Britannica Expedition:LEARN!

Teacher Toolkit

Analyze and Interpret Data: Grades 3–5

OVERVIEW:

At the basis of all scientific and engineering endeavors is the collection of data as empirical evidence. That data must then be analyzed and interpreted to reveal patterns that are used to support conclusions, make sense of phenomena, and evaluate engineering designs. Students who can effectively analyze and interpret data are better able to evaluate experimental design and can more easily recognize and compare important patterns in data sets. They can also find meaning in data and connect that meaning to information they've learned through reading, and have a better understanding of how the fields of science and engineering make advancements in knowledge and technology.

Students are expected to analyze and interpret data by organizing it into data tables, displaying it in graphs, charts, and diagrams, and using mathematical reasoning to identify trends in the data.

Mini-Lesson I

Establish a Science Notebook (15-20 minutes)

Background: Setting up a dedicated science notebook provides students with a single place to record observations, questions, explanations, and more. Using this notebook enables students to develop good habits for the study of science, such as thoroughly recording data, forming hypotheses, asking questions, and explaining patterns or anomalies. It will take time and practice for students to fluently express their scientific thinking, and the science notebook provides a space for this skill to develop over time. The following teaching suggestions are based on the article "Using Patterns to Predict Moon Phases" from the *Expedition: Learn!* lesson "The Phases of the Moon."

- Share with students that observations and data are at the root of good science work. In order to understand how our world works, we must first observe it and make notes about what we see.
- Provide or invite students to take out a blank notebook and write "Science Notebook" on the cover.
- Explain that this notebook will be where they collect scientific data throughout the year. Share that data can be drawings, numbers, or words, depending on the topic or concept being studied.
- Emphasize that as scientists, students must make sure that their data is recorded clearly and in a way that is able to be understood, because later on they will need to derive meaning from data.
- Share that it is important to include complete information when recording data. This might include the date, time of day, units of measurement, labels or other information that will allow students to read and analyze it later.

- Explain that the information that is important to include will vary, depending on what is being recorded. For example:
    - *Imagine you are collecting data on how much a plant grows each day. Your data would include the date, the time of day, and the height of the plant and units of measurement you are using. It would also include the difference in height each day or each week. It might include a drawing or picture of the plant each day.*
- Explain to students that in this mini-lesson, they will learn about the phases of the moon and use their science notebook to record observations.
- Conduct a read-aloud of the article "Using Patterns to Predict Moon Phases."
- After reading, share with students that they will use their science notebooks to record observations of the Moon for the next month.
- Invite students to turn and talk, discussing what information they will need to include. Ask a few students to share out. For example:
    - *date, time of observation, moon phase, picture or drawing of the Moon*
- Guide students in setting up their science notebook for the observation. Two possible options are shown:
    - **Option 1: Table**

Date/Time	Moon Phase	Picture of Moon
April 1 / 8:15PM	waxing crescent	

    - **Option 2: Calendar**

April						
Sunday	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**
		 1 waxing crescent	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

- Provide class-specific instructions for when and how to record data, emphasizing that gathering data safely is an important consideration for both students and scientists. Emphasize that if they are not able to gather the data safely (i.e., with a trusted adult, in a location where being outside at night is safe), students can obtain the data from their fellow scientists at school.
- After the prescribed amount of time for data collection, invite students to make observations, notice patterns, and generate further questions based on their data.

Mini-Lesson II

Interpreting Graphs in Science Texts (30 minutes)

Background: Learning how to read graphs is an important skill students must develop to support their science area reading. The ability to read graphs enables students to build on the knowledge they acquire from text, understand and interpret patterns and phenomena, make observations, and form hypotheses. Before expecting students to use the information contained in graphs, teachers first need to provide explicit instruction that helps them read and interpret graphs. The following teaching suggestions are based on the article "Using Weather Data to Identify Patterns" from the *Expedition: Learn!* lesson "Weather Data."

- Share with students that in science texts, authors often use different types of graphs to represent data and support their written ideas.
- Explain that in this mini-lesson, students will focus on reading several types of graphs about weather.
- Introduce the text students will read and share that this text includes several different types of graphs.
- Reiterate that authors include graphs to help explain an idea, provide examples, or support an argument. Share that knowing how to read a graph helps students understand and analyze the information the author includes.
- Display the **How to Read a Table or Graph anchor chart**. Introduce the steps to students by reading each step aloud and then modeling each step using the pictograph "Average Monthly Temperature" from the lesson:
    - Step 1: Read the title or heading to learn what the table or graph is showing.
        - *The title is "Average Monthly Temperature."*
    - Step 2: Read all the labels on the table or graph.
        - *The x-axis shows the names of the months. The y-axis is labeled "Average temperature (in degrees Celsius)." It goes from 0 to 20 in increments of 5 degrees.*
    - Step 3: Look for a key that explains any symbols or colors.
        - *There is no key for this graph.*
    - Step 4: Look at the data included in the table or graph. Think about what the information is telling you.
        - *I see that January is the coldest month and July is the hottest. The temperature increases a little every month from January to July. After July, the temperature decreases a little every month.*
    - Step 5: Write the main idea of the table or graph.
        - *The average temperature is lowest in January, climbs slowly each month until it peaks in July, and then slowly falls again over the following months.*
- Emphasize that being able to read the graph helps the reader understand the weather pattern in this particular location.
- Invite students to view the next two graphs in the article. Ask them to work with a partner, following the steps to read and analyze the graphs. For example:
    - *The title of the first graph is "Precipitation Days per Month in Antarctica" and the second is "Precipitation Days per Month in Egypt."*
    - *The x-axis on both is the months January through April. The y-axis is labeled "number of days" and goes from 0 to 10 in increments of one.*
    - *There is no key for the graphs.*
    - *The data in the first graph helps me understand that March is the month with the most precipitation in Antarctica, with almost nine days. January has the least precipitation, with just over six days. The data in the second graph helps me understand that during these same months in Egypt, January has the most precipitation, and April has the least.*
    - *In Antarctica, the year starts out with less precipitation and gradually gets more precipitation. During these same months in Egypt, January has the most days with precipitation, and they then decrease a little each month.*

- Invite students to respond to the following prompts:
  - What other patterns do the graphs show about how much precipitation each place gets?
  - Why might scientists collect this type of data?
- Emphasize that knowing how to read and interpret graphs can help us to better understand science, identify patterns, and form hypotheses about phenomena.

Mini-Lesson III

Setting Up a Data Table (15 minutes)

Background: One of the skills that students need to develop as scientists is setting up and using a data table to record information. Using a table allows students to record data in an organized way that enables them to analyze data or use data for graphing. This mini-lesson shows students how to set up a data table, record data, and draw conclusions from that data using the daily temperature. Students can use a physical thermometer or a standardized measurement, such as the same weather app each day, to gather the data.

- Explain that in a scientific experiment, students will often look at two variables—*independent variables* and *dependent variables.*
- Explain that the independent variable is the thing that you can change or decide on before the experiment starts. The dependent variable is the thing that changes based on how the independent variable changes. For example, how much water you give a plant each week is an independent variable. How much it grows each week is the dependent variable. The time of day is an independent variable. The number of cars that go down a street at that time is a dependent variable.
- Share that when collecting data for an experiment, students will record independent and dependent variables in a data table.
- Explain that as a class, you will record data about the weather by looking at the temperature every day for a week.
- Show students how to draw a data table, titling the first column “Date” and the second column “Temperature.”
- Model putting the dates (the independent variable, or thing that is being changed in the experiment) in the first column.
- Explain that each day at the same time, you will check the thermometer (or weather app) to see what the temperature is and record it in the table.
- Record that day’s temperature (the dependent variable, or thing that changed as a result of the changes) in the appropriate space in the second column.
- Ensure that you repeat this process each day at the same time, modeling checking the temperature and recording it.
- At the end of the week, invite students to view the data and make observations. Consider providing prompts as needed:
  - Which day was the hottest?
  - Which day was the coldest?
  - Did any days have the same temperature?
- Explain that scientists keep data tables like this to help them observe the world, make predictions, and form hypotheses. Keeping your data organized can make your science work clearer and more accurate.

Check for Understanding

If you observe …	Then try …
students struggling to interpret the information in a graph	working with students to create their own simple graph in order to show how graphs are used to show information. For example: • Poll the group about their favorite foods, giving them four to six options to choose from. Keep a tally on the board, and then work with the group to build a graph, using a think-aloud to explain each element as you add it.

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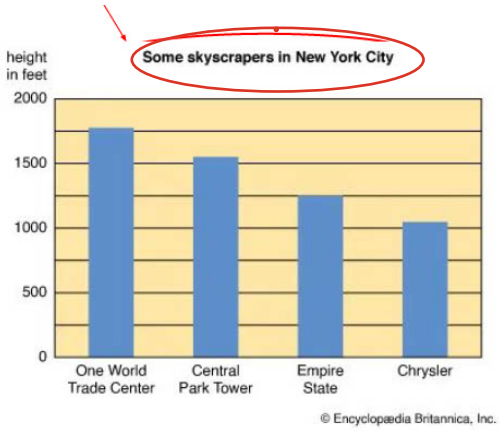
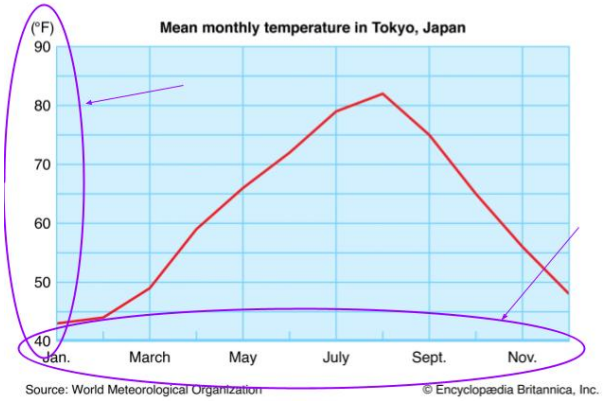
Teacher Toolkit 6

How to Read a Table or Graph

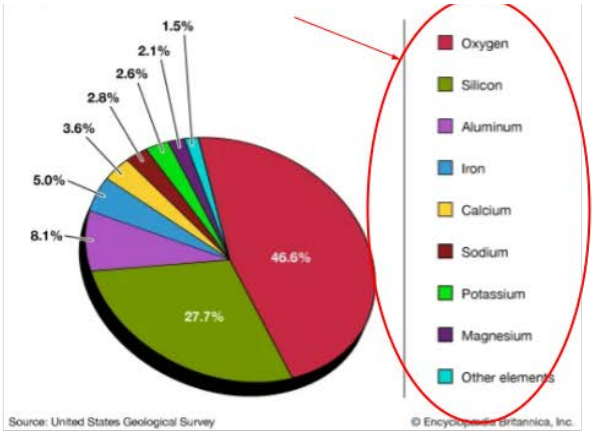


Read the **title** or heading to learn what the table or graph is showing.



Read the **labels** on the table or graph.

- On a table, these are usually column or row headings.
- On a graph, these are usually labels for the x-axis and y-axis.



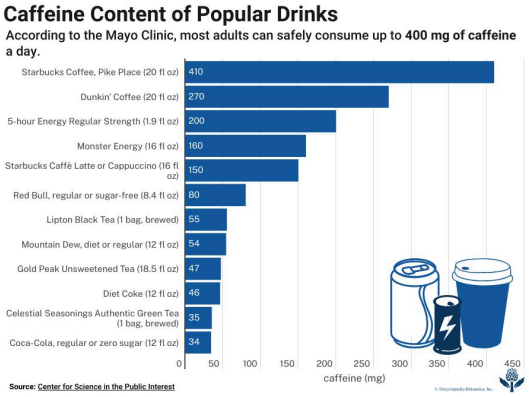
Study the **key** to know what the symbols or colors represent.

How to Read a Table or Graph

Amounts collected for charity

ROOM	AMOUNT
A	$76.00
B	$94.00
C	$37.00
D	$55.00

Study the **data** included in the table or graph. Think about what the information is telling you.



Different drinks have varying amounts of caffeine. In this graph, Starbucks coffee has the most caffeine and Coca-Cola has the least.

Write the main idea of the table or graph.