledge, comprehension, application, analysis, synthesis, evaluation

STRATEGIES.....Scientific inquiry, decision making, problem solving, writing

DURATION.....2 class periods, 3-hour field trip to Aztec Ruins

CLASS SIZE.....Any, groups of 4 or 5

OBJECTIVES

In their study of the application of the scientific method to a question about building the West Ruin, students will:

1. Form a hypothesis, and develop a procedure to test it.
2. Make observations to test their hypothesis.
3. Make inferences regarding the behavior of the Aztec builders.
4. Evaluate the hypothesis.
5. Compare and evaluate the effectiveness of procedures used to test a hypothesis.

MATERIALS

- Approximately 150 dominoes, Legos[®], or similar rectangular solids for each 4-5 person team; store in ziplock bags
- 2 12-foot tape measures
- Calculator (optional)
- “Map of West Ruin” HANDOUT

VOCABULARY

data: information, especially information organized for analysis.

great house: large pre-planned multi-room structure surrounding a plaza.

hearth or firepit: a stone- or plaster-lined pit used for containing fire.

hypothesis: a proposed explanation accounting for a set of facts that can be tested by further investigation.

inference: a conclusion derived from observations.

kiva: room with distinctive features, usually underground, probably for ceremonial use; similar structures are still used by Pueblo people today.

mealing bin: a pit, usually rectangular and slab-lined, in which metates were set for use.

observation: recognizing or noting a fact or occurrence.

pithouse: dwelling excavated in the earth.

BACKGROUND

Archeologists call the large multi-story structures found at Aztec Ruins and other places "great houses." They consisted of multiple stories surrounding a flat open plaza, with exterior earthen berms, mounds, middens, and roadways defining access and enhancing their appearance. Great kivas, large subterranean kivas that were probably used for community-wide activities, are frequently associated with great houses. The area within Chaco Culture National Historical Park was the center of this style of architecture and contains many of these buildings that have anywhere from 100 to 700 rooms. Throughout the northern part of the Southwest, the appearance of great houses suggests the widespread influence of the people of Chaco Canyon.

At the same time people in the Southwest built great houses, they also built other structures they used for habitation. Some consisted of one or two rows of interconnected rooms in a single story, while others were multi-story buildings of hundreds of interconnected rooms.

We can see some of these large pueblos tucked into cliff overhangs in national parks and monuments such as Mesa Verde National Park in Colorado and Navajo National Monument in Arizona. In other areas in the Southwest, builders placed them on mesa tops or river valleys near dependable water supplies.

The great houses differ from the large buildings at Mesa Verde in that they required a greater degree of planning, followed a consistent layout, and required more energy to build. Constructing one was not just a matter of stacking single story residential style rooms.

Great house rooms are usually larger, the walls higher and thicker, and the masonry more intricate – requiring more materials and labor. Locating, transporting, preparing, and placing the stones, timbers, and mortar for such a massive job required well-organized teams of workers. Archeologists think that builders constructed major sections of great houses as single projects, reflecting the need for prior planning.

In early years, archeologists assumed that great houses were built to house a large community of people. But because of their monumental scale, the planning required, and the great energy invested in building them, they now suggest that the people built them primarily as public buildings – for ceremonial, administrative, and/or trading functions.

The largest of the great houses at Aztec Ruins is called the West Ruin. The interconnected rooms formed three stories in places and had about 450 rooms. The reconstructed great kiva is situated in the enclosed plaza.

Although the evidence is unclear, some feel that early in the building's 200-year period of use, a small number of caretakers lived in the structure year round, with periodic influxes of people using it for ceremonies or other purposes during certain times of the year. Later in its history, people modified the building and used rooms for a variety of purposes, including work areas, storage, tombs, middens, rituals, and latrines. Some archeologists believe in these later years that they used the building to a certain extent for habitation, while they also built small houses adjacent to its exterior for that purpose. In addition, nearby they lived in masonry structures of 10 to 50 rooms as they had throughout much of Aztec's history.

Like other scientists, archeologists use the scientific method to help answer questions about the great houses and their builders. The scientific method begins with a question such as "Why did they build the great houses?" A *hypothesis* is a proposed explanation to the question and it can be tested by further investigation. It is based on observable facts gained through prior knowledge and experience. A hypothesis for this particular question could be: "If the scale of construction demonstrates a large investment of energy, then the great houses were built for reasons other than habitation." Archeologists undertake a procedure to test the hypothesis. Based on the testing, they accept, reject, or revise the hypothesis. They may also make additional *inferences*, or conclusions derived from observations and testing.

An archeologist must use accurate data and a good procedure to yield valid inferences. Early archeologist Earl Morris inferred a population of about 1000 people in the West Ruin based on a poor procedure and data. First, he determined the ratio of inhabitants to total number of rooms in an occupied pueblo of the time. Morris then applied that ratio to the total number of rooms in the West Ruin. Morris incorrectly assumed that the building functioned primarily for habitation as in modern pueblos, and so inflated the population estimate through making an invalid comparison.

A more accurate procedure is to count the number of rooms in the West Ruin that contained hearths or mealing bins – which indicated a living area for one family group. For the West Ruin, mealing bins and hearths were overlooked, undiscovered, or poorly reported,

thus leaving archeologists with little data on which to base estimates of how many people used the building as habitation. Nonetheless, if the West Ruin follows the pattern present in most great houses of very few hearths and mealing bins, then we would not expect to find a large population actually living in the rooms – perhaps only between 100 and 300 people or fewer, depending on the time period.

SETTING THE STAGE

Brainstorm with students and write responses to the following question on the board:

What are examples of public buildings we have today?

Examples: post offices; performance halls; courthouses; shopping malls; schools and universities; museums; churches; airports and train terminals; monuments and visitor centers.

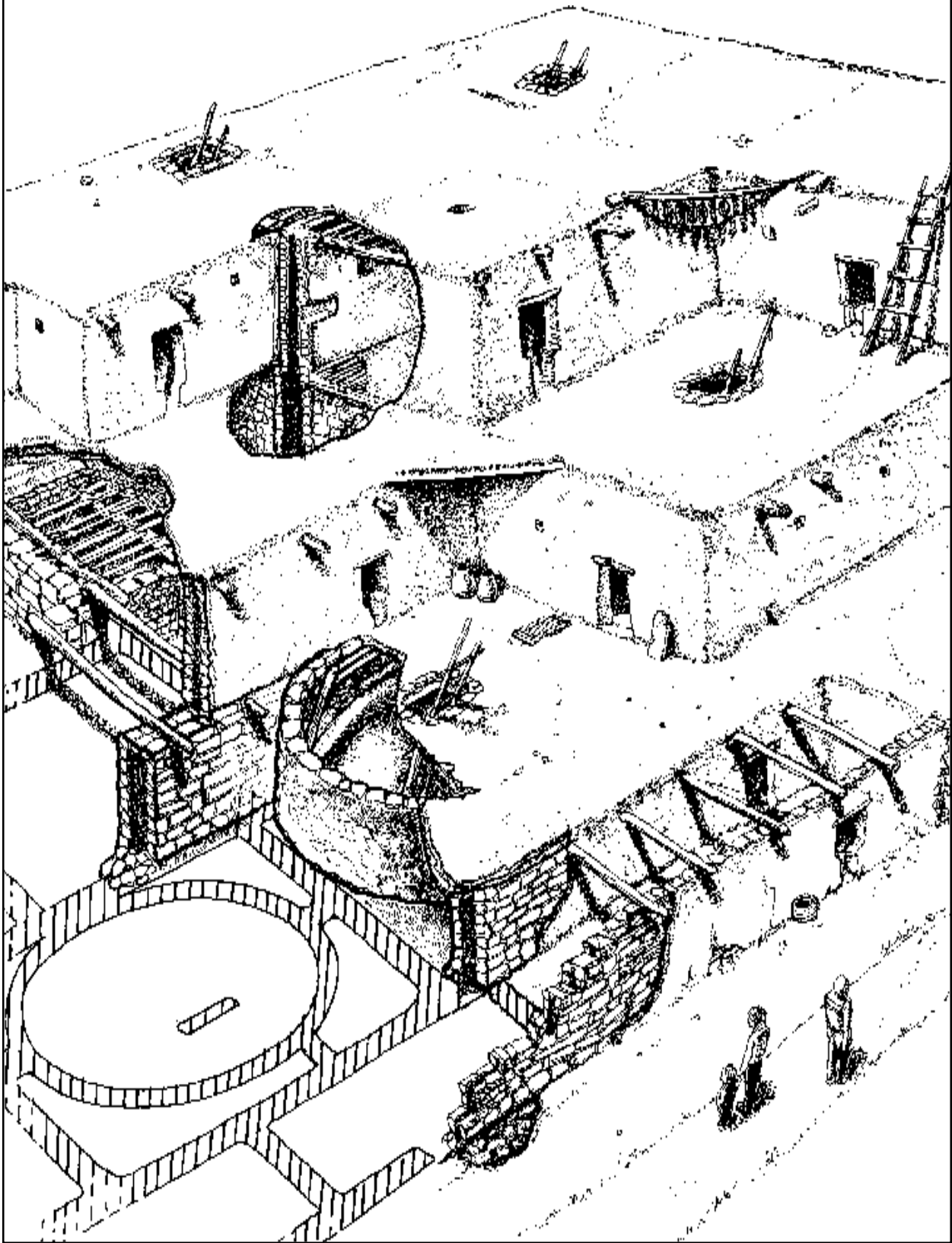
Share **BACKGROUND** information regarding the West Ruin and great houses, their characteristics, occurrence, and recent archeological thought regarding their function. Emphasize their primary purpose as public buildings, not as habitations.

Write the following research question on the board:

Did the builders of the West Ruin save materials and labor by joining rooms in multiple stories?

Explain to students that they will attempt to answer this research question by forming and testing a hypothesis. Have them write the question in their notebooks.

Artist's reconstruction of northeast corner of West Ruin



PROCEDURE

1. Briefly review steps and concepts in the scientific method: research, question, observation, hypothesis, procedure, inference.
2. Students write a possible hypothesis that addresses the research question in their notebooks under the heading "hypothesis." It should be in the form of an explanation that can be tested. To help them develop it, suggest that they draw on their prior knowledge, experience, and observations of places like Aztec Ruins. Example: If the builders stacked rooms in stories so that they shared walls and floor/roofs, then they used fewer materials per room and less labor than in building single-story rooms.
3. Distribute dominoes or Legos® to work groups. Students write the heading "Procedure" in their notebooks, with a sub-heading "data." Students carry out a procedure to test the hypothesis in the classroom. This may involve constructing models of single-story and multi-story rooms of shared walls and ceiling, and recording the number of blocks used for each. Students may expand their model both horizontally and vertically to experiment with use of the materials. Record results in student notebooks.
4. Discuss the data from students' model building. Review the meaning of "inference." Based on the data suggested by the model-building, discuss possible inferences about prehistoric building behaviors.
5. Explain the assignment for the field trip to Aztec Ruins. Distribute the "Map of West Ruin" HANDOUT to each work group. Show students the areas on the map where they will conduct their research:
 - Students will test the hypothesis by comparing amounts of materials used in single story rooms to those in multi-story rooms in the West Ruin. They will measure the height, width, and thickness of walls in both single story and multi-story rooms.
 - Students record their measurements under the "data" section of their notebook.
 - Students also make observations that will help them test the hypothesis. Compare materials and construction of the single-story structures with multi-story structures. For instance, are the stones smaller and/or better dressed in one than the other? Do the mortar types vary? Do the types of stone differ? Do wall widths differ? Students record their observations under a heading marked "observations."
 - Students need to consider and record observations regarding the condition and completeness of the walls.
6. Take the field trip and complete the assignments.

7. While on site, discuss the observations and data the students collected. Compare them with the data from the pre-field trip model-building exercise. Discuss possible explanations for discrepancies. Discuss the implications of using a good procedure based on valid information when using the scientific method (research the real thing, otherwise you will have worthless data upon which to base the evaluation of the hypothesis and drawing of inferences.) Discuss Earl Morris' population estimate from the background information as an example of using a poor procedure.
8. Based on the data yielded by the procedure and the observations made, students write at least one inference under the heading "Inferences" in their notebook. Discuss. Examples: the builders of the multi-story buildings made the walls thicker to support the added weight of the upper stories. The builders used materials that would allow them to build the fastest way possible. The builders wanted to impress other people with the size of the building.
9. Evaluate the original hypothesis developed in PROCEDURE 2. Accept, reject, or revise as necessary.

CLOSURE

Review the specific steps in the scientific method and how they were applied in this lesson. Students discuss their results in view of the original question: Did the builders of the West Ruin save materials and labor by joining rooms in multiple stories? As a final entry in their notebooks, students consider their experiences on their field trip and write a question about Aztec Ruins that might be answered by the scientific method.

EVALUATION

Teachers evaluate students' participation in discussions and the thoroughness and neatness of their notebook entries.

EXTENSIONS

1. During closure, ask students to consider how their question about Aztec Ruins might be answered by writing a hypothesis and a procedure for testing it.
2. To shorten the lesson, omit OBJECTIVE 5 and steps 3, 4, and the portion of 7 that use and evaluate the model building procedure in the classroom.
3. Students research Chacoan great houses and the structures found in cliff overhangs at Mesa Verde National Park. Create written lists comparing and contrasting the two, focusing on the architecture and functions of the buildings. Challenge the students to brainstorm hypotheses that explain why people began building the larger multi-story buildings in each place.
4. Add additional math elements by having students complete the "Prehistoric Buildings" WORKSHEET included in the "Impacts on the Environment" lesson.

REFERENCES

A Trailguide to Aztec Ruins, Southwest Parks and Monuments Association, Tucson, 1994.

Lekson, Steve, et al., *The Chaco Canyon Community*, Scientific American, Vol. 259, No. 1, pp. 100-109, July 1988.

MAP OF WEST RUIN

Take measurements for multi-story rooms from trail between markers 6 and 18: take measurements for single-story rooms next to trail at marker 21.

