ALL for Science™
Authentic Literacy and Language for Science

Baylor College of Medicine
CENTER FOR EDUCATIONAL OUTREACH

DAY 4: SETTING UP AN INVESTIGATION

MINI-LESSON

Teacher introduces the "Drawing Conclusions" anchor chart and models the strategy for the class.

SCIENCE INQUIRY CIRCLES

Teams use a different resource to answer another inquiry question or add information to a question already answered.

GUIDED SCIENCE INVESTIGATIONS

Teams set up their investigations to observe how different amounts of rainfall may affect plants.

ABBREVIATED STANDARDS

- Reading TEKS: 4.6F
- CCSS: RI.4.1
- NGSS: 3-5-ETS1-3, 3-LS3-2,
- Science TEKS: 2018–19: 4.10B; 2024–25: 4.13B

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Day 4: Setting Up an Investigation

Literacy Strategy: Drawing conclusions from informational texts.

Science Concept: Germination begins with seeds absorbing water. The amount of water a seed receives during germination might affect a plant's characteristics.

Science and Literacy Connection: Scientists do a lot of reading as they expand their knowledge about a topic they are investigating. Being able to quickly and efficiently find the specific information they need is important.

Mini-Lesson (15 minutes)

OVERVIEW

The vast majority of our day as humans is spent drawing conclusions about the world around us. In this mini-lesson, the teacher may use the following to introduce learners to the way people might draw conclusions from available information:

"If I were to stand in front of you and cross my arms like this [model] with this expression on my face [scowl], you might draw the conclusion that I'm unhappy with something, even though I don't tell you that directly. When you drew that conclusion, you were using what you see (my expressions) with what you know (you've seen someone cross their arms before) to conclude how I might be feeling.

"When at work, scientists draw conclusions, too. For example, when they conduct investigations, one of their final steps is to draw a conclusion. Their conclusions are grounded in what they see (the data they collect) and what they know about what they see. Scientists are not as quick to 'jump to a conclusion' as you were when you tried to interpret my feelings just now; rather, their conclusions come only after careful and systematic data collection and interpretation.

"Just as scientists draw conclusions from their hands-on investigations, they draw conclusions while reading informational texts; as a reader, I draw conclusions about what I read."

NOTE: You are encouraged to create the "Drawing Conclusions" anchor chart with your learners as you move through the lesson, using the provided anchor chart as a model. 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)
- "Drawing Conclusions" anchor chart as a model
- informational text to model the strategy, such as http://texastreeid.tamu.edu/content/texasEcoRegions/WesternGulfCoastalPlain/

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may choose to use for the lesson; additional teacher actions and considerations are in parentheses.

Tell what the strategy is (declarative knowledge)

1. *This strategy is called "drawing conclusions from informational texts." It is really reading between the lines and trying to understand a point that isn't directly stated in a text. Drawing a conclusion is a type of inference.*

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

1. *Drawing conclusions is an important strategy because authors can't possibly give me all the information I need to know while I am reading. Can you imagine how long a website or book would be if the author wrote everything I possibly might need to know to understand their text? They often leave out information and make me "read between the lines"; that's called drawing a conclusion. For example, if authors leave out the main idea of a paragraph, I have to infer or draw a conclusion about the main idea. Other times, authors use a word I may not be familiar with, but through the surrounding words, I can conclude the meaning of the unfamiliar word.*
2. *As a strategic reader, I do this often, sometimes after each paragraph or section in the text I am reading, and sometimes after each sentence. I do this because it makes my reading clear and helps me remember what I read.*

Tell how to use the strategy (procedural knowledge)

1. *The first thing I do as I'm reading is to be actively aware of whether the author is making overt statements about my topic or leaving things out, requiring me to infer or draw a conclusion. If the information I need is stated, I don't need to draw a conclusion. If it's not, then I do this:*
    - *First, I pay attention to the details the author gives me in the text.*
    - *Next, I think about the author's intentions (what the author wants me to know).*
    - *Then, I combine what I already know, the details from the text, and the author's intentions to draw a conclusion.*
2. *If the conclusion I've drawn answers one of my inquiry questions, I jot it down in my own words on my Inquiry Chart.*

Model the strategy

Suggested resource for modeling the strategy:
http://texastreeid.tamu.edu/content/texasEcoRegions/WesternGulfCoastalPlain/.

1. *Let's practice using our new strategy. On the website above, the author writes, "Soils throughout this region are primarily sand-based. Mud flats near the Gulf Coast often have high salt content and only support vegetation such as salt grass." I think one of the conclusions the author wants me to draw from this statement is that soils in the Gulf Coast region are very sandy. I know this*

because the author says, "Soils throughout this region [meaning the Gulf Coast] are primarily sand-based [see the word 'sand-based']," making me think that the Gulf Coast region has sandy soils.

2. *I can confirm my conclusion through the next sentence of that same paragraph: "Mud flats near the Gulf Coast often have high salt content and only support vegetation such as salt grass" I concluded correctly—the author is taking about the soil in the Gulf Coast region. This sentence also adds to my conclusion. Now I think the conclusion the author wants me to draw is that the soils in the Gulf Coast region are sandy AND salty, and, therefore, only certain kinds of plants [like salt grass] can live there.*
3. (You might also want to model adding information in your own words to the model Inquiry Chart.)

Science Inquiry Circles (30 minutes)

OVERVIEW

Scientists often work in teams when conducting inquiry and investigations. Today, we will work in inquiry circles to investigate different questions about ecosystems and the traits of plants that live there. Prior to starting the inquiry circle work, be sure to have texts and technology available for your learners. As children begin working, you may have some teams working online while others are working with traditional texts. This will depend on your access to technology and texts.

MATERIALS

Each team needs:

- team Inquiry Chart
- pencils
- access to informational texts/media

Teacher needs:

- "Ecosystem Resources" spreadsheet for ideas

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may choose to use for the lesson; additional teacher actions and considerations are in parentheses.

Before Inquiry Circles

1. *It is time to get into our inquiry circle teams. You will be with the same team as yesterday, but we will rotate the science roles.* (Assign roles at your discretion and have the Equipment Directors gather the Inquiry Chart for their team).
2. *You are already familiar with the Inquiry Chart and your inquiry questions. Today we will answer more questions or add additional information to a question you've already answered.*
3. *Keep in mind that you might develop new questions as you are working today. If your team develops a new question, add it to your Inquiry Chart as a new column.*
4. *As you look for answers to your questions, you will practice your roles as scientists. As scientists, you will make sure to carefully record your findings and sources on your Inquiry Chart.*

During Inquiry Circles (20 minutes)

1. *Today you will use a different book, eBook, website, or video to find answers to the question you're investigating about your plant or add information to a question you've already answered.*

(You may want to show or project a blank sample Inquiry Chart or your model Inquiry Chart. Also, you may choose to be more explicit for your class and only allow them to answer one question at a time daily. Use your judgement on the level of guidance, especially in the first few days.)

2. *We have anchor charts to help guide your thinking. Do not forget to use them while working.* (Refer to the "Drawing Conclusions" anchor chart and the other anchor charts already introduced. Remind learners that they can use any of the reading strategies taught so far.)
3. *The Lead Scientist will guide all inquiries for the day by picking which question(s) will be answered. The Data Scientist will record on the team Inquiry Chart all source information and the answers to your inquiry questions.*
4. *Remember, it is important to record on your Inquiry Chart where you found the information (source). You will need to carefully keep track of your 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 online and in texts.* (Remind learners 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 (10 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 about its ecosystem and the traits of plants that live there? 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?* (After you have allowed the teams to gather their thoughts, have the Data Scientist share with the class. Try to encourage teams to share a variety of things—you do not want just facts about plants, just reading strategies, or just cooperative learning strategies.)
2. (After all learners have shared, thank them for their hard work, and point out any excellent behaviors that 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

Teams set up their investigations to observe how different amounts of rainfall may affect plants.

GUIDING QUESTIONS

How might seeds respond to different amounts of water during germination? How might our investigation allow us to observe inherited and acquired traits in our plants?

BACKGROUND INFORMATION FOR THE TEACHER

The germination of seeds (growing from seeds into seedlings or young plants) begins with a stage called imbibition, when seeds absorb water to begin the growth process. Too little or too much water affects seed germination. Other important factors also play a role in successful germination: temperature, which affects growth rate and metabolism; and the availability of oxygen for respiration. For this investigation, teams will consider only the role of water.

It is expected that the investigations and daily observations will span a time- period of 5 days. However, it is okay if a weekend falls in the middle of the investigation since they will only add water in the beginning.

MATERIALS

Each team member needs:

- science notebook
- pencil

Each team needs:

- copy of “Planting the Seeds” instructions
- copy of “Investigation Data” page
- 3 hydroponic sponges (each measuring 1-in^3)
- 6–8 seeds
- 1 plastic graduated cylinder
- 1 plastic measuring cup
- 3 clear 8-ounce solo cups
- water
- black marker
- sticky notes
- paper towels

Teacher needs:

- copy of "Planting the Seeds” instructions
- copy of “Investigation Data” page
- hydroponic sponges
- package of Wisconsin Fast Plants seeds
- graduated cylinders
- plastic measuring cups
- clear 8-ounce solo cups
- water
- paper towels
- black markers
- sticky notes
- 2 clamp lamps
- 2 fluorescent LED bulbs
- “Planting the Seeds” video: https://www.youtube.com/watch?v=9jR9EfGsPhM

SETUP

- Make copies of the "Planting the Seeds" instructions (1 per team).
- Prepare for each team a tray or container containing 3 hydroponic sponges, 3 solo cups, 1 graduated cylinder, 1 measuring cup, paper towels, sticky notes, a copy of the "Planting the Seeds" Instructions, and a copy of the "Investigation Data" page.
- Teams will need a source of water to fill their measuring cups. Using the measuring cups with a pour spout will make it easier for learners to pour water into the graduated cylinders.
- Prepare a designated space where all team investigations will be set up together. Teams will need both clamp lamps positioned 15 to 18 inches above the plants, and **the light will need to be left on for the duration of the investigation.**
- Prepare to project/share the "Planting the Seeds" video. The teacher may choose to run this video once for the class, then use it with stops so the class can follow along as they set up their own investigations.

SAFETY

- Caution learners to handle seeds carefully. They are tiny and can be easily lost.
- Remind teams to clean up any water spills right away.
- **Advise learners not to touch the clamp lamps once they are turned on.**

DAILY OBSERVATIONS

Learners will make their first observations on their seeds as they prepare for their investigations. After today, they will make daily observations on the seed growth through Day 8.

PROCEDURE

Engage

1. Announce that today teams will set up their investigations to observe the response of a plant seed to the amount of water it receives.
2. Let them know that water is essential for seed germination, the process of a seed growing into a seedling or young plant. In the first stage of germination, the seed needs water to be able to carry out all of the functions required for growth. Add that teams will learn more about this process in the next class. Today is all about setting up the investigations.
3. Ask if the teams have a plan for who is going to do each part of the setup. If not, allow a few minutes for them to decide. Remind them to consult the printed setup instructions as needed.

Explore

1. Have the Equipment Directors collect a tray or container with the materials their team need for the setup. Point out the designated area where you have set up the lighting for the investigation and tell teams they will be placing their cups there for the duration of the investigation.
2. When ready, project the "Planting the Seeds" video, stopping as needed to emphasize points. Then, run the video again, with stops, allow the children to follow along as they set up their investigations. Remind teams to pay close attention to the instructions in the video and to refer to the written instructions as needed.
3. **When teams are ready to place the seeds into the sponges, the teacher should distribute them by hand to each team. Teams may place 2 seeds in each sponge.**
4. When the setup is complete, ask teams to make their first observation of the seeds and record these on the "Investigation Data" page; ask them to include a drawing of what the seeds look like in addition to describing them in words.

5. Remind teams that they will be making daily observations of their seeds and will use the "Investigation Data" page to describe what they are seeing, both through drawings and words.
6. Encourage teams to decide who will be responsible for drawings and notes on their "Investigation Data page," suggesting that they take turns.
7. As teams complete their setups and observations, direct them to the area you have prepared where they will set their investigations under the lights. Ensure that teams have arranged their cups in the correct order (least water to the most, L–R) and have labeled them with an identifying sticky note (team name or number).
8. Explain that teams will take turns during the next 5 days to make their observations, **but it is important not to move the cups from their positions. Also, they will not add any more water to the cups after the setup.**

Elaborate

1. Remind the children that inherited traits are passed down from parent to offspring—these are traits that offspring are born with. They should expect to see similar traits in their seedlings since the seeds are all Wisconsin Fast Plants. However, let them know that the seedlings will be tiny since they are only growing for 5 days or so.
2. Ask them to consider how the amounts of water they used might affect the seeds and then turn and share their ideas with a partner on their team.
3. Let them know they will learn more about how seeds become seedlings in the next class.

Evaluate

1. Did learners start with a plan and work cooperatively to complete their setups?
2. Were any new questions raised about how seeds become plants?

Science Language

- A **trait** is physical attribute of an organism such as eye color, feathers, or the shape of leaves. Traits can be inherited or acquired.
- **Inherited traits** are passed down from parent to offspring.
- **Acquired traits** are not passed down but are the result of environmental or external factors.
- A **testable question** is connected to a specific science concept and can be answered by conducting an investigation or experiment.
- A **scientific investigation** is a plan for finding answers to questions and solving problems.
- A scientific **variable** is something (a factor or condition) that can change or potentially change in a scientific investigation.

Expanded Standards

Reading TEKS

4.6F: Make inferences and use evidence to support understanding.

CCSS

RI.4.1: Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

NGSS

3-5-ETS1-3: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
3-LS3-2: Use evidence to support the explanation that traits can be influenced by the environment**.**

Science TEKS

2018–19: 4.10B: Explore and describe examples of traits that are inherited from parents to offspring such as eye color and shapes of leaves and behaviors that are learned such as reading a book and a wolf pack teaching their pups to hunt effectively.

2024–25: 4.13B: Differentiate between inherited and acquired physical traits of organisms.