Being Skeptical

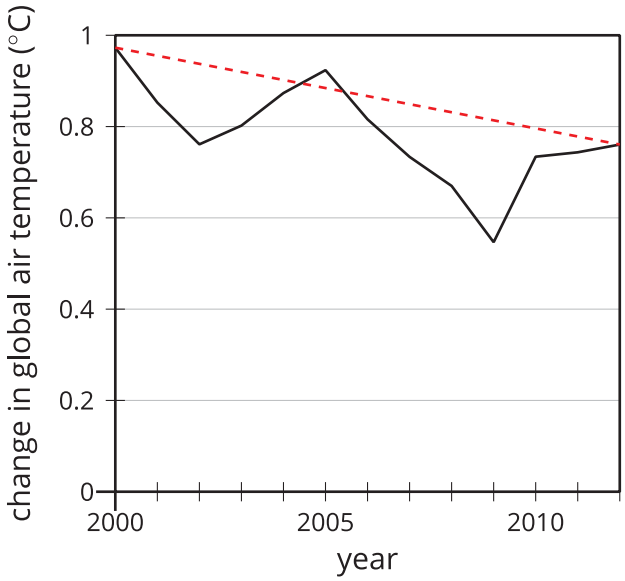
Let's examine some ways people use statistics.

1.1 Notice and Wonder: Headlines

A graph and two headlines from a website are shown.

What do you notice? What do you wonder?

1.



2. "80% of Dentists Recommend Acme Toothpaste"
3. "Pythagoras Brand Rulers Measure 20% Better"

1.2 Take Turns: Statistical Design

For each pair of prompts, one partner should read the statistical question and the first study design, and the other partner should read the second. Together, sort each study design into one of the study types:

- **Survey**
- **Observational study**
- **Experimental study**

Then select which study method would provide more insight into the statistical question. Explain your reasoning.

1. Why are students in the district missing so much school?
    a. A district administrator selects 300 student names at random from the enrollment list for the district and sends a letter to each student's home. The letter includes a page to be returned to their school signed by a parent or guardian. The page asks, "How many days has your student missed school this year?" and "What are the reasons for missing school on those days?"
    b. A district administrator chooses one of the elementary schools in the district and asks the principal to provide information about the number of absences and the excuse notes provided to the school.

2. What type of sweetener do flies prefer?
    a. A scientist puts the same amount of each sweetener into different bowls of water and counts the number of flies that drink from each bowl in 4 hours.
    b. A scientist divides the flies into different groups and gives each group only water with a certain type of sweetener in it for 3 days. The scientist then does a test on each group to see how well the flies go through a maze.

3. Is there a link between walking outdoors and serotonin levels (a natural mood stabilizer) when compared to walking on a treadmill inside?
    a. A doctor asks 5 friends to walk outdoors for 30 minutes each day for a week and 5 other friends to walk on a treadmill for 30 minutes each day for a week. The doctor then compares their serotonin levels before a walk at the beginning of the week to their levels after a walk at the end of the week.
    b. A psychologist gathers 60 people, selected at random, then randomly assigns half of the group to walk outside for 30 minutes each day and the other half to walk on a treadmill for 30 minutes each day. Everyone is to keep track of any food they eat in an app provided. Each person's serotonin levels are measured before and after each walk.

4. Do voters in the district favor a sales tax increase of 1% to fund the parks and recreation department?
    a. A politician sends a letter asking, "Would you pay extra money on your essential groceries to hire more government workers to plant flowers around the town?" to 300 voters in the district.
    b. A politician sends a letter asking, "Would you be in favor of a 1% increase in sales tax to fund the parks and recreation department in town?" to 300 voters in the district, selected at random.

Are you ready for more?

A college student wants to study how sleep impacts college students.

1. Ask a statistical question about this topic that can be answered with a survey.

2. Ask a statistical question about this topic that can be answered with an observational study.

3. Ask a statistical question about this topic that can be answered with an experimental study.

Lesson 1 Summary

There are many things a researcher should consider when collecting data about a question they are interested in. How the subjects of the study are selected as well as the details of how the study is conducted are very important in getting useful data to answer the question at hand. In particular, the researcher should consider:

- selecting subjects that are representative of the larger population
- how subjects are selected for a study or assigned to groups within a study
- making sure that the question does not lead subjects to answer a certain way
- making sure that data is collected and analyzed fairly
- using a sample that is large enough to detect differences in the presence of variability
- collecting data directly related to the question being asked

Without directly addressing these concerns, the data collected might result in misleading conclusions. Three common types of studies are surveys, observational studies, and experimental studies.

- A **survey** is a set of questions given to people to seek their responses.
- An **observational study** collects data without influencing the subjects directly.
- An **experimental study** collects data by directly influencing one variable to determine how another variable is changed.