



Collecting Data

11.3B

What You Will Learn

- ▶ Identify types of sampling methods in statistical studies.
- ▶ Recognize bias in sampling.
- ▶ Analyze methods of collecting data.
- ▶ Recognize bias in survey questions.

Core Vocabulary

random sample, *p. 610*

self-selected sample, *p. 610*

systematic sample, *p. 610*

stratified sample, *p. 610*

cluster sample, *p. 610*

convenience sample, *p. 610*

bias, *p. 611*

unbiased sample, *p. 611*

biased sample, *p. 611*

experiment, *p. 612*

observational study, *p. 612*

survey, *p. 612*

simulation, *p. 612*

biased question, *p. 613*

Previous

population

sample

Core Concept

READING

A *census* is a survey that obtains data from every member of a population. Often, a census is not practical because of its cost or the time required to gather the data. The U.S. population census is conducted every 10 years.

Methods of Collecting Data

An **experiment** imposes a treatment on individuals in order to collect data on their response to the treatment. The treatment may be a medical treatment, or it can be any action that might affect a variable in the experiment, such as adding methanol to gasoline and then measuring its effect on fuel efficiency.

An **observational study** observes individuals and measures variables without controlling the individuals or their environment. This type of study is used when it is difficult to control or isolate the variable being studied, or when it may be unethical to subject people to a certain treatment or to withhold it from them.

A **survey** is an investigation of one or more characteristics of a population. In a survey, every member of a sample is asked one or more questions.

A **simulation** uses a model to reproduce the conditions of a situation or process so that the simulated outcomes closely match the real-world outcomes. Simulations allow you to study situations that are impractical or dangerous to create in real life.

Identifying Methods of Data Collection Identify the method of data collection each situation describes.

- a. A researcher records whether people at a gas station use hand sanitizer.
- b. A landscaper fertilizes 20 lawns with a regular fertilizer mix and 20 lawns with a new organic fertilizer. The landscaper then compares the lawns after 10 weeks and determines which fertilizer is better

SOLUTION

- a. The researcher is gathering data without controlling the individuals or applying a treatment. So, this situation is an observational study.
- b. A treatment (organic fertilizer) is being applied to some of the individuals (lawns) in the study. So, this situation is an experiment.

On your own:

Identify the method of data collection the situation describes

- a. Members of a student council at your school ask every eighth student who enters the cafeteria whether they like the snacks in the school's vending machines.
- b. A park ranger measures and records the heights of trees in a park as they grow.
- c. A researcher uses a computer program to help determine how fast an influenza virus might spread within a city.

Solution:

- a. Survey
- b. Observational
- c. Simulation

Recognizing Bias in Survey Questions

When designing a survey, it is important to word survey questions so they do not lead to biased results. Answers to poorly worded questions may not accurately reflect the opinions or actions of those being surveyed.

STUDY TIP

Bias may also be introduced in survey questioning in other ways, such as by the order in which questions are asked or by respondents giving answers they believe will please the questioner.

Questions that are flawed in a way that leads to inaccurate results are called **biased questions**. Avoid questions that:

- encourage a particular response
- are too sensitive to answer truthfully
- do not provide enough information
- address more than one issue to give an accurate opinion

Identify and Correct Bias in Survey Questioning

A dentist surveys his patients by asking, “Do you brush your teeth at least twice per day and floss every day?” Explain why the question may be biased or otherwise introduce bias into the survey. Then describe a way to correct the flaw.

SOLUTION

Patients who brush less than twice per day or do not floss daily may be afraid to admit this because the dentist is asking the question. One improvement may be to have patients answer questions about dental hygiene on paper and then put the paper anonymously into a box.

On your own: Explain why the survey question below may be biased or otherwise introduce bias into the survey. Then describe a way to correct the flaw.

“Do you agree that our school cafeteria should switch to a healthier menu?”

SOLUTION

It encourages a yes response; Sample answer: Should the school cafeteria switch to a healthier menu?

Homework: page 615; Exercises 21 – 32, 34