A Curator's Dilemma: Teacher Guide

Subject: Biology
Grade Level: High School 9-12

Case Summary

Do you know how to identify the composition of fabric? Follow the young curator as she uses the science behind art conservation in processing a gift to the museum.

Credits

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This case was adapted using *Fiber Identification Lab* (Smith, Commander, Etre, & Stein), 2013). Stein, R., Smith, T., Etre, K., & Commander, J. (2013). The Science Behind Art Conservation, July 8-12, 2013, Fiber Identification Lab 6, manual from workshop sponsored by Emory University Carlos Museum.

Learning Objectives

1. Learns to recognize plant and animal fiber characteristics
2. Learns to recognize man-made fiber characteristics
3. Uses technology
4. Recognizes the importance of explaining data with precision and accuracy

Georgia Performance Standards

SB1. Students will analyze the nature of the relationships between structures and functions in living cells.

c. Identify the function of the four major macromolecules (i.e., carbohydrates, proteins, lipids, nucleic acids).

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

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Assessment

- Students who demonstrate understanding can construct an explanation based on evidence for how the structure of fibers is indicative of their composition and function.
- Students will record their results by sketches of magnified fibers and the description of burn time/combustion products.
- Student will draw conclusions about the composition of the fabrics.
- Students will demonstrate an extension of learning by constructing flowcharts, timelines, and pamphlets.

Implementation Strategy

Day 1:

- Distribute student materials- scene, box chart, resources, and Fiber Identification lab.
- 15 minutes- Students will read the scene and complete the box chart.
- 15 minutes- Students will be introduced to the operation and parts of the microscope using demonstration and diagrams.
- 30 minutes- Students will learn to make a wet mount and observe by performing lab exercise part A and B, letter "e" and human hair.
- Homework- Students should look through resources and make a chart of the types of natural and synthetic fibers and their characteristics.

Day 2:

- 30 minutes- Students will make and observe wet mounts of natural fibers.
- 15 minutes- Students will conduct flame tests of natural fibers.
- 15 minutes- Students will repeat wet mounts and flame tests with synthetic fibers.
- Homework- complete Analysis questions and look through resources.

Day 3:

- Students should construct a flow chart of fabric identification by fiber analysis.
- Students can construct a timeline of fabric and fashion using appropriate images.

Facilitator Guide

Day 1:

- Hand out the materials to students and allow groups to self-assemble based on lab constraints since this will require microscopes and bench time. Groups of 2-4 are desirable.
- Ask the students to read the Scene- A Curator's Dilemma out loud. Have the students fill out the box chart and ask the students to highlight unfamiliar vocabulary. Have the students look at the example of condition reports for textiles (below in resources).
- Discuss briefly their charts.
- Begin the Lab I-A&B with a demonstration of how to carry & clean the microscope & slides.
    a. Demonstrate the parts of the microscope.
    b. List the steps in operation of the scope on the board.
    c. Start with the lowest power, clicked in.
    d. Place slide on stage with clips on slide.
    e. Check location of iris diaphragm and adjustment knobs taking notice of which direction increases and decreases working distance.
    f. Look through ocular, move slide by touching the left or right edge, then place the specimen in the center of vision and use coarse adjustment to focus. If the specimen "goes away, just slowly turn the coarse adjustment knob in the other direction.
    g. Finally, use fine adjustment to get the sharpest image to sketch.
    h. Try rotating the nosepiece to increase magnification.
    i. Now, using only FINE adjustment focus the image.
    j. Take note of the numbers on the objective lens.
- Demonstrate the making of a wet mount, using letter e and hair
- Announce you will circulate clockwise to aid the students in their work. Observe the participation level of each student and record inactive students with a minus.
- Allow the students to make sketches and slides for the remaining time.
    a. If students complete their required sketches have different types of animal hair and thread to observe.
    b. Allow students to photograph the image seen thought the eyepiece using a cellphone to allow improvement of sketches at home.
- Announce clean up instructions and homework assignment.

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Day 2:

- The second day of lab should be split into 2 sessions allowing for everyone to complete the 4 different types of fiber sketches and flame tests.
- Make sure you stop all students after 20 minutes to demonstrate the safety procedures for the burn test.
    a. Write directions on the board.
    b. Prepare fibers by placing one of each in a petri dish (avoid flammable materials)
    c. Ready the metal forceps
    d. Light the candle
    e. Carefully hold fiber 10 cm from the flame and move closer
- Announce clean up instructions and homework.

Day 3:

- The beginning of the third day should be used to turn in lab work and analysis questions. Collect and mark the time they turn in their lab work.
- Connecting the "Curator's Dilemma to the science lab:
    a. Distribute large pieces of newsprint and have the group flowchart the fiber analysis for fabric identification.
    b. Ask the students to brainstorm how this is related to the dilemma. Brainstorm why it would be important to know from what type of fibers a costume is made. Hints about why we wash in delicate and dry wool flat may help (ie shrinkage of different fibers).
- Homework
  Ask the groups to brainstorm and research:
    a. What types of fibers are used in garments? → construct their ideas into a timeline of garments
    b. Care of textiles and the role of a conservator → create a pamphlet showing how they can care for their textiles, when to consult a conservator, and an example of what a textile conservator can do

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Resources

Garment collections
http://www.metmuseum.org/collections/search-the-collections?&rpp=60&noqs=true&ao=on&ft=*&what=Costume&deptids=62&pg=1

History of garment production
http://en.wikipedia.org/wiki/History_of_clothing_and_textiles#

Background on fibers
http://msnucleus.org/membership/html/k-6/as/scimath/6/assm6.html

Condition Reports for Textiles
http://www.nemanet.org/files/4413/8552/6675/Condition_Reporting_Textiles_by_Museum_Textile_Services.pdf

Caring for Your Treasures
http://www.conservation-us.org/about-conservation/caring-for-your-treasures/textiles#.UuVYjLT0DJw

American Institute of Conservation
http://www.conservation-us.org

Podcast on Conservation of Garments
http://www.carlos.emory.edu/conservation/case-studies/ancient-american

Necessary Instructions and Forms for Lab

Found in "The Science behind Art Conservation" Manual and online at
http://www.carlos.emory.edu

Teacher's Guide for Fiber Identification Lab 6
Student's Guide for Fiber Identification Lab 6

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A Curator's Dilemma: Scenario

The Metropolitan Museum of Art in New York City has received a large bequeath of household goods from the Carnegie estate located on Cumberland Island, GA. One of the massive crates contains clothing and is directed towards the Costume Institute's collection. Savannah Tucker, who is the new intern in the conservation lab and a textile specialist, is charged with the task of uncrating the gift, sorting the garments into fabric type, and documenting their condition.

Follow Savannah's tweets for more information.
@SavTuckConserve-What a career opportunity!#CarnegieBequeathMet
@SavTuckConserve-What do you do with a ton of vintage clothes?#MetCostumeInstitute
@TyraBanks-Way to go grl!
@AndrewBolton-Keep me posted!

When Savannah uncrates the garments, she finds them all wrapped in bed sheets, and is delighted to find a wide variety of female clothing including: one Regency style ball-gown, one modern ball-gown, one petticoat, one crinoline, one suit, one pair of woven trousers, a bathing suit, a seersucker dress. Her first job is documentation, which involves forms to fill out, sketches of the garments including highlighted condition issues, and photographing the garments. Then, Savannah knows the task of finding fibers within the seams begins!

@SavTuckConserve-Score! Every conceivable type of fabric to take to the lab!
@TyraBanks-Can't wait to see them on display!#MetCostumeInstitute
@AndrewBolton-Love the photos! Those seams are generous-great luck!

@SavTuckConserve- time to get the fibers to the lab for testing!

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A Curator's Dilemma

Brainstorm and Organize

BIG IDEA

What is the curator's dilemma? List two things you need to know or define before understanding her dilemma?

1.

2.

ESSENTIAL QUESTIONS

List three questions you need to know the answers to before understanding Savannah Tucker's dilemma.

1.

2.

3.

PROBLEM

What is the central challenge facing Savannah?

HYPOTHESIS

Predict what type of analysis the conservator will have to perform.

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A Curator's Dilemma: Projects

I. Construct a flowchart using the microscopic fiber analysis and burn tests to help Savannah construct a reference chart for the conservation lab. Use boxes to describe the steps, use arrows labeled with outcomes to point towards the next step or final outcome.

For example
Fiber microscopy→ natural fiber→ burn test→ cotton → Twisted, burns completely to ash

Your flowchart will have pathways leading to cotton, linen, silk, wool, and possibly a synthetic.

II. Create a timeline of fiber use in textiles. Indicate on your timeline when and where each of the fibers you identified where used in clothing. Give an example of typical garments at time at which these fibers were first used.

III. Research the role of a conservator. Create a pamphlet showing how you can help to preserve a textile and when to call in a conservator. Include one example of work a conservator can do. This example should come from a museum.

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Roadmap To "A Curator's Dilemma" PBL

Day 1

Case outline and Brainstorm activity

Student Lab Activity

FIBER IDENTIFICATION LAB I A & B

Day 2

Student Lab Activity

FIBER IDENTIFICATION LAB I C, II A, B, & C

Day 3

Lab End Product turn in

I. Microscope Sketches

II. Burn Test Tables

III. Analysis Questions

Begin final project

Brainstorm, Research, and Construct a visual representation of:

fiber analysis process in flowchart format

garment construction by fiber timeline

garment cleaning by fiber pamphlet

Deadline

Final Project Presentation

Flow Chart of Fiber Identification Analysis

Timeline of types of fiber used in garment production

Guideline pamphlet on

Assessment for PBL

Labwork End Product- 1 test grade/ individually graded

1/3 Participation

1/3 Observations – End Product I & II

1/3 Analysis- End Product III

Final Project End Product – 1 test grade /graded as a group

Flow chart and timeline

1/3 neat complete and on time

1/3 creative graphics, conveys information

1/3 contains accurate, detailed findings

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Resources

BACKGROUND:

Individual fibers have unique physical and chemical characteristics. They can be classed by origin into natural and synthetic as well as subdivided into the derivative processes or organisms. Natural fibers include both plant and animal sources. Cotton and linen are the most common plant fibers while silk and wool are the most used animal fibers. Synthetic fibers, such as rayon, nylon, and polyester are a result of industrial chemistry processes.

Natural fibers have very characteristic features. Cotton fiber's are flat fibers and twisted. Linen is smooth yet jointed like bamboo. Wool is a class of fibers from different animals, such as sheep, goat, llama, and vicuna. Most woven woolen garments are from sheep hair. This wool fiber has a rough scaly exterior. Silk from the silkworm has smooth, reflective strands. Synthetic fibers are more difficult to visually distinguish. Rayon has smooth glass-like rods, nylon has smooth clear rods, and polyester has rod-shaped cloudy fibers. All synthetic fibers are produced by polymerization where monomers are repeated and aligned in a pattern.

Natural fibers have a long history in human textile production. Cellulose is a natural polymer found in wood, paper, and cotton. Natural fibers such as cotton, linen, and wool have been used to weave many different fabrics over the course of human civilization.

Synthetic fibers have a more recent history. They were developed during the Industrial Revolution period. In 1884, Louis Bernigaut successfully created an artificial silk, which was the precursor to rayon. Unfortunately, the synthetic fabric was highly flammable and burnt a young lady while in the ballgown. In 1926, rayon was generated from the cellulose polymers produced by the DuPont Company. Nylon was first used in woman's stockings to replace the scarce silk stockings during World War II in 1940's. Nylon, as a light and durable fabric was used for parachutes and ropes. Synthetic fabrics like Kevlar, a bulletproof fabric, are also in the nylon family. Olefin is a lightweight synthetic fiber found in sportswear and thermal underwear. Acrylic and modal acrylic fibers are used with cotton to make fake sheep fleece, which is then used in deep pile coats and stuffed animals. Spandex is a stretchable fiber used in bathing suites and other sports wear.

Whether the fiber is natural or synthetic, they all are used to make fabrics by interlocking the fibers using felting, weaving, knitting, or crocheting. The fabric fiber content of modern garments is usually listed on labels and the method of fabric construction is evident under magnification.

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GUIDE TO FIBERS

PLANT FIBERS

COTTON is derived from a cotton plant. The fibers appear as flat ribbons under the microscope that are slightly twisted. The fabric that cotton produces is soft, absorbs water, and wrinkles easily. Cotton is a fabric that is light and cool.

LINEN is derived from the stems of flax plants fibers which are jointed appearing like miniature bamboo. The fiber is shiny, strong, softens with use, absorbs water, and wrinkles easily. Linen is considered a cool fabric for warmer climate.

ANIMAL FIBERS

SILK is from the cocoons of silkworms. The fiber is double strands, smooth, and shiny. The fabric is lightweight but can keep its wearer warm when knitted and cool when woven.

WOOL comes from sheep. Under the microscope, it looks like scaly corkscrews. The fiber is elastic, long lasting, and resists wrinkling. Wool easily absorbs water and is known for its ability to "breathe" keeping wearers warm in the winter and somewhat cool in warmer weather. Wool picks up static electricity easily when rubbed.

SYNTHETIC FIBERS

RAYON is made from wood. The fibers are smooth and glass-like rods, which stretches easily. Rayon doesn't wrinkle, is soft, and absorbs water.

ACETATE is a created from wood. Under the microscope there are grooves that run the length of the fibers. Acetate is soft, smooth, and will melt under a hot iron. It does not absorb water. The fabric is cool and smooth.

NYLON is derived from coal. The fibers under the microscope are smooth and clear rods. Nylon is shiny, tough, elastic and melts under a hot iron. The fibers are non-absorbent, quick drying, and don't wrinkle. The fabric is cool, but clammy. When knitted, it provides form-fitting garments.

ACRYLIC is made from petroleum. Under the microscope the fiber is dog-bone shaped with cut ends. The fabric is lightweight, warm, and quick drying.

POLYESTER is derived from petroleum. Under the microscope the rod shaped fiber looks like nylon but is not clear. The fiber does not wrinkle, is silk-like, strong, and absorbent.

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Continued – Resources

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