ACTIVITY 6

Claims and Evidence

COMPUTER SIMULATION

6: CLAIMS AND EVIDENCE

GUIDING QUESTION

How can evidence be used to support or refute a claim?

INTRODUCTION

Scientists often make claims about a phenomenon based on data that already exists or from data that they gather. Data becomes evidence when it has been interpreted and is used to support or refute a scientific idea. Gathering enough evidence that is relevant, accurate, and reliable helps support or refute scientific ideas. In this activity, you will investigate the role of evidence from different scientific tools and techniques in supporting or refuting claims about the quality of Skipton's water. A claim is a statement that asserts something is true.

CONCEPTUAL
TOOLS

MULTIPLE LINES
OF EVIDENCE

SENSES &
INSTRUMENTATION

Sampling water from lake.

PROCEDURE

PART A: FINDING AND EVALUATING EVIDENCE ABOUT A CLAIM

1   Read the following scenario.

The Skipton city council has decided to move forward with sourcing water directly from Lake Timtim. As they gather more data to support this decision, individual members of the city council have made the following four claims about water in Lake Timtim:

CLAIM 1: The algae in Lake Timtim is harmless.

CLAIM 2: Lake Timtim will likely have water for another 100 years.

CLAIM 3: The amount of suspended solids in Lake Timtim is decreasing.

CLAIM 4: Lake Timtim does not contain levels of the chemical tributyltin (TBT) high enough to pose a health concern.

Based on their prior experience, many residents would like to further investigate these claims. The city council has asked scientists at the nearby Skipton University to collect data about Lake Timtim and the surrounding areas. You will determine whether the data supports or refutes these claims.

2   Your teacher will assign you and your partner a claim to investigate. Read your assigned claim and the background information provided.

THE ALGAE IN LAKE TIMTIM IS HARMLESS.

Background Information

There are many types of algae that grow in aquatic environments: brown algae, red algae, green algae, and blue-green algae (also known as cyanobacteria). Some algae are beneficial to a healthy ecosystem, while others are harmful. Some species of blue-green algae produce toxins such as microcystin. When people are exposed to contaminated water or eat contaminated shellfish such as mussels or clams, these toxins are poisonous and cause short-term memory loss and even death. These toxins can also cause the death of fish, birds, and mammals. Algal growth is associated with increased nutrient levels (such as nitrogen and phosphorus) in the water, high light levels, and warm water temperatures. Microscope images can be used to distinguish between toxic and nontoxic species of algae since some species are too small to identify with the human eye.

Water quality Limits

The U.S. Environmental Protection Agency (EPA) recommends water for recreational use to have microcystin levels below 8 micrograms per liter (µg/L). Drinking water should have less than 0.3 µg/L for infants and preschool-age children and less than 1.6 µg/L for all other age groups.
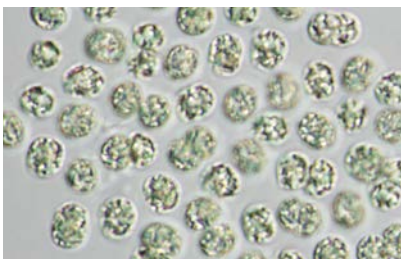
Some blue-green algae species such as *Microcystis* produce toxins (left), while other blue-green algae species, such as *Arthrosprira* (right), are used as a food supplement.

LAKE TIMTIM WILL LIKELY HAVE WATER FOR ANOTHER 100 YEARS.

Background Information

Some residents of Skipton have raised concerns about the long-term reliability of water from Lake Timtim. Factors such as rainfall, temperature, drought conditions, water capacity, and water level can all contribute to the potential longevity of a water source. Residents point to how some of these factors have caused long-term change at nearby Wazi Lake, which has a similar climate and geography. They are concerned that something similar could happen to Lake Timtim.

Satellite images are digital pictures of Earth's surface compiled from data collected by satellites that orbit Earth.

THE AMOUNT OF SUSPENDED SOLIDS IN LAKE TIMTIM IS DECREASING.

Background Information

Turbidity is a water quality indicator that refers to the clarity of the water. The greater the amount of suspended solids, the cloudier the water appears, and the higher the measured turbidity. Clay, silt, sand from soils, phytoplankton, bits of decaying vegetation, industrial wastes, and sewage are examples of suspended solids. In general, lower turbidity is associated with cleaner water. This is not always the case, though. For example, a clean lake may have a large amount of suspended sediments after a heavy rainfall, resulting in high turbidity. Turbidity measurements can vary across different types of environments, so they are especially useful when comparing similar environments or the same water body through time.

Water quality Limits

Turbidity readings using a turbidity meter are recommended to be below 0.3 NTUs for drinking water sources and below 5 NTUs for recreation.

The water in this river has high turbidity.

LAKE TIMTIM DOES NOT CONTAIN LEVELS OF TRIBUTYLTIN (TBT) HIGH ENOUGH TO POSE A HEALTH CONCERN.

Background Information

Tributyltin (TBT) is a chemical that used to be found in boat and marine paints. It has been banned in marine paints worldwide since 2008 because it has been shown to have toxic effects on organisms. At concentrations of 1,500,000 parts per trillion (ppt), TBT affects the development of shellfish such as mussels and clams. TBT accumulates in organisms higher up the food chain and can have negative impacts on human health. Though it may no longer be present in the water column, it can persist in aquatic sediments for many decades. Gas chromatography-mass spectrometry is a scientific technology that can be used in a laboratory to isolate and identify chemical compounds in a sample, including chemicals such as TBT.

Water quality Limits

TBT levels are required to be lower than 460,000 ppt in drinking water sources.

These workers are cleaning the side of a large ship. TBT was used to prevent algae, molluscs, and other organisms from attaching to boats and other marine equipment.

3 You will use a computer simulation to gather evidence related to your claim. Follow your teacher's instructions for accessing the <u>Lake Timtim Evidence Simulation</u>, found at <u>https://sepup.lawrence hallofscience.org/lake-timtim-evidence-simulation/</u>.

4 The **Map mode** shows multiple sites where data has been collected. You can explore the locations in any order. The small circles under the site number change colors, helping you track whether you viewed all the evidence at that site, as well as whether or not you saved the evidence for use with your claim. (White: unviewed data; gray: viewed data; green: saved evidence)
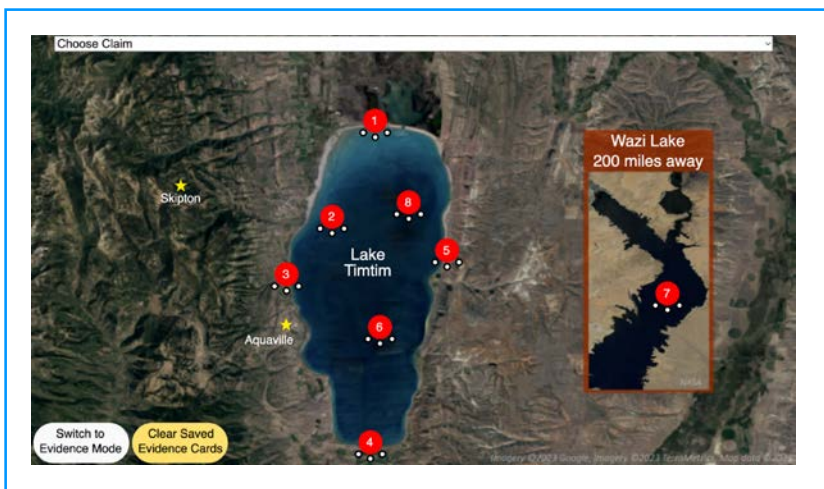
a If you determine that the data is relevant to the claim you are investigating, save it by selecting the **Save Evidence** button. You will be able to save up to eight (8) evidence statements.

b Each site contains more than one piece of evidence. Decide with your partner whether you'd like to gather more evidence at a particular location.

c Continue to visit sites until you have looked at evidence from each location.

5 Select the button to switch to **Evidence mode**. Evidence mode shows you all the pieces of evidence that you saved from the map. You can then sort it based on whether it supports or refutes your claim (or is not relevant).
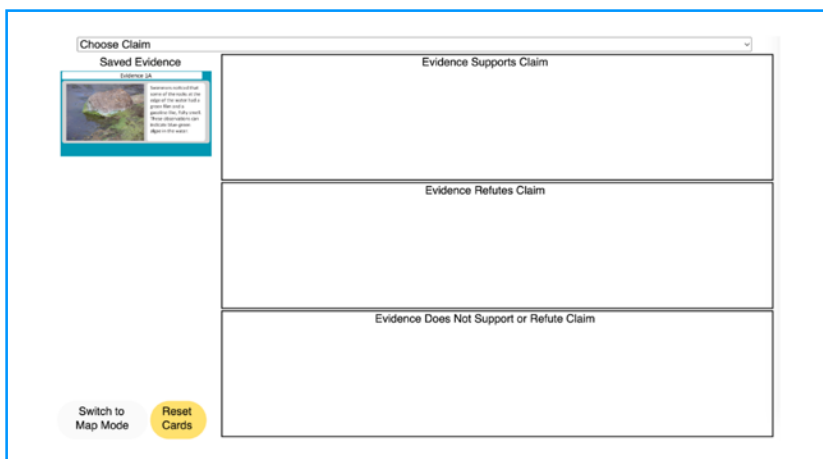
    a Select your claim at the top of the page.

    b Select the title of one of the Evidence cards that you saved (on the left side of the screen).

    c With your partner, discuss the evidence to determine how it is related to the claim.

    d Select a button to place the evidence into a category:

        • Evidence Supports the Claim
        • Evidence Refutes the Claim
        • Evidence Unrelated to the Claim

6 Complete Student Sheet 6.1, "Assessing My Evidence," by:

    a evaluating the relevance of a particular piece of evidence.

    b determining if a particular piece of evidence supports or refutes your claim.

    c explaining any limitations of your data, questions you may have, and anything else.

    d deciding if your claim has been supported or refuted by considering all the evidence.

7 Based on your conclusion, discuss with your partner whether you think Lake Timtim would make a good source of drinking water for Skipton. Record your ideas in your science notebook.

PART B: SHARING CLAIMS AND EVIDENCE ABOUT LAKE TIMTIM

8   Your teacher will pair you with another pair of students who investigated the same claim. As a group, compare the evidence you found and your conclusions about your claim.

Remember to listen to and consider the ideas of other members of your group. If you disagree with others in your group, explain why you disagree.

9   Work with your group to prepare to present your claim to the class. Use Student Sheet 6.2, " Writing Frame: Claims, Evidence, and Reasoning," to help you organize your ideas. To help you prepare, summarize the following points:

a   your claim

b   whether your claim was supported or refuted by the evidence

c   evidence relevant to your claim

10 Present your claim and evidence to the class. As your classmates share their findings, record notes on Student Sheet 6.3, "Sharing Claims and Evidence."

11 With your group, revisit your decision about whether you think Lake Timtim would make a good source of drinking water for Skipton.

BUILD UNDERSTANDING

① What is your recommendation to the Skipton City Council about the use of Lake Timtim as a drinking water source? Write a letter to the Skipton City Council supporting your answer with multiple lines of evidence and identifying the trade-offs of your decision.

② In the simulation, each location provided different evidence, such as observations from human senses, results of lab tests, or data from scientific technology.

   a Select one site and describe all the evidence found at that location.

   b How could you improve the reliability of this data?

CONNECTIONS TO EVERYDAY LIFE

③ Your teacher just told the class that soccer is the most popular sport in the world. What evidence could you collect (without using an Internet search) to evaluate this claim? Explain how this evidence would support or refute this claim.

④ In your everyday life, how do you decide if you have enough evidence to support a decision? Explain your thinking by describing an everyday example, such as when you go to sleep or how you spend money.

EXTENSION

Consider the range of water quality tests—such as pH, turbidity, and water sampling—for bioindicators such as algae. Multiple lines of evidence from these various tests are used to determine overall water quality. Select one water quality indicator and describe what information it does and does not provide about water quality. Explain why its use is important in determining water quality as well as its limitations.

KEY SCIENTIFIC TERMS

claim