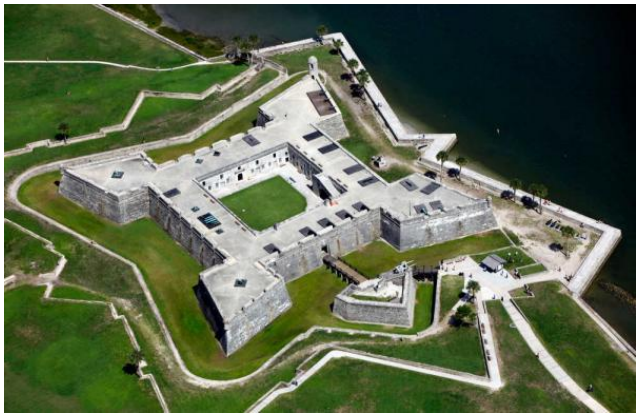
Preservation and Rehabilitation of Heritage Sites in Florida

Subject Area(s) Science and Technology

Associated Unit External Surfaces/Archaeology

Lesson Title Preservation and Rehabilitation of Heritage Sites in Florida

Image 1



ADA Description: A bird's eye view of the fort on Florida's east coast

Source/Rights: Picture courtesy saintaugustine.com

Caption: Castillo de San Marcos: St. Augustine, FL

Grade Level 11-12

Lesson #

Lesson Dependency

Time Required 7 days + 1

Summary

Students will be given a problem to try and solve: how do we preserve Florida's heritage sites for future generations while maintaining the sites integrity? Students will be given samples of typical building material used at Florida's sites and will also be given a brief background on current preservation methods.

Engineering Connection

Engineering involves problem solving and often the creation of functional materials. Humans have a long history of using engineering to create structures with various purposes. Many of these structures are cultural heritage sites that stand as a testament to human perseverance and ingenuity. Sadly, many of these places are faced with preservation issues as they are under assault from a variety of pollutants and other assailants. Students will be asked to use their problem solving skills to propose and test ideas for slowing or halting the degradation of Florida heritage sites.

Engineering Category

1. Relating science and/or math concept(s) to engineering

Keywords

Rocks, Minerals, heritage, argumentation, scientific process

Educational Standards

State STEM Standard Florida: Science [2008] Nature of Science (9-12) Standard 1: The Practice of Science • Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:

1.pose questions about the natural world,

2.conduct systematic observations,

3.examine books and other sources of information to see what is already known,

4.review what is known in light of empirical evidence,

5.plan investigations,

6.use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),

7.pose answers, explanations, or descriptions of events,

8.generate explanations that explicate or describe natural phenomena (inferences),

9.use appropriate evidence and reasoning to justify these explanations to others,

10.communicate results of scientific investigations, and

11. evaluate the merits of the explanations produced by others.

ITEEA Standard Technology [2000] Design (K-12) • Standard 10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

NGSS Standard Science [2013] Science and Engineering Practices (9-12) Constructing Explanations and Designing Solutions • Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Pre-Requisite Knowledge

Students should understand that in order for modern structures to remain in use they must be constantly maintained and sometimes renovated. Students should have a basic understanding of materials that we use to build structures and a basic understanding of WHY structures need to be maintained (why they don't just stay the same).

Students should know that rocks and minerals are some of the resources humans use to build structures.

Students should have some knowledge of what pollution is and how humans cause it.

Students will already have learned about the identifying characteristics of rocks and minerals – this lesson expands on this information.

ANTHRO ONLY: Anthropology students would have created adobe for testing through an experimental archaeology lesson earlier in the year.

Learning Objectives

After this lesson, students should be able to:

- **Students will be able to describe the ideal characteristics of rock based building materials with emphasis on longevity by participating in an interactive student led lecture and by reflecting on the answers to yesterday's pre-assessment.**
- **Students will research a problem and use this information to create experiment proposals in the effort to find the best cost effective and environmentally sustainable method for preserving rock based heritage structures.**
- **Students will investigate the best materials for preserving rock based heritage structures by using lab time to work through the experiments they designed.**
- **Students will analyze, interpret, and present their data to the class by using whiteboards (ADI methods) to engage in scientific argumentation with their peers.**
- **Students will create rough drafts of their lab reports using a modified ADI rubric. Students will use media center resources to produce 3 typed copies of their report for peer review.**
- **Students will engage in the peer review process by reviewing 2-4 of their classmates' papers. Reviewed papers will be returned to the students for final editing. Final copies with all reviewed copies/rubrics due next week.**

Optional Extension:

- **(Short Day) Students will debate long term testing methods for the best methods of preserving rock based heritage structures based on their experiment results. The top three feasible methods will be implemented with the intention of analyzing final data at a later date.**
- **(One month later) Students will analyze the results of their heritage preservation experiments to determine what, if any, lab report conclusions should be revisited in light of their long term findings by writing these modified conclusions as well as proposals for next steps.**

Introduction / Motivation (5E – Engage)

https://www.youtube.com/watch?v=psY6tyPNlwU

Hook students with a brief introduction to the oldest city in America and the Castillo de San Marcos. Students will watch a video to spark their interest in one of Florida's heritage sites (as well as give them some background on a unique building material – coquina).

Lesson Background & Concepts for Teachers (5E – Explain)

ADI Packet heritage pres.docx (attached)

Teachers can use the student packet for background knowledge. Teachers can also read: ..\Ferro et al_Coquina Symposium_2000.pdf for more information on coquina heritage preservation.

Vocabulary / Definitions

Word	Definition
Heritage site	A natural or man-made site, area, or structure recognized as being of outstanding importance and therefore as deserving special protection.
Rock	Mineral matter of variable composition, consolidated or unconsolidated, assembled in masses or considerable quantities in nature, as by the action of heat or water.
Mineral	A naturally occurring, homogeneous inorganic solid substance having a definite chemical composition and characteristic crystalline structure, color, and hardness.
Preservation	To keep in perfect or unaltered condition; maintain unchanged (in heritage preservation – to keep mostly unchanged and maintain for future generations)
Rehabilitation	To restore to good condition (in heritage rehabilitation – to try and make something close to its original or historically appropriate condition)
Limestone	a sedimentary rock consisting mainly of calcium carbonate, deposited as the calcareous remains of marine animals or chemically precipitated from the sea: used as a building stone and in the manufacture of cement, lime, etc.
Coquina	A soft porous limestone, composed essentially of fragments of shells and coral, used as a building material
Sandstone	any of a group of common sedimentary rocks consisting of sand grains consolidated with such materials as quartz, haematite, and clay minerals: used widely in building
Adobe	a kind of clay used as a building material, typically in the form of sun-dried bricks
Aesthetics	An artistically beautiful or pleasing appearance
Soiling	To become dirty, stained, tarnished, or polluted with organic contaminants

Associated Activities (5E – Explore)

- **Students will be able to describe the ideal characteristics of rock based building materials with emphasis on longevity by participating in an interactive student led lecture and by reflecting on the answers to yesterday's pre-assessment.**
    - Students will: Discuss the answer you can up with to the HW question with your group Have an open discussion about your responses and attempt to refine and improve on the answer. Agree on a response as a group. (5 min max)
    - Create a poster answering your question by highlighting key information. This should be a visual aid to help you explain your answer to the class. (Initial by your individual contribution to the poster) (10 min max)
    - Put your poster up in its designated location. Once all groups in your section are ready you will present your poster to the other groups. This will continue until you have heard the responses to all 5 questions. When everyone is finished leave a post-it note on another groups poster – this can be used to ask a question, leave feedback, or compliment the work done. (10 min max – about 1 min per presentation, about 1.75 min for each presentation)

- **Students will research a problem and use this information to create experiment proposals in the effort to find the best cost effective and environmentally sustainable method for preserving rock based heritage structures.**
    - Students must write out your proposed lab procedures as a rough draft.
    - Then, once they have been approved by the teacher you will make any modifications and all of you will copy your procedures onto your ADI graphic organizer (found in your packet).
    - You must have this with you tomorrow as your "prelab" to participate in the lab.
- **Students will investigate the best materials for preserving rock based heritage structures by using lab time to work through the experiments they designed.**
    - Students will work in the lab using the experiments they designed the previous day. Then they will create a "rough draft" of their ADI board for tomorrow
- **Students will analyze, interpret, and present their data to the class by using whiteboards (ADI methods) to engage in scientific argumentation with their peers.**
    - Students must write fill out their collaborative ADI board by agreeing on the points made in your rough drafts.
    - You have 20 minutes to complete your ADI board.
    - Place the board in the location assigned to your group and choose a speaker for your group to stay with the board.
    - Everyone except the speaker will travel around to other boards to ask questions and discuss the boards.
    - You will leave post-it note feedback with the speaker. This should be a suggestion for improvement OR what you think is very well done OR a question you think could be addressed. Mrs. Martin will also participate in this step.
    - You have 10 minutes to do this; you should contribute to AT LEAST 2 boards.
- **Students will create rough drafts of their lab reports using a modified ADI rubric. Students will use media center resources to produce 3 typed copies of their report for peer review.**
    - Activity –writing in the media center including a works cited page
- **Students will engage in the peer review process by reviewing 2-4 of their classmates' papers. Reviewed papers will be returned to the students for final editing. Final copies with all reviewed copies/rubrics due next week.**
    - Activity – peer review

Optional Extension:

- **(Short Day) Students will debate long term testing methods for the best methods of preserving rock based heritage structures based on their experiment results. The top three feasible methods will be implemented with the intention of analyzing final data at a later date.**
- **(One month later) Students will analyze the results of their heritage preservation experiments to determine what, if any, lab report conclusions should be revisited in light of their long term findings by writing these modified conclusions as well as proposals for next steps.**

Lesson Closure

Assessment (5E – Evaluate)

Pre-Lesson Assessment
Individual Brainstorming – What do you already know? Students will write a response to the following questions:

- What rocks and/or minerals are readily available in Florida for use in building structures? What rocks and/or minerals available in Florida were used in building structures in the past? Compare and contrast these materials.
- Why are some materials more suitable than others in building structures? How can we identify the characteristics of rocks and minerals to evaluate their suitability for use as building material?
- What is a cultural heritage site? What are the benefits of maintaining and preserving Florida's heritage sites?
- What building materials (in Florida) would you use to build something you wanted to last for hundreds of years? Why?
- What problems might a structure encounter over time that leads to its deterioration? What are possible solutions to these problems?

Post-Introduction Assessment
Students will have time to individually modify and add to their discussion questions answers in a different colored pen. Journals are graded and the teacher will be able to see both the original and secondary answers.

Students will then get into their lab groups and each group will have one discussion question assigned to them. The groups will then come up with complete collaborative responses to the questions and share them with the class.

Lesson Summary Assessment
Students will complete a lab report. This will be done with an ADI report template (including the peer review process).

Homework
-Students will read the following article and complete a graphic organizer that goes with the article.

http://www.ournationalparks.us/park_issues/preservation-vs-reservation-at-san-marcos/

Then students will bring in an outside resource to share with their lab partners. The resource must be used in their final report and cited appropriately.

-Students will complete a report and bring in 3 copies to use for peer review.

-After peer review students will submit a final report to the teacher.

Lesson Extension Activities (5E – Extension)

At the conclusion of the ADI lesson students will debate long term testing methods for the best methods of preserving rock based heritage structures based on their experiment results. The top three feasible methods (chosen by the students as a result of their debate) will be implemented with the intention of analyzing final data at a later date.

(One month later) Students will analyze the results of their heritage preservation experiments to determine what, if any, lab report conclusions should be revisited in light of their long term findings by writing these modified conclusions as well as proposals for next steps.

Additional Multimedia Support

Link to video about the Castillo:

https://www.youtube.com/watch?v=psY6tyPNlwU

References

- D'Orazio, L., & Grippo, A. (2014). A water dispersed Titanium dioxide/poly(carbonate urethane)nanocomposite for protecting cultural heritage: Preparation and properties. *Progress in Oragnic Coatings, 79*, 1-7.
- La Russa, M., Ruffolo, S., Rovella, N., Belfiore, C., Palermo, A., Guzzi, M., & Crisci, G. (2012). Multifunctional TiO2 coatings for Cultural Heritage. *Progress in Organic Coatings, 74*, 186-191.
- Watt, J., Tidblad, J., Kucera, V., & Hamilton, R. (2009). *The Effects of Air Pollution on Cultural Heritage*. New York: Springer Science.

Attachments

Anthro_ESS ADI lab lesson plan layout.pptx

ADI Packet heritage pres.docx (will be modified as needed)

Investigation Proposal A - ADI.docx

Peer Review Guide and Grading Rubric - ADI.pdf

ADI Lab Investigation whiteboard template.docx

Contributors

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Classroom Testing Information