Formulating Statistical Questions

HABITS OF MIND
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.

In this module, you will begin your formal study of statistics and the *statistical process*. Statistics is a problem-solving process because the heart of statistics is about determining a possible answer to a question that has *variability*.

TAKE NOTE...
In statistics, **variability** means that the value of the attribute you are studying can change from one person or thing to another.

The **statistical process** has four components:

STEP 1 Formulate a statistical question.

STEP 2 Collect appropriate data.

STEP 3 Analyze the data graphically and numerically.

STEP 4 Interpret the results of the analysis.

Statistical problem solving begins with a *statistical question*. A **statistical question** is a question that anticipates an answer based on *data* that vary.

› Analyze the questions posed by Bianca and Rajan.

Bianca

"What clubs am I in?"
"How many students are in the Chess Club?"

Rajan

"What clubs do my classmates belong to?"
"How many members do the clubs at my school have?"

1. Explain why Bianca's questions are not statistical questions but Rajan's are.

Bianca's questions will only have one answer.

Rajan's questions will have more than one answer (vary)

TAKE NOTE...
Data are categories, numbers, or observations gathered in response to a statistical question.

2. What kinds of answers do you expect from Rajan's questions?

The first question will give club names as answers
The second question would have number of members as answers

Statistics is about posing interesting questions that you want to answer about varying attributes.

› Gather the survey questions from the Getting Started activity.

3. Which questions from your sort are statistical questions? **Explain how you would expect the answers to those questions to vary.**

TAKE NOTE...
Keep your questions. You will need them later in the lesson.

Answering a statistical question requires collecting variable data. You will learn about two types of data: *categorical data* and *quantitative data*.

4. Are the answers to Rajan's questions categorical or quantitative?

5. Which questions have categorical answers and which have quantitative answers? **Explain your reasoning.**

TAKE NOTE...
Categorical data, or *qualitative data*, fit into exactly one of several different groups or categories. You can place **quantitative data**, or *numeric data*, on a numeric scale and compare. #'s

6 For each question, determine whether it is a statistical question. If it is not, rewrite it as a statistical question. Then, state whether the data would be categorical or quantitative.

DID YOU KNOW?
Just as you can describe graphs as discrete or continuous, you can describe quantitative data as discrete or continuous.

dont connect

connect

(a) How many text messages did you send and receive yesterday? Not statistical

How many text messages do sixth graders receive in a typical day?

Quantitative

(b) What school mascot do students at my school prefer?

Statistical

Categorical

(c) How much time did you spend watching TV or playing video games last weekend? Not statistical

How much time do sixth graders spend watching TV and playing video games each day?

Quantitative

(d) How many hours do 6th graders sleep each night?

Statistical

Quantitative

7 Write at least 2 additional statistical questions that you would have an interest in answering. State whether the data would be categorical or quantitative.

ASK YOURSELF...
Don't worry about the answer to the question, if there even is one. What would you like to know?

Methods of Data Collection

In this activity, you will learn about the second component of the statistical process: collecting appropriate data.
What is the best way to collect the data to answer the statistical question?

HABITS OF MIND

- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.

Suppose you want to collect data on the topic of school lunches.

1 Write three statistical questions that you can ask about school lunches.

(a)

(b)

(c)

You can answer a statistical question by collecting data from an entire *population* or, more commonly, from a *sample* of the population. A **population** is an entire set of items from which you collect data. A **sample** is a selection from a population.

› Consider the answer to the question, "How tall are 6th graders?"

WORKED EXAMPLE

To answer the question using the population of all 6th graders, you need to determine the heights of every 6th grader in the world.

To answer the question using a sample of 6th graders, you can collect data from just the 6th graders at your school.

Three common methods of data collection are *surveys, observational studies,* and *experiments*.

- In a **survey**, you ask people one or more questions.
- In an **observational study**, the researcher (you!) collects data by observing the variable of interest.
- In an **experiment**, the researcher imposes a condition and observes the results.

You could conduct an experiment to investigate whether sixth graders perform better on an assessment when they read a textbook or when they watch a video about the material. You would randomly assign half the students to read the text and half the students to watch the video. All students would then take the same assessment. You would compare the scores of the students in the two groups.

DID YOU KNOW?
If you have ever completed a science project, you have probably conducted an experiment.

2 For each statistical question you wrote in Question #6

- Identify the population and sample of interest.
- State whether you would use a survey, observational study, or experiment to collect the data to answer your statistical questions.
  Explain your reasoning.

ⓐ Population: All sixth graders in the world
Sample: Sixth graders at CMS

Survey: Ask students how many texts the send each day for a week so you can average their totals to get a typical day.

ⓑ Population: All CMS students
Sample: 20 kids from each grade

Survey: Ask students to select their favorite mascot from a list

ⓒ Population: All sixth graders in the world
Sample: CMS sixth graders

Survey: Ask students to record their total tv/video game times for a specific day.