ALL for Science™

Authentic Literacy and Language for Science

Baylor College of Medicine

CENTER FOR EDUCATIONAL OUTREACH

DAY 6: ARE ALL SEEDS THE SAME?

MINI-LESSON

Teacher introduces the "Reading Data through Graphs" anchor chart and models the strategy for the class.

SCIENCE INQUIRY CIRCLES

Teams complete their Inquiry Charts, making sure all questions are answered and all sources carefully recorded.

GUIDED SCIENCE INVESTIGATIONS

Teams explore similiarities and differences among seeds and discover the embryo inside a pre-soaked lima bean.

ABBREVIATED STANDARDS

- Reading TEKS: 4.13C
- CCSS: RI.4.7
- NGSS: 4-LS1-1A
- Science TEKS: 2018–19: 4.10A; 2024–25: 4.2D, 4.13A

Day 6: Are All Seeds the Same?

Literacy Strategy: Reading data through graphs.
Science Concept: Seeds come in many shapes, sizes, and colors, but most seeds contain an embryo and stored food in a protective covering.
Science and Literacy Connection: Scientists evaluate the claims of other scientists and authors to make sure the information is true and reliable.

Mini-Lesson (15 minutes)

OVERVIEW

Scientists come across many different types of texts when they look for information written by other scientists. In addition to words, images, and captions, scientists also have to interpret data found in graphs. Graphs can appear in scientific papers, reports, books, and on websites. Many graphs illustrate changes over time and are helpful for understanding patterns or trends in a phenomenon. Some graphs are interactive, allowing users to look for specific information.

When scientists record measurements or observations, these measurements represent only one single moment in time—a snapshot—but scientists use graphs to record multiple moments in time, which can reveal patterns over longer periods of time, such as hundreds of years. When scientists interpret graphs, they have to look at all the data points together rather than one by one. Zooming out to look at the big picture allows scientists to notice patterns in the data. Part of interpreting a graph is drawing conclusions about patterns in the graph and making predictions based on those patterns.

At this point, your learners might have added questions to their Inquiry Charts about how environmental conditions in their ecoregions have changed over time. If they have not, you might want to lead them toward asking a question that addresses change in their ecoregion over time. You might model this by saying something like, *We've been discussing rainfall over the last few days. I've been thinking about my ecoregion, and wondering if the rainfall in the Gulf Coast ecoregion is always the same or if it has changed over time.*

NOTES: You are encouraged to create the "Reading Data Through Graphs" 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.

This mini-lesson is intended to teach learners to read data represented in graphs. Learners should be able to apply this strategy to any graph they encounter. (**Drawing conclusions** and **making predictions** are sub-routines embedded in this strategy.) However, we have also provided information to support you and your learners in navigating a specific online data set represented in graphs. The teacher instructions below will help your learners use the online system to generate a graph that represents specific information for a specific state or county. **We recommend that you practice using the online system to generate graphs together as a class before teaching this mini-lesson. This lesson will support learners in reading the graphs they have generated.**

Instruction for generating graphs to read:

- Open the Climate at a Glance page on the National Centers for Environmental Information website: https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series
- Scroll down select your state (Texas) and a county in Texas. Direct your learners to counties located in the ecoregion they are studying. Some examples can be found on this map from Texas Highways: https://texashighways.com/wp-content/uploads/2020/03/wildflower-regions-of-texas.jpg
- You can select from several parameters (e.g., precipitation, average temperature) to graph.
- Set the start year as 1895 and the end year as 2023.
- Click "Plot" to generate a graph.

MATERIALS

Teacher needs:

- chart paper
- marker(s)
- "Reading Data through Graphs" anchor chart as a model
- online graphs to model the strategy
- precipitation graph for 1895–2023 (generated on https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series)

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. *Today, we will learn how to read data through graphs. Graphs are particularly helpful for understanding changes over time. While scientists (and you) can observe and record the environmental conditions (e.g., temperature, rainfall) on a particular day, this is just one moment in time. Scientists use graphs to record, understand, and communicate how environmental conditions change over longer periods of time, such as hundreds of years. When interpreting a graph, scientists look at the "big picture": they examine all the data points together (instead of one by one) to look for patterns.*
2. *The information represented by a graph is called "data." Graphs can be found in books and videos, but today we will explore graphs online. The graphs we will explore today are interactive—this means that you will interact with the map or graph to find the information you need. Being able to create and read a graph is important because they help us understand changes over time.*

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

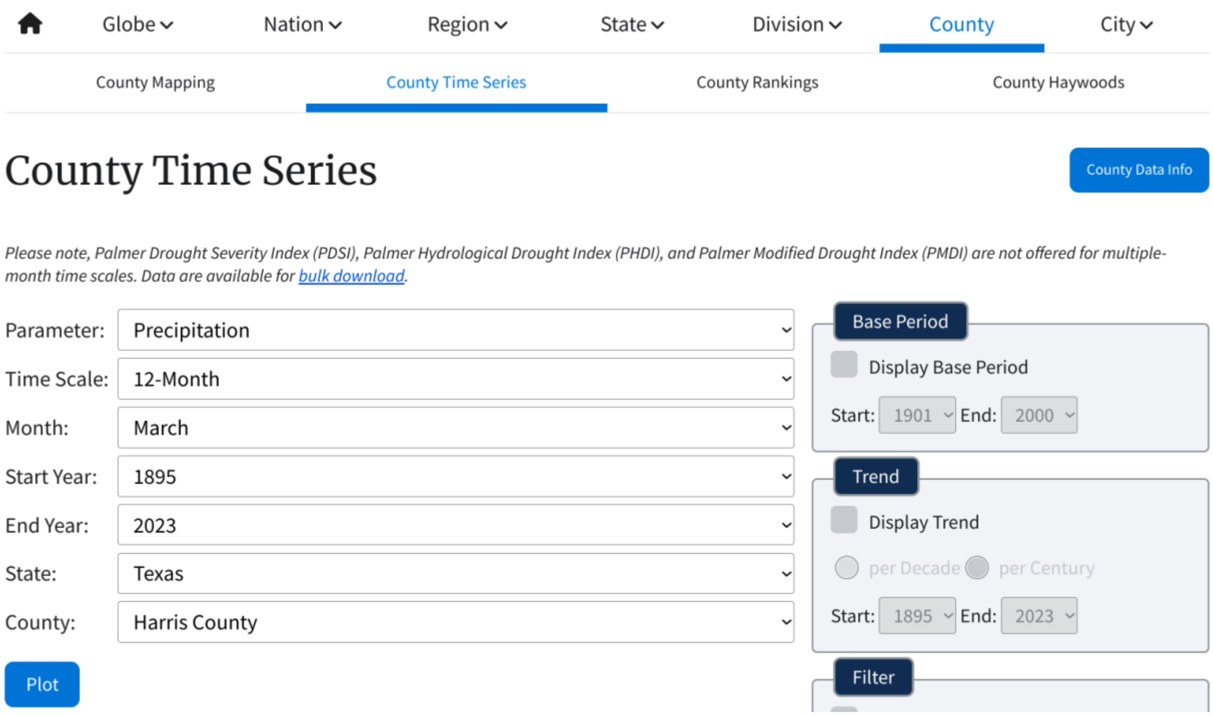
1. *I create and read graphs whenever I want to understand how something is changing over time. When I come across a graph in a text I'm reading, I read the graph to help me understand patterns related to the topic I'm reading about.*
2. *Graphs offer unique information that I can't get from the text, so it's important that I stop to read the graph and think about the unique information it contains. This information may be useful when I'm writing a scientific report.*

Tell how to use the strategy (procedural knowledge)

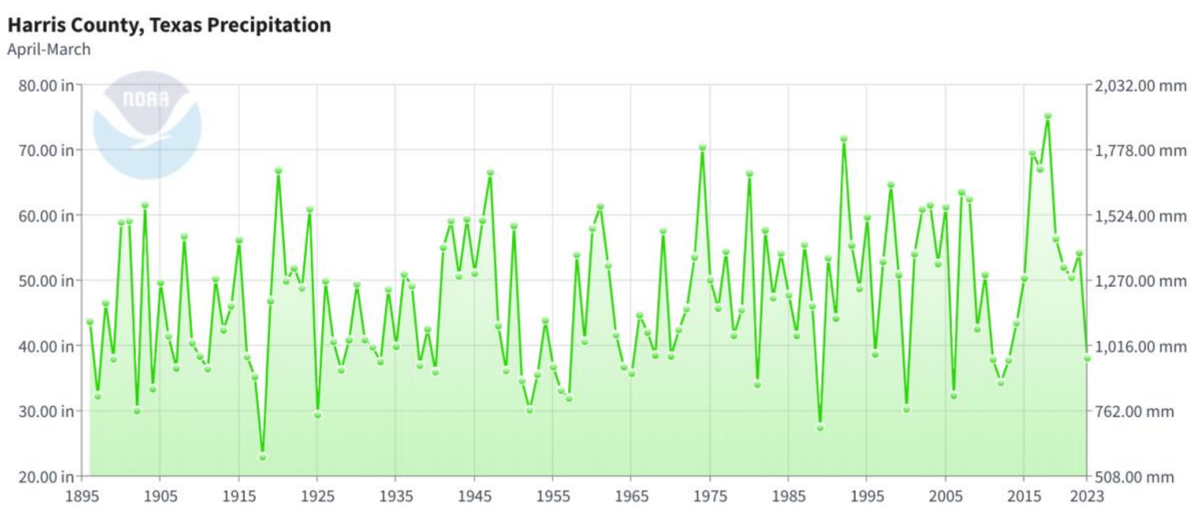
1. *First, I notice the features that tell me I am looking at a graph:*
   - *A graph is a visual representation of data (e.g., temperature, precipitation). Graphs have a title that tells us what the data in the graph is about. A graph includes labels on the bottom (along the x-axis) and the side (along the y-axis).*
   - *Usually, measurements are written on the side (y-axis) and time is written on the bottom (x-axis). Each point on the graph represents a measurement, and the labels along the bottom (x-axis) tell us when that measurement was recorded.*
   - *I can look for a unit next to the measurements to help me understand what is being measured and how. For example, because time is usually on the x-axis, I can look at the bottom for units of time (sec, min, hr, day, year) to understand how time is measured.*
2. *I note the title and the labels on the x-axis and y-axis and ask myself, What information is this graph representing?*
3. *Then I look at the whole graph and all the data points. I ask myself, What is the big picture? What patterns do I notice in the data?*
4. *Then I draw a conclusion about what this pattern means. I combine what I know about the information the graph is representing AND the patterns I notice.*
5. *Finally, I make a prediction based on the pattern and the information in the graph. I ask myself, What would it look like if this pattern continues?*

Model the strategy:

1. *I am curious about the precipitation, or rainfall, in the Gulf Coast ecoregion. The Gulf Coast is a big ecoregion, but one of the counties in this region is Harris County, which includes most of the people who live in Houston, Texas.*
2. *First, I'll open the link to the Climate at a Glance page on the National Centers for Environmental Information website: https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series*
3. *Then I'll adjust the settings so that they are set to my state (Texas) and the county I am interested in (Harris County). Next, I'll select the parameter I want: precipitation. Later, I might go back to explore other parameters, such as average temperature. Finally, I'll check to make sure that the start year is set to 1895 and the end year is set to 2023. I will leave the month setting in March.*



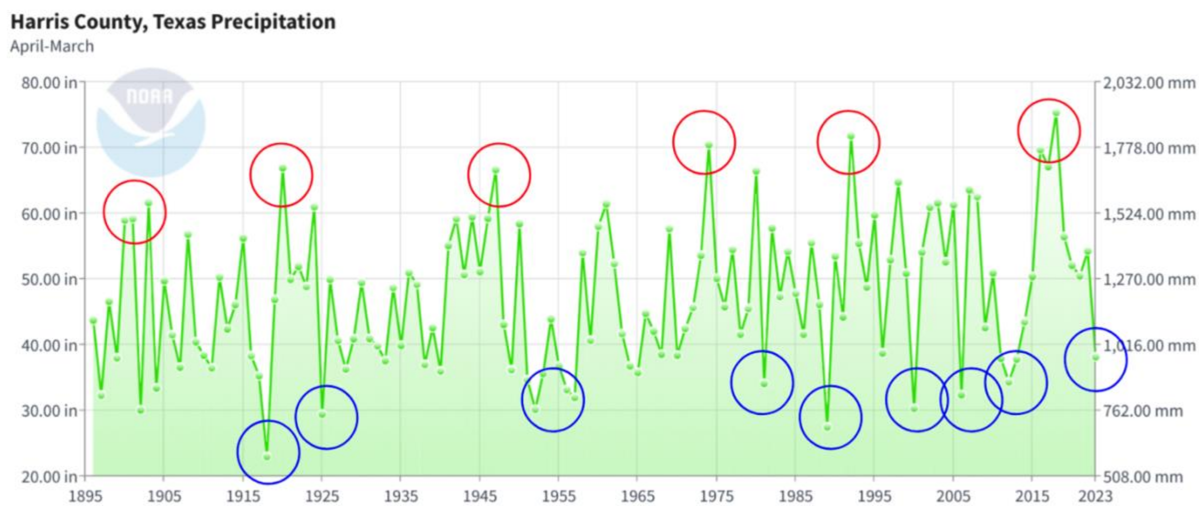
4. *Then, I will click "plot" to graph the data.*



5. *First, I read the title of the graph: "Harris County, Texas Precipitation." I know the graph represents the amount of precipitation (rainfall) in Harris County, Texas. Then, I read the labels on the bottom of the graph (x-axis). The number starts with 1895 and ends with 2023. Because I selected 1895 and 2023 as my start and end years, I know that the x-axis tells me the year each measurement was recorded. Then I look at the labels on the side (y-axis), and I notice that each number is*

followed by "in." I remember that "in" stands for "inches." I can conclude that the y-axis tells me the amount of precipitation in Harris County, Texas, in the month of March each year.

6. *Then, I read the graph. When I first look at this graph, I notice a lot of ups and downs. I conclude that in March of some years, Harris County got more rainfall, and in March of some other years, it gets less rainfall. When I look at the data points one by one, there is no clear pattern. In March 2024, Harris County might get more rain than in March 2023, or it might get less. I can't make a strong prediction here; I need to look at the data differently in order to make a prediction.*
7. *To find a pattern, I have to "zoom out" and look at all the data together as a whole. If I look across this graph at all the annual rainfall measurements, I notice that the highest points on the graph—the rainiest years—are getting slightly higher. I also notice that the lowest points on the graph—the least rainy years—are getting slightly higher as well. This makes me conclude that, over 123 years, the wettest years have been wetter, and even the driest years have been less dry.*



8. *Finally, I can make a prediction. Because I have observed this pattern in the data from the last 123 years, it is reasonable to predict that it might continue. I can predict that, over the next 100 or more years in Harris County, Texas, we might expect more precipitation and wetter conditions overall. However, it is important to note that I **cannot** predict more precipitation every year. Rather, I can reasonably expect ups and downs (some dryer years and some wetter years) because this has been the case for the last 123 years.*

Science Inquiry Circles (30 minutes)

OVERVIEW

If they have not already done so as part of the mini-lesson, encourage teams to generate and read at least one graph and record their patterns, conclusion, and predictions on their Inquiry Chart (they might need to add a new question). Use the Climate at a Glance page from the National Centers for Environmental Information website at https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series. You might need to help learners select a county in their ecoregion to explore. Examples can be found on this map from Texas Highways: https://texashighways.com/wp-content/uploads/2020/03/wildflower-regions-of-texas.jpg. You might have different members of a team generate and read graphs of different parameters (e.g., precipitation, average temperature, maximum temperature) for the same county in their ecoregion.

Ideally, teams should complete their Inquiry Charts today. Teams with a completed Inquiry Chart may want to explore other online resources that include graphs (see the "Online Data" section of the "Ecosystem Resources" spreadsheet).

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. *We will start writing synthesis statements tomorrow, so we need to be sure to complete the Inquiry Chart today. (You may need to make adjustments for teams that will not be able to complete their Inquiry Charts today.)*
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 your sources on your Inquiry Chart.*
5. *If your team finishes answering your inquiry questions with time to spare, begin checking the information in your column of sources and note if any information is missing.*

During Inquiry Circles (20 minutes)

1. *You should make sure that your Inquiry Chart is complete. Have all questions been answered? Do you need more information? Have you recorded all of your resources on the Inquiry Chart?* (While teams are working together, walk around the room to facilitate as needed and to monitor progress.)
2. *Remember, you have anchor charts to help guide your thinking. Do not forget to use them while in teams.* (Refer to all the mini-lesson anchor charts used to date, which should be posted in the classroom where learners can easily refer to them.)
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 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 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. (At this point, teams might have information under multiple questions and from multiple sources. You may need to remind teams that **information in the same row is from the same source and information in the same column pertains to the same question**. One source might answer multiple questions.)
6. *Everyone should help find the answers to the questions online and in texts.* (Remind learners how the Inquiry Chart will organize their progress.)
7. *My role is to help guide the inquiry circles, but I expect you to work as a scientific 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 allow 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 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 explore the differences among seeds and discover the embryo inside one of them.

GUIDING QUESTIONS
Are all seeds the same? Do all plants have seeds?

BACKGROUND INFORMATION FOR THE TEACHER
Many plants produce seeds. However, these seeds come in different shapes, sizes, and colors. Most seeds have three things in common: an embryo (or baby plant) inside the seed, stored food for the embryo, and a protective covering.

MATERIALS

Each team member needs:

- science notebook
- pencil

Each team needs:

- 1 container or tray with assortment of seeds
- 2 dried lima bean, presoaked
- hand lenses

Teacher needs:

- assortment of seeds
- 8–10 l dried lima beans
- containers or trays for the seeds
- hand lenses

SETUP

- Presoak the lima beans for 6–8 hours before class time. This will allow the seed coat to peel off easily. Do not oversoak!
- Prepare 1 container or tray per team with an assortment of 10–15 seeds; include hand lenses.

SAFETY

- **Before this lesson, the teacher should check with learners for any potential plant allergies.**
- Caution learners not to eat any seeds.
- Seeds should be handled responsibly.
- Wash hands after handling seeds.

DAILY OBSERVATIONS

Remind learners to make their daily observations on the seed investigations.

PROCEDURE

Engage

1. Begin, *How many of you have eaten seeds this week? What seeds did you eat?* Accept responses, which may include sunflower, pumpkin, chia, or sesame seeds.
2. Besides the most obvious seeds learners may identify, reveal that many other foods have seeds they have likely eaten and didn't think about. Offer examples such as bananas, cucumbers, or pickles that contain tiny seeds; breads and bakery products that come from grain seeds like wheat or barley; and coffee and cocoa beans used to create beverages (the "beans" are actually seeds).
3. Share that while many plants produce and are grown from seeds, some plants, such as mosses, ferns, and horsetails don't produce seeds—they have other ways to reproduce.
4. Ask Equipment directors to collect a container or tray of seeds and hand lenses for their team.

Explore

1. Explain that team members should work together to sort and make careful observations of the different kinds of seeds in their container or tray.

2. **Encourage team members to come up with their own method for sorting the seeds.** They could consider color, shape, size, etc. After the sorting, learners should record in their science notebooks a written description and drawing for each sorted seed group.
3. Allow 15 minutes for completion. The teacher should walk among the teams and observe their work, listening to their discussions and reasoning as they sort the seeds.

Explain

1. When time is up, ask the Data Scientists from each team to explain the team's sorting: *How did your team decide how to group your seeds?*
2. After all teams have reported on their observations, acknowledge their observations that seeds come in all kinds of colors, shapes, and sizes. They also come packaged in different ways—some in hard shells, like nuts; some in pods, like beans; and some in fleshy coverings, like bananas.
3. Explain that although seeds look different, most seeds have three things in common: an embryo (baby plant) inside the seed, food for the embryo, and a protective covering around the seed.
4. Distribute 2 presoaked lima beans per team. Model how to gently peel off the seed coat to expose the two thick fleshy parts that store the food for the embryo. Then, carefully lift one of the thick parts away from the other to find the tiny plant!

Elaborate

1. Remind the teams of what they have learned about how seeds germinate and the investigations they are conducting. Add that even the tiniest seeds, such as the ones they have planted, contain an embryo inside.
2. Ask teams to share anything interesting they have learned or read about seeds and plants in their inquiry circles.

Evaluate

1. Review the descriptions and drawings learners made in their science notebooks during their observations. Did they provide enough information to communicate their observations effectively?
2. Are learners communicating, either verbally or in writing, new or prior knowledge about seeds or plant structures?
3. Are they using new science language correctly in their verbal or written communications?

Science Language

- A **seed** is an undeveloped plant embryo and food reserve enclosed in a protective outer covering.
- **Germination** is the process by which a plant grows from a seed.
- The **embryo** is the tiny plant inside the seed.

Expanded Standards
Reading TEKS **4.13C** identify and gather relevant information from a variety of sources.
CCSS **RI.4.7**: Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.
NGSS **4-LS1-1A:** Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
Science TEKS **2018–19: 4.10A:** Explore how structures and functions enable organisms to survive in their environment. **2024–25: 4.2D:** Analyze data and interpret patterns to construct reasonable explanations from data that can be observed and measured. **4.13A:** Explore how structures and functions enable organisms to survive in their environment.