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***Putting Back the Pieces***

**Writer:** Deborah Boxall, Chemistry Teacher

**Grade Level:** 6–9

**Related Big Picture Concepts:** Part/Whole, Problem-solving, Place, Environment

**Subject Areas:** Science, Social Studies, Visual Arts

**Essential Question:** How can knowledge of science and history help us solve real-world problems?

**Abstract:** Students will design a plan for reconstructing a work of art, outlining the steps they will need to take and the materials that they will need to use.

**Duration:** 2 90-minute class periods

**Focus Work of Art:**

[](http://68.169.57.134/sites/default/files/Costa%20Rican,%20Crocodile%20Effigy%20Vessel,%2096_4_29.jpg)

Unknown Artist (Costa Rican)

***Crocodile Effigy Vessel*, circa 300-1100**

Ceramic

H. 5 3/4 in. (14.6 cm)

[www.artnc.org/node/348](http://www.artnc.org/node/348)

**North Carolina Standards Correlations:**

Science: 8.P.1.3, PSc.2.1.3

Social Studies: 6.G.1.4, 6.C.1.1, WH.2.9

Visual Arts: 6.V.2.1, 6.CX.1, 7.V.3.2, 7.CX.2.3, 8.CX.2.3, B.CX.1.5, I.V.2.1, I.CX.1.2

**Student Learning Objectives:**

* Students will identify the skills and technology used by an art conservator.
* Students will carefully observe fragments of a work of art, identify questions and constraints, and collaboratively design solutions for a reconstruction problem.
* Students will understand how the physical characteristics of clay affect the selection of the binding agent used during reconstruction.
* Students will consider how ancient Costa Rican religion and environment influenced cultural products.

**Activities:**

1. Introduce the art museum conservator as a blend of scientist, artist, and historian. Ask students: *Why might an art museum need a conservator?* (to take care of objects in the collection) *What kinds of skills might an art conservator need?* (painting/sculpting, knowledge of art history, chemistry) *What type of technology might a conservator of art use?* (computers, X rays, sampling and analysis of materials)

Tell students they will be solving a real problem that NCMA conservators encountered a few years ago. Show students the image of the reconstructed *Crocodile Effigy Vessel* and tell them the object was buried in the ground for hundreds of years. Ask: *What kinds of conditions was it exposed to over this time?* (heat, dirt, microbes, water, handling) *How might those conditions have affected the object?* (changed the color, caused nicks and breaks, caused the material to become more fragile) *Why do you think the object was made of clay rather than some other material?* (clay was readily available, easy to shape; wooden objects wouldn’t have lasted that long underground)

Tell the students that the Crocodile Effigy Vessel came to the Museum in pieces (show them the image) and had to be restored by the NCMA Conservation Lab. Ask: *How did the conservators know what the work of art looked like originally?* (comparison with other crocodile effigies and other examples of ancient Costa Rican art) *What are some precautions that the conservators had to take when reassembling the work of art?* (not altering the appearance, matching the appearance when filling in gaps, preventing any further damage from occurring)

1. Divide students into groups and tell them that they are to imagine that they are a team of conservators who have the task of putting this broken work of art back together. Give each team a printout of the broken work of art and the [background information](http://ncmoa.org/artnc/object.php?themeid=4&objectid=34). Tell the students that they are to complete the examination report after considering the following questions:

* What does the visual information tell you about the condition and construction of the object?
* How can the background information give you more information?
* What material do you think the object is made of? What makes you think that?
* Upon first impression, what shape do you think this object was? What makes you think that?
* What questions do you have about the object? Where/How do you plan to find the answers to these questions?

1. As a homework assignment, have the students explore two or three of the Web sites about Costa Rican history and pottery listed in the Resource section. Instruct them to write a two- to three-paragraph response to the following prompt: *Imagine that you are a native of Costa Rica in the time before the Spanish Conquistadors arrived and that you want to create your own ceramic effigy of an animal. Write a story in which you describe your adventures while you dig up the clay from a river bank, shape the effigy, and then fire it in a wood fire. Be sure to include in your story your reason(s) for your choice of animal for the effigy.*
2. (Day 2) Ask students to consider the type of binder they will use to put this work of art back together. Tell them to create a list of criteria for their binder and predict which material will work best. Have them consider the following questions.

* How long does the binder need to last?
* Does the material the object is made of require a special type of binder? Is it porous or smooth? Will contact with the binder change the chemical composition of the object?
* What kinds of conditions will the binder need to withstand? Physical stresses from movement or vibration, temperature, humidity, light exposure?
* Are there any other constraints that should be taken into consideration when choosing a binder, such as cost, availability, or temperature?
* Can a binder be too strong?

Physical science variation

Ask the students: *How do you think glue holds things together?* (by filling in the spaces between objects, by chemically reacting with the objects) *Elmer’s glue says that it is water soluble; that means that the dried glue will dissolve in water. Do you think that there’s a chemical reaction going on when you use Elmer’s glue?* (No, because it just dries out.) *Rubber cement is another type of adhesive that holds objects together after drying. Adding alcohol or acetone (fingernail polish remover) will dissolve the rubber cement.*

*Superglue and B72 adhesive are examples of glues that bind objects together by reacting with the water/moisture that is present on the surface of the object. Do you think that there’s a lot of moisture on the surface of a clay pot?* (No, it appears very dry. Most clay pots have to be fired in a kiln to convert them into a ceramic.) *Do you think these two adhesives are going to form a strong or a weak bond with the pieces of clay pot?* (probably a weak bond because there’s not very much water present)

*Epoxy is another type of adhesive that uses a chemical reaction to bind objects together. Unlike Superglue, epoxy doesn’t need any additional ingredient to form chemical bonds and actually generates heat while it is curing. As a conservator, would you want to use an adhesive that generates heat? Why or why not?* (No, because the heat might damage the object.)

Tell students the following simulation will help them determine what kind of binder to use. Then give each group of students one small terracotta flowerpot (ideally painted with a design of some sort to simulate the finish on the art object), a towel or cloth, and a hammer. Instruct the students to cover the pot with a towel and break the pot into pieces with one strike of the hammer. Give them a variety of binders, such as Elmer’s glue, rubber cement, Super Glue, epoxy, and B72 adhesive (model airplane glue). Tell the students that they will have to use the scientific process to determine which binder is most effective for reconstruction of the object. Each group will need to create a hypothesis, develop their own test and criteria for judging the binder, make observations, record data, and determine results. This process should be documented in a group lab report.

1. Instruct each group to complete the treatment report outlining the procedure they would follow to piece the *Crocodile Effigy Vessel* back together. This report should include a description of the tools and materials that will be used in the conservation process, such as adhesives/binders, references or other resources that might be used for research, etc. Compare the students’ treatment reports to the actual treatment provided by the NCMA Conservation Lab.

Assessments:

* Participation in group discussion will demonstrate students’ understanding of how physical and chemical changes can occur.
* (For Physical Science) Participation in group discussion will demonstrate students’ understanding of the difference between physical and chemical changes.
* Participation in group discussion will demonstrate students’ understanding of how a society’s values and environment impact its art and culture.
* Students’ responses to the writing prompt will demonstrate their understanding of pre-Columbian life and culture.
* Each group’s examination report, reconstruction lab report, and treatment report will demonstrate students’ ability to engage in collaborative problem-solving.
* The reconstruction lab report will demonstrate students’ understanding of the importance of proper materials selection when solving artistic problems.

Resources:

Vocabulary:

conservator: a person responsible for the repair and preservation of works of art, buildings, or other things of cultural or environmental interest

effigy vessel: a pot made to resemble a human or an animal; often used as a burial urn

binder: a substance that binds objects together

porous: full of pores, holes, or pockets

Materials:

Picture of the *Crocodile Effigy Vessel* before and after reconstruction

For each student group:

* Printout of the *Crocodile Effigy Vessel* before reconstruction
* Terracotta pot
* Hammer
* Towel or cloth
* Elmer’s glue
* Super glue
* Epoxy
* Rubber cement
* B72 adhesive
* Examination report form
* Treatment report form

Links:

Ancient Costa Rican Art

<http://www.precolumbianstone.com/costarica.htm>

Pre-Columbian Culture in Costa Rica

<http://www.vivacostarica.com/costa-rica-information/history-of-costa-rica-1.html>

<http://www.explorecostaricanow.com/indians.htm>

History of Pottery in Art

<http://tlc.howstuffworks.com/home/pottery.htm>

Reworking clay without a kiln

<http://www.goshen.edu/art/DeptPgs/rework.html>

Lab Report: *Which Binder is the Best?*

Researcher Names:

Hypothesis:

Materials:

* Terracotta pot
* Hammer
* Towel or cloth
* Elmer’s glue
* Super glue
* Epoxy
* Rubber cement
* B72 adhesive

Observations of terracotta pot before restoration:

Procedure:

1.

2.

3.

Data Table

|  |  |
| --- | --- |
| Binder | Observations |
| Super glue |  |
| Epoxy |  |
| Rubber cement |  |
| B72 adhesive |  |

Conclusion:

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CONSERVATION LABORATORY

EXAMINATION REPORT

|  |  |  |  |
| --- | --- | --- | --- |
| Artist: |  | Treatment Number: |  |
| Title: |  | | | |
| Date: |  | | | |
| Size: |  | | | |
| Materials: |  | | | |
| Examiner: |  | | | |
| Examination Date(s): |  | | | |

Construction:

Condition:

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RECOMMENDED TREATMENT

|  |  |
| --- | --- |
| Treatment Number: |  |
| Artist: |  |
| Title: |  |
| Examiner: |  |
| Examination Date(s): |  |

## Proposed Treatment Plan:

|  |
| --- |
|  |

# Proposed Treatment—Additional Comments:

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TREATMENT REPORT

|  |  |
| --- | --- |
| Treatment  Number: | 96.4.29 |
| Artist: | Unknown New World, Costa Rican, Guanacaste-Nicoya Zone |
| Title: | *Crocodile Effigy Vessel* |
| Examiner: | William P. Brown |
| Examination Date(s): | April 1999 |

## Proposed Treatment Plan:

|  |
| --- |
| 1. Sized edges of broken pieces with dilute B-72. Kept sizing to inside 2/3 of edge to avoid staining exterior skin along edges. 2. Glued pieces together with B-72 glue. 3. Reinforced the glue joints from the interior with B-72 bulked with fumed silica. 4. Sized edges of glue joints with Soluvar to serve as a masking for the fills. 5. Filled losses along joints with Latex Spackle toned with dry pigment. When the Soluvar was removed ghosting from the fill material came away. 6. Inpainted fills with watercolor. |