

Under the Microscope

Lesson Plan

LESSON OVERVIEW

Grades: 6–12

Duration: 125–130 minutes

The [RLC Presents: Art + Science](#) video series and related curriculum supports middle and high school students in exploring science concepts and careers in museum conservation. This material is based upon work supported by the National Science Foundation under Grant No. OISE 1743748.

[In the Lab: Under the Microscope](#)

Textiles conservator Isaac Facio discusses how he uses magnification tools to learn about how, when, and where a fabric was made, assess its condition, and prepare it for exhibition. Students will watch the video and respond to a brief set of reflection questions.

Lesson Plan Summary

Through modeling, inquiry stations, and reflection, students begin to understand how observation and close looking are essential to scientific investigation. Optional activities invite students to explore related concepts using the museum's collection. Engage your students in all of the activities provided, or select those most relevant to your teaching.

Driving Question:

Which material do you think would work best to make a shirt that would be comfortable to wear in the summer?

Anchoring Phenomenon:

Students look closely at an image of a textile under magnification to observe qualities unseen under the naked eye.

Lesson Objectives

Students will:

- Make observations and inferences and ask questions
- Create a model/explanation based on phenomenon, experience, and prior knowledge
- Play a game to learn vocabulary related to close looking and observation
- Complete inquiry station to examine textiles under a variety of magnifications
- Revise their initial model/explanation
- Reflect on their learning

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| | | |
|-----------------------|---|--|
| Key Vocabulary | <ul style="list-style-type: none">● Fiber● Macro● Magnify● Micro● Observation● Pattern | <ul style="list-style-type: none">● Textile● Warp● Weft● Weave● Knit |
|-----------------------|---|--|

Lesson at a Glance

1. **Video Viewing and Reflection (20 minutes)**

Students watch a video of a museum conservator at work in their lab and reflect on his work by responding to questions.

2. **Opening Activity: “See, Think, Wonder” (10 minutes)**

Students make observations, inferences, and ask questions about an image of a textile from the museum’s collection under magnification.

3. **Initial Model: Which material do you think would work best to make a shirt that would be comfortable to wear in the summer? (10–15 minutes)**

Students create an initial model/explanation about which fabric would work best to make a comfortable shirt to wear in the summer.

4. **Vocabulary: “Two Truths and a Lie” Game and “Warp and Weft” (20 minutes)**

Students learn and reinforce key vocabulary terms with their classmates.

5. **Textile Inquiry Stations (45 minutes)**

Students complete three stations focused on making observations of different textiles with magnification.

6. **Final Model: Which material do you think would work best to make a shirt that would be comfortable to wear in the summer? (10 minutes)**

Students revise their initial model using their updated knowledge and experience of observing textiles under magnification.

7. **Learning Reflection (10 minutes)**

Students choose from a variety of questions to reflect on what they learned within the lesson.

8. **Possible Extensions**

This includes creative response, personal reflection, and exploring the collection.

Next Generation Science Standards

- **NGSS Science and Engineering Practices**
 - Analyzing and Interpreting Data
 - Asking Questions and Defining a Problem
- **Scale, Proportion, and Quantity**
 - **MS-LS1-1:** Phenomena that can be observed at one scale may not be observable at another scale.
- **NGSS Cross Cutting Concepts**
 - Patterns
 - **K-LS1-1:** Patterns in the natural and human designed world can be observed and used as evidence.

National Core Art Standards

- **Connecting**
 - **Standard 10:** Synthesize and relate knowledge and personal experience to make art. Relating artistic ideas and work with personal meaning and external context.

UNDER THE MICROSCOPE LESSON PLAN

PREPARING THE MATERIALS

Materials

- The following resources are at the end of this document:
 - [Image of the overall or macro view of that textile](#)
 - [Image of textile from the museum's collection under a microscope](#)
 - [Vocabulary Information Sheet](#) (1-2 per group of four students)
- Magnifying glasses (4 per group)
- Microscope (1 per group)
 - Microscope slides (1-5 per group)
 - *Note: There are excellent "pocket microscopes" that can be purchased easily online for about \$15 that can be used as a substitution for a regular microscope.*
 - *Note: Microscope slides are optional as most fabrics can be viewed by placing them directly under the microscope lens.*
- Five different fabrics (1 set per group)
 - Linen
 - Polyester
 - Wool
 - Burlap
 - Fleece

Worksheets

1 Per Student

- [Under the Microscope Student Resource](#)
 - “See, Think, Wonder” chart (page 2)
 - Model/Explanation (page 3, page 10)
 - Vocabulary: Two Truths and a Lie (page 4)
 - Vocabulary: Warp and Weft (page 5)
 - Textile Inquiry Stations (pages 6–9)
 - Reflection on My Learning (page 11)
- Notebook paper and pencil for reflection

SET UP THE LESSON

Steps to Set-Up Lesson

1. Print the [Under the Microscope Student Resource](#) for each student or provide them with electronic access.
2. Prepare the vocabulary game materials.
 - Print [Vocabulary Information Sheet](#) (1 or 2 per group)
3. Prepare station materials.
 - All stations require pieces of textiles. The materials are for one group of 4 students. The pieces of each textile need to be large enough for students to hold and make observations. The same pieces of textiles can be used for all three stations.
 - Piece of linen fabric (1)
 - Piece of polyester fabric (1)
 - Piece of wool fabric (1)
 - Piece of burlap fabric (1)
 - Piece of fleece (1)

Station 1: Observing Textiles

Gather materials for the station. Each group of 4 students should have:

- Set of textiles (1)

Station 2: Closer Looking: Observing Textiles with a Magnifying Glass

Gather materials for the station. Each group of 4 students should have:

- Set of textiles (1)
- Magnifying glass (4)

**If supply is limited, have students share magnifying glasses.*

Station 3: Microscopic Observations

**Note: Part of station 3 can still be completed if you do not have access to microscopes.*

Gather materials for the station. Each group of 4 students should have:

- Set of textiles (1)

- Microscope (1)
- Microscope slides (1-5)

**Note: Microscope slides are optional as most fabrics can be viewed by placing them directly under the microscope lens.*

FACILITATION INSTRUCTIONS

Video Viewing, and Reflection (20 minutes)

1. Ask the students to answer the following question in a whole class discussion, small group, or pairs:
 - Did you know that scientists work in some museums?
 - What do you think they might do?
2. Have students watch the video, [In the Lab: Under the Microscope](#) (runtime: 7 minutes 3 seconds) as a class or individually.
3. Ask students to reflect on the following questions in writing, whole class discussion, or in pairs, sharing with a partner.
 - How does Isaac Facio's work relate to both art and science?
 - What did you learn about his career path? What advice did he offer?
 - What else did you learn that is new or surprising?

Opening Activity: See, Think, Wonder (10 minutes)

1. Review the sections of the "[See, Think, Wonder](#)" chart (page 2) as a class.

**Recommendation: Give students a concrete number of items they need to put in each column.*
2. Project the image of the [Textile: Macro View](#) followed by the [Textile: Micro View](#) for the students.
3. Students look at the images for 3-5 minutes and complete the chart referencing the micro view. Then, students compare the two views. Once completed, ask for volunteers to share one thing they noted in their chart.

**Opportunity for differentiation: To simplify, complete this in pairs or small groups.*
4. Students can share their observations, inferences, and questions from their charts with an elbow partner, small group, or whole class.

Initial Model: Which material do you think would work best to make a shirt that would be comfortable to wear in the summer? (10-15 minutes)

1. As a class, review the instructions (page 3).
2. Individually, in pairs or small groups, students explain which fabric they think would make the most comfortable shirt to wear in the summer. Students can use words, pictures, or a combination of both to explain as thoroughly as they can, but this is intended to be an educated guess.

**Opportunity for differentiation: To simplify, begin a model together as a class and let students finish it in smaller groups.*
3. Student groups share their ideas with the class.

Vocabulary: “Two Truths and A Lie” Vocabulary Game and “Warp and Weft” (20 minutes)

1. Give each small group one or two copies of the [Vocabulary Information Sheet](#).
2. Review the vocabulary words and definitions as a class.
3. Instruct each student to turn to their “[Two Truths and a Lie” Vocabulary Entry](#) sheet (page 4) in their student resource and review the instructions. One example is provided.
**Opportunity for differentiation: Complete additional examples as a class.*
4. Each student writes two true statements and one false statement about one of the vocabulary terms.
5. Students take turns reading their two truths and a lie to their small group. Everyone in the small group guesses which statement is a lie. Encourage students to mix up the truths and lie when they are sharing.
6. Review the instructions on [Vocabulary: Warp and Weft](#) (page 5). Students complete questions about woven textiles.

Textile Inquiry Stations (45 minutes)

- [Student Textile Inquiry Stations](#) (page 6–9)

**Note: The focus of this lesson is on the process of conducting investigations, so observations may vary.*

Station 1: Textile Observations

1. At the station, students examine a set of textiles.
2. Students make observations of each of the textiles and record them in the appropriate place on their student document.

Station 2: Close Looking—Textile Observations Using a Magnifying Glass

1. At the station, students examine the same set of textiles, but this time using a magnifying glass.
2. Students examine each textile with a magnifying glass and record their observations in the appropriate place on their student document.
3. Students identify what new observations the magnifying glass helped them to make and record their responses in the appropriate place on their student document.

Station 3: Microscopic Observations

1. At the station, students examine the same set of textiles using a microscope.
2. Students examine each textile under the microscope and record their observations in the appropriate place on their student document.
3. Students record the new observations they’ve made using the microscope in the appropriate place on their student document.

**If students are new to using microscopes, you may need to review how to focus.*

**If time is limited and you have access to multiple microscopes, each sample can be focused so students can simply look through the eyepiece and record their observations.*

**If you do not have access to microscopes, you can skip steps 1-3 and proceed to step 4.*

4. Students analyze their observations from the three stations and draw conclusions on the use of magnification

tools for scientific observation.

**Opportunities for differentiation: set a required number of vocabulary words that need to be used in their analytical responses.*

Final Model: Which material do you think would work best to make a shirt that would be comfortable to wear in the summer? (10 minutes)

1. In the same pairs or small groups, students revise their explanation (page 10). Students may use words, pictures, or a combination of both to explain as thoroughly as they can.

Reflection on My Learning (10 minutes)

1. Students complete a written reflection about their learning, selecting and responding to one question from each column (page 11).

ONGOING LEARNING

About the Conservator



Isaac Facio focuses on the care, preservation, and exhibition of objects as the associate conservator for Textiles at the Art Institute of Chicago. He uses tools of science, including microscopes, to look closely at textiles to learn about how, when, and where a fabric was made, assess its condition, and prepare it for exhibition. Facio is also senior lecturer in Fiber and Material Studies at the School of the Art Institute of Chicago.

Facio's love of textiles began as a child when, as young as five, he would sit and sew alongside his mother. This passion connects both his professional and creative lives. As an artist, Facio uses research and

science to explore technology and create 3D woven structures. Facio received training in textiles, textiles conservation, studio art, material science and technology across Chicago, Manchester, England, and Paris, France.

Possible Extensions

Creative Response

- Look online for simple instructions to make a cardboard loom. The textiles from the museum’s collection that are explored in “Under the Microscope” and below reflect choices made by artists with distinct cultural backgrounds and personal tastes. Materials used to create the weft of a textile can vary from yarn to natural fibers and strips of paper or plastic. Ask students to weave a textile using materials, colors, and patterns that reflect their lives and interests. Create a gallery of textiles and ask students to discuss their works.

Personal Reflection

- Museum conservator Isaac Facio considers the important role that textiles play in our everyday lives and cultures in items such as garments, bedding, and fabrics used in ceremonies or at the table. Ask students to think about something made of fabric that has been significant in their life. They could then sketch or write a poem, such as a haiku, to evoke sensory impressions and memories and share with a partner.

Explore the Collection

Explore the artworks featured in this lesson by clicking on the titles below. Access the museum’s full collection by browsing the collections page at <https://www.artic.edu/collection>.

- [Nasca, Panel Fragment, 200-500](#)
- [Spain or Italy, Altar Frontal, 1480-1550](#)

Other textiles in our collection:

- [Anirnik Oshuitog, Lovers, c. 1967](#)
- [Bisa Butler, The Safety Patrol, 2018](#)
- [Mayan, Married Woman's Pot or Huipil \(Blouse\), early to mid-20th century](#)
- [Manchu, Qing Dynasty, Man's Rank Badge, 1880-1900](#)

ANSWER KEY

Video Viewing and Reflection

1. Ask the students to answer the following question in a whole class discussion, small group, or pairs:
 - Did you know that scientists work in some museums? *Answers vary*
 - What do you think they might do? *Answers vary*
2. *N/a*
3. Ask students to reflect on the following questions in writing, whole class discussion, or in pairs, sharing with a partner.
 - How does Issac Facio's work relate to both art and science? *Answers vary but may include: Issac uses close looking with microscopes to examine and repair works of art.*
 - What did you learn about his career path? What advice did he offer? *Answers vary*
 - What else did you learn that is new or surprising? *Answers vary*

See, Think, Wonder Opening Activity

Answers vary but may include observations on how the micro view reveals that two different threads create a different color when seen in the macro view.

Initial Model: Which material do you think would work best to make a shirt that would be comfortable to wear in the summer?

Answers will vary as this is intended to be an educated guess. Answers will be revised later.

Vocabulary: Two Truths and a Lie Game

Answers vary but should align with the vocabulary word's definition on the Vocabulary Information Sheet.

Vocabulary: Warp and Weft

1. Which color thread is warp? *Tan* Why did you choose this answer? *Warp threads are organized lengthwise.*
2. Which color thread is weft? *Blue* Why did you choose this answer? *Weft threads are organized crosswise.*
3. What do you think would happen if the weft didn't alternate over and under? *Answers vary but may include: There wouldn't be a structure to the fabric; The pattern would be uneven.*

Station 1: Textile Observations

Answers vary

Station 2: Close Looking: Textile Observations Using a Magnifying Glass

Answers vary but should reflect more details than observed in Station 1.

Station 3: Microscopic Observations

Answers vary but should reflect more details than observed in Station 1 and Station 2.

1. How did the magnifying glass and microscope influence the observations you made about the textiles? *Answers may vary but should reflect that the magnifying glass and the microscope revealed more details.*
2. What patterns became visible as you looked at the textiles more closely and magnified them with the magnifying glass and microscope?
Answers may vary depending on the specific materials used but possible responses may include observations on woven or knit patterns.
3. What might be some reasons a textile conservator would use a microscope to observe a textile?
Answers may vary but possible responses may include: Magnification tools help a conservator understand a material such as what it's made of and how it is made; A microscope can reveal the patterns of the material which can help a textile conservator identify how exactly to repair the textile.
4. What conclusions might you make about each fabric you observed? What might be the best use for each fabric?
Answers may vary but should reflect details observed in the stations. Answers can also reflect students' lived experiences.

Final Model: Which material do you think would work best to make a shirt that would be comfortable to wear in the summer?

Student's responses should reflect details and reasoning from their observations in Station 2 and Station 3. Linen is a strong response, as the warp and weft may allow for breathability and the material is comfortable to the touch, but answers may vary. Students may also reference their lived experiences in their responses.

Reflection on My Learning

Answers vary

TEXTILE: MACRO VIEW

Note: The arrow points to the area that is magnified in the next image.



Panel Fragment

Nazca

South coast, Peru

200–500

Wool (camelid) and cotton, plain
weave of discontinuous single
interlocking warps and wefts

The Art Institute of Chicago

Purchased with funds provided by
Mrs. Edwin A. Seipp

TEXTILE: MICRO VIEW



VOCABULARY INFORMATION SHEET

| Word | Part of Speech | Definition |
|-------------|-----------------------|--|
| Fiber | Noun | A long and thin thread or strand of material |
| Knit | Verb | To create fabric by connecting loops of thread or yarn |
| Macro | Adjective | Large scale; an overall view |
| Magnify | Verb | To enlarge the appearance of an object |
| Micro | Adjective | Small scale; looking at details |
| Observation | Noun | Noticing facts or an occurrence |
| Pattern | Noun | Something that happens or appears in a repeated way |
| Textile | Noun | A woven or knit cloth |
| Warp | Noun | Threads organized length-wise on a support to create a structure for weaving |
| Weave | Verb | To form fabric or material by interlacing threads |
| Weft | Noun | Crosswise threads woven on a support, under and over the warp |