ALL for Science™

Authentic Literacy and Language for Science

Baylor College of Medicine

CENTER FOR EDUCATIONAL OUTREACH

DAY 3: What Is Soil?

MINI-LESSON

Teacher introduces the "Evaluating Claims and Evidence in Online Media" anchor chart and models the process.

SCIENCE INQUIRY CIRCLES

Teams work on answering their Inquiry Chart questions about their food-disposal method.

GUIDED SCIENCE INVESTIGATIONS

Teams examine a soil sample to separate and identify its components.

ABBREVIATED STANDARDS

- ELA and Reading TEKS: 5.9(E)(i)(ii)
- CCSS: RI.5.8
- NGSS: 5-LS2-1
- TEKS: 5.1(A)(D)(E), 5.3(B), 5.5(D)(F)

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Day 3: What Is Soil?

Literacy Strategy: Evaluating claims and evidence in online media

Science Concept: Soil is a combination of many living and nonliving things.

Science and Literacy Connection: Scientists evaluate the claims of other scientists and authors to make sure the information is trustworthy and reliable.

Mini-Lesson (15 minutes)

OVERVIEW

News articles and videos are online media, and online media is usually not written by scientists. So, how do scientists know that the news they are reading or listening to is trustworthy? They use a reading strategy called *evaluating claims and evidence in online media*. A claim is a statement that can be supported by evidence; claims are trustworthy when they are well supported by evidence. Claims that are not supported by evidence are not trustworthy. Scientists use this strategy to evaluate the claims written by authors of online media.

NOTES:

It is important that young people begin building skills to engage critically with online media so that they are prepared to consider the claims and evidence presented in online media that they read in the future. These skills are imperative for informed citizenship and making important decisions about scientific topics that impact lives and well-being.

You are encouraged to create the "Evaluating Claims and Evidence in Online Media" anchor chart with your learners as you move through the lesson below, using the provided anchor chart as a model. You might want to post it for easy reference when completed and remind learners to refer to the anchor charts during inquiry circles.

MATERIALS

Teacher needs:

- chart paper
- marker(s)
- "Evaluating Claims and Evidence in Online Media" anchor chart as a model
- Fighting Food Waste by Scholastic News (suggested)

PROCEDURE

The *italicized statements* below offer suggested wording the teacher may choose to use in the lesson.

Tell what the strategy is (declarative knowledge)

1. *Today we're going to learn a strategy that will help us determine if the claims we read in online media are supported by evidence. This strategy is called evaluating claims in online media.*

Tell when and why to use the strategy (conditional knowledge)

1. *I evaluate claims and evidence when I read or listen to online media. I use this strategy because I know it is important that I can trust what I read and hear online and know that it is supported by evidence.*

Tell how to use the strategy (procedural knowledge)

1. *When I am reading or listening to online media, I first identify when the author is making a claim. A claim is a statement the author makes about something they believe to be true.*
2. *The first thing I do as I evaluate an author's claim is to think about what I know to be true about the topic. Does this claim seem reasonable based on what I already know?*
3. *Then I look for evidence that supports the claim. Evidence usually comes right before or after the claim.*
    - *Evidence might be an example or list of examples.*
    - *Evidence might be data in the form of numbers (e.g., measurements or statistics).*
    - *Evidence might be a quote from an expert.*
4. *If the claim seems reasonable based on what I know and is supported by evidence, I can probably trust the claim.*

Model the Strategy

You might use this online article to model the strategy: Fighting Food Waste by Scholastic News (p. 2).

1. *I start reading then stop when I identify a claim: "Throwing away food is wasteful in many ways." I know this is a claim because it is a statement the author believes to be true. The author thinks that throwing away food is wasteful.*
2. *Then I think about what I know and have experienced. Sometimes, when my family and I don't finish the food on our plates, we put leftover food in the refrigerator to eat later. So far, it seems reasonable to believe that throwing away food is wasteful.*
3. *Then I keep reading and I look for evidence. The next sentence says, "*For one, that food could help the hungry. In 2018, more than 37 million Americans didn't always have access to food they could afford."
    - *I recognize this as evidence because it comes right after the claim, it is related to the claim (the claim and the evidence are both about why throwing away food is wasteful), and the evidence is in the form of numbers.*
    - *I ask myself, does this evidence support the claim? I think the author's claim (that throwing away food is wasteful) is supported by the evidence. If "37 million Americans didn't always have access to food they could afford," this tells me there are a lot of people in the U.S. who are hungry, and that food could be given to hungry people instead of being thrown away. Throwing away food that could help feed a hungry person seems wasteful to me.*
4. *The author's claim that "throwing away food is wasteful" seems reasonable based on what I know and what is supported by evidence. I think I can trust the claim made by this author.*

Optional Practice
If learners need more practice identifying claims and evidence, you can invite them to evaluate these claims from the online article: Fighting Food Waste by Scholastic News.

- Claim: "There are many reasons that food gets tossed" (p. 3).
    - Evidence (example): "Farmers often dump fruits and veggies that are bruised or oddly shaped. Customers aren't as likely to buy these "ugly" foods."
    - Evidence (example): "Supermarkets also play a role. Many stores throw away damaged cans and boxes that contain perfectly edible food. Or they sell oversized packages of food. Some of that food is likely to go to waste."
- Claim: "Tossing an uneaten apple in the trash isn't just wasting food. It also wasting other resources" (p. 3).
    - Evidence (example): "For example, it wastes the water used to grow the apple."
    - Evidence (example): "It also wastes the fuel used by the truck that delivered it to a store."
    - Evidence (numbers): "About 20% of all farmland in the U.S. is used to grow food that is never eaten."

Science Inquiry Circles (30 minutes)

OVERVIEW
Scientists often work in teams when conducting inquiry and investigations. Today, learners will work in inquiry circles to investigate different questions about their food-disposal method, how schools reduce their food waste using this method, and what happens to the organic matter and stored energy in the food scraps. Prior to starting the inquiry circle work, be sure to have texts and technology available for your learners. As a reminder, the "Food Waste Resources" spreadsheet contains a list of suggested books and media, but feel free to use other resources.

You may need to provide learners with specific instructions on how to access websites within your school district, or you may want to create a click sheet of approved websites for learners to be distributed through your learning management system (Google Classroom, Schoology, etc.).

MATERIALS
Each team needs:

- team Inquiry Chart
- pencils
- preselected informational texts/media

Teacher needs:

- "Food Waste Resources" spreadsheet for ideas

PROCEDURE
The *italicized statements* below offer suggested wording the teacher may choose to use in the lesson.

Before Inquiry Circles (5 minutes)

1. *It is time to get into our inquiry circles. I will remind you which inquiry team you'll be working in.*
2. *You will be with the same team as yesterday, but we will rotate the science roles. Remember that each team member has a role or a job within a team.* (Assign roles at your discretion and have the Equipment Directors gather the Inquiry Chart for their teams).
3. *Yesterday we generated questions to guide our inquiry. Take a few moments to look at the questions on your Inquiry Chart. If you came up with any new questions while you were working yesterday, now is a good time to add them. Remember, questions should be about your food-disposal method, how schools reduce their food waste using this method, and what happens to the organic matter and stored energy in the food scraps. If your team develops a new question, add it to your Inquiry Chart as a new column.*
4. *Today you will start by choosing one question about your food-disposal method and looking for answers to that question. As you look for answers, you will practice your roles as scientists. You will do this because scientists have a special way in which they look for answers. One way scientists look for answers is to do investigations. This means they look at text (in books and online) that might help them find information they can use.*
5. *Scientists also record their findings in an organized way. You will record your findings on your team Inquiry Chart. (*You may want to show or project a blank sample Inquiry Chart or version of the sample Inquiry Chart with your class's shared inquiry questions filled in. You might also want to model how to record information in the column below the corresponding question and how to record the source where the information was found in the corresponding row.)

During Inquiry Circles (20 minutes)

1. *Today and for the next few days, you will investigate your food-disposal method, how schools reduce their food waste using this method, and what happens to the organic matter and stored energy in the food scraps. You will investigate by using eBook, websites, web articles, and videos. I have provided a list of sources you can use.*
2. *You have anchor charts to help guide your thinking. Do not forget to use them while working.* (Refer to today's anchor chart and all the anchor charts used to date. Remind learners that they will practice each day's literacy mini-lesson during this inquiry circle time. Once you have taught several mini-lessons, they can use any of the reading strategies taught, not just the one for that day.)
3. *The Lead Scientist will guide the inquiry for the day by picking which question(s) will be answered. The Data Scientist will record all source information and the answers to your inquiry question on the Inquiry Chart.* (You may want to explicitly show learners which square to write in for their first question using their first resource.)
4. *Remember, it is important to record on your Inquiry Chart where you found the information (the source). You will need to keep track of your sources carefully because you will create a list of your sources at the end of your inquiry.* (Point out to learners where sources are located on the Inquiry Chart and how one source may answer multiple questions. Remind learners to record the title, author, publisher, and year of publication for all sources and to include the URL for websites and videos.)
5. *Everyone should help find the answers to the questions in texts and online. Remember to work as a team, helping each other listen for the answers to your question.* (Be sure to model for learners where to record their source and where to record answers to specific questions. Explicitly show them how the Inquiry Chart will organize their progress.)

6. *My role is to help guide the inquiry circles, but I expect you to work as a science team to solve your problems together.* (While teams are working, walk around the room to facilitate as needed.)

After Inquiry Circles (5 minutes)

1. *As we conclude our inquiry circles for today, each team will have a chance to share the information they found related to their questions, what they accomplished, and what literacy strategies they used. The Lab Director will lead the discussion about today's results. What has the team learned? What problems did the team encounter? How did the team resolve those problems? Did the team use a reading strategy? Which one and how did it help? What new questions does the team have?*
2. After you have allowed the teams to gather their thoughts, have the Data Scientists share with the class. Try to encourage teams to share a variety of things—you do not want just facts about food waste, just reading strategies, or just cooperative learning strategies.
3. After all learners have shared, thank them for their hard work, and point out any practices of scientists you observed. If you saw an outstanding example of using a reading strategy or collaborative work, explicitly point it out. If you notice any problems in the teams during the lessons, take a moment to point them out, and explain your expectations for all future inquiry circles. Collect all Inquiry Charts or have learners put them in their normal classroom place for ongoing work so they can easily access them.

Guided Science Investigation (30–45 minutes)

OVERVIEW

Learners examine a soil sample to separate and identify its components.

GUIDING QUESTIONS

What is soil? What is soil made of?

BACKGROUND INFORMATION FOR THE TEACHER

Soil is made up of both living and nonliving components. It is constantly being changed by the action of weather, water, and organisms. The nonliving parts originated as rocks in the Earth's crust that were gradually broken down over time by wind, water, chemical weathering, and intense heat and cold. The properties of soil are determined by the size and mineral composition of the particles.

Decomposed plant and animal material enrich most soils. Bacteria, fungi, algae, earthworms, insect larvae, and plant roots are some of the organisms that call soil *home*. Typical garden soil is 25% water, 45% minerals, 5% material from living organisms, and 25% air.

During decomposition, large or complex molecules are broken down into simpler ones. This process is important for maintaining a healthy ecosystem because it provides nutrient cycling of molecules such as phosphorus, nitrogen, water, carbon, and sulfur. Soil organic matter, which includes plant or animal matter in different stages of decay, holds three times as much carbon as either the atmosphere or living vegetation. This is important because the production of an ecosystem is dependent on carbon and

nitrogen. The rate of decomposition in any environment is affected by soil type, water content, temperature, climate, and substrate quality.

Many organisms are involved in the early process of decomposition in soil. However, it is the work of macro- and microorganisms that is vital to decomposition and the cycling of nutrients back into the soil. Bacteria, archaea, fungi, and other groups of microorganisms are responsible for the health and productivity of soil.

DAILY OBSERVATIONS

Each day, teams will examine their bottles and record observations in their Investigation Journals. Observations can be made at any time of the day.

MATERIALS

Each team member needs:

- Investigation Journal
- pencil
- colored pencils or crayons
- goggles
- non-latex gloves

Each team needs:

- 2 cups of soil
- paper for covering the work area (e.g., newspaper, craft paper, or paper bags)
- toothpicks or coffee stirrers
- hand lenses

Teacher needs:

- bucket or large bag of natural soil
- shovel or hand trowel
- measuring cup
- large paper plates
- paper (newspaper, craft paper, paper bags, etc.)
- toothpicks or coffee stirrers
- hand lenses
- goggles
- non-latex gloves
- "How Is Soil Formed" video

SETUP

- Natural soil (from home, yard, playground, etc.) should be **collected 24 hours or less before class time**. It can be stored in a large plastic bag (left open) or an uncovered bucket.
- **Raw soil poses health risks** for learners. For examining soil in classrooms, learners should wear goggles and single-use non-latex gloves then wash their hands after handling the soil.

- **Baking soil before use with learners or using simulated soil** is a safer practice. You may want to sterilize soil by baking it a 375° for 30–40 minutes. Alternatively, you can create your own soil mix by combining packaged top soil and sand with a small amount of mulch.
- Prepare an area where the Equipment Directors can measure out 2 cups of soil for their team.
- Place paper supplies, paper plates, toothpicks or coffee stirrers, and hand lenses in a designated area for collection.
- Prepare to project the soil video.

SAFETY

- You may want to sterilize your soil by baking it for 30–40 minutes at 375° or microwaving loosely covered damp soil for 7 minutes at full power.
- Do not allow any food or drink items on the work surface.
- Children should wash their hands after the activity.
- Remind learners not to shake the columns or move them in a way that disturbs the layering.

PROCEDURE

The *italicized statements* below offer suggested wording the teacher may choose to use in the lesson.

Engage

1. Hold up the bag or bucket of soil and ask, *What **is** soil?* Accept all responses.
2. Announce, *Today, we will closely examine soil samples to explore what soil is made of and identify its different components.*
3. Tell them they will be required to wear gloves and goggle for safe handling of the soil samples.

Explore

1. Instruct the Equipment Directors to go to the designated materials area to collect goggles and gloves for their team. They will also need to collect paper, toothpicks or stirrers, and hand lenses.
2. Wearing gloves and goggles, the Equipment Directors will measure 2 cups of soil onto a paper plate for their team.
3. Have learners spread out the paper to cover their workspace. The soil will be spread out in the center of the workspace so that all team members will have access to it.
4. Explain that they will examine the soil closely to separate and observe the different components.
5. They will record their observations on the Day 3 Soil Sample page in their Investigation Journals. The Lead Scientists should lead a team discussion about what team members are seeing.
6. Allow adequate time for observations and sharing among team members.

Explain

1. When ready, ask the Data Scientist from each team to summarize the team findings.
   Ask, *What did your team see in their soil sample?* (Possible answers may include twigs, roots, insects, leaves, pebbles or rocks, and sand.)
2. *Which visible components come from biotic, or living, sources, and which do not?*
3. Explain that the biotic components in soil include all the living and dead organisms, and their waste. The abiotic, or nonliving, components in soil include rocks and minerals, water, and air.

4. Next, have team members turn and talk with a partner to answer the question, *What are some things that might be in the soil that we can't see?* (Answers may include water, air, microorganisms.)
5. Randomly pick partners to share their ideas with the class and discuss.
6. End by asking if anyone has a new question about soil.

Elaborate

1. *Does decomposition contribute to the formation of the soil?* (Although the decomposition of plants and animals adds organic matter and nutrients to the soil, it does not directly contribute to the **initial formation** of soil.)
2. Watch this short video: How Is Soil Formed?

Evaluate

1. Direct learners to the acrostic word "SOIL" at the bottom of the Soil Sample page their journals.
2. Instruct them to use each letter to begin a short sentence about what they have learned about soil or questions they still have about soil.

This lesson is adapted from the Baylor College of Medicine Science of Food Teachers Guide: What Is Soil Made Of? This and other free science resources can be found at https://www.bioedonline.org/.

Science Language

- **Decomposition** is the breaking down of certain types of matter, including dead organisms like plants and animals.
- **Observing** is carefully looking at something or someone to gather information.
- **Soil** is made up of both biotic and abiotic components and is constantly being changed by the action of weather, water and organisms.
- **Biotic** components in soil include all the living and dead organisms and their waste.
- The **abiotic**, or nonliving, components in soil include rocks and minerals, water, and air.

Expanded Standards

English Language Arts and Reading TEKS

5.9(E)(i) identifying the claim; **(ii)** explaining how the author has used facts for or against an argument.

CCSS

RI.5.8 Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).

NGSS

5-LS2-1 A system can be described in terms of its components and their interactions.

Science TEKS

5.1(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations; **(D**) use tools, including calculators, microscopes, hand lenses, metric rulers, Celsius thermometers, prisms, concave and convex lenses, laser pointers, mirrors, digital scales, balances, spring scales, graduated cylinders, beakers, hot plates, meter sticks, magnets, collecting nets, notebooks, timing devices, materials for building circuits, materials to support observations of habitats or organisms such as terrariums and aquariums, and materials to support digital data collection such as computers, tablets, and cameras to observe, measure, test, and analyze information; **(E)** collect observations and measurements as evidence; **5.3(B)** communicate explanations and solutions individually and collaboratively in a variety of settings and formats; **5.5 (D**)examine and model the parts of a system and their interdependence in the function of the system; **(F)** explain the relationship between the structure and function of objects, organisms, and systems.