3.2 Avoiding Bias in Data Collection

▶ **GOAL**

Understand different ways to collect data and analyze bias in data-collection methods.

Learn about the Math

At Fleury Public School, many students seem to arrive at class late. The student council has proposed starting school 1 h later. Ms. Chan, the student council advisor, wants the council members to gather some data to support their proposal.

? How should the council members collect their data?

The council members start by brainstorming ways to gather the data they need.

Peter: "I think we should try an experiment. Half the school could start at the regular time, and the other half could start 1 h later. We could see if there are fewer students in the second group who are late for school."

Jasleen: "We should do some research. If we find other schools that have a later start than us, we can ask them what the good and bad points are."

Ms. Chan: "But what works for another school may not work here."

Heather: "Let's survey all the students in Grade 7 to find out their opinions. We could use actual quotes to support our proposal."

Ms. Chan: "That's a good idea, Heather, but you might get **biased results** . We have students from kindergarten to Grade 8 in this school. The Grade 7 students may not have the same sleep patterns as younger students do. They may not be a good **sample** of the entire **population** ."

Zach: "Why don't we take a **census** ? We could make a questionnaire and give it to every student in the school."

Ms. Chan: "I think most students will want to start later, but I'm not sure if their parents or teachers will. We have to get these opinions, too."

biased results
when the results of a survey of one group are not likely to apply to another group selected from the same population

sample
a part of a population that is used to make predictions about the whole population

population
the total number of individuals or items

census
the counting of an entire population

Reflecting

1. Whose ideas involve collecting primary data, and whose ideas involve collecting secondary data? Explain.

2. Whose suggestions are most likely to provide biased results for the student population? In what way would the data be biased?

3. Whose suggestions are most likely to provide unbiased results? Explain.

4. Would Ms. Chan's suggestions create or remove a source of bias? Explain.

Work with the Math

Example: Analyzing sources of bias in a survey

The student council decides to conduct a survey to see if the school community is in favour of changing the start time. How should the survey be set up? How might the results be biased?

Students' Solutions

Idea for Survey	Potential for bias
Jasleen: "We could arrive early one morning and survey the first 100 people—students, teachers, and parents—who walk by."	This survey would be biased in favour of those who prefer an early start. The first 100 people would not be those who have trouble arriving on time.
Heather: "At morning recess, we could phone 100 families selected randomly from the home phone number list."	This survey would be biased against parents who work outside the home, assuming that you don't leave a message that is answered.
Peter: "We could go down to the office after morning announcements and survey the first 100 people who walk into the office."	This survey would be biased in favour of those who prefer a late start. Many of the people in the office at this time would be arriving late and signing in.

Ⓐ Checking

5. The following students suggest other ways to conduct the survey. Would the results in each case be biased? Justify your answers.

a) Zach: "Ask 10 students, 10 teachers, and 10 parents. Then combine their answers."

b) Samantha: "Use the office student list, and survey the first 100 names."

c) Takumi: "Set up a desk in the front foyer, and let anyone who wishes complete the survey."

6. Explain whether each source is an example of primary data or secondary data.

    a) telephone interviews

    b) data from an encyclopedia

    c) information from a newspaper

Ⓑ Practising

7. Explain how each source could involve primary data or secondary data.

    a) completed questionnaires

    b) votes at an election

    c) observations of bird behaviour at a park

8. A survey may be biased in favour of or against different parts of a population. For each situation below, describe the groups for which the survey is likely to show bias.

9. For each survey question below, describe the sample you would use to avoid bias. Explain why your sample would avoid bias.

    a) What is the most common family size in your community?

    b) What are the most popular television shows for families in Ontario?

    c) What is the favourite type of music for people in your community?

    d) Do more people in your province prefer hockey or soccer?

    e) What is the best day of the week for students?

    f) If a movie is shown at one time only at the theatre, should it start at 4:00 p.m., 7:00 p.m., or 10:30 p.m.?

	Situation	Group that survey is likely biased in favour of	Group that survey is likely biased against
a)	A company selects every 100th name in the telephone book to call between 10:00 a.m. and 2:00 p.m., and doesn't leave messages. The question is "How many teenagers live in your home?"		
b)	Every 10th person who walks by a particular intersection in downtown Toronto is asked, "Should hunting be banned in Ontario?"		
c)	Every third person who enters a large toy store is asked, "Should the old age pension be increased?"		
d)	On Saturday mornings, from 9:00 a.m. to 11:00 a.m., every 10th family entering the local zoo is asked, "How much time, on average, do you spend with your children?"		
e)	An Internet survey is conducted to find out about computer use in Canadian households.		

10. The following names have been suggested for a new kind of cookies: Chocolatines, Mocha Chews, and Chocolicious. Explain why you would or would not use each method for collecting data to decide the best name.

    a) census   **c)** questionnaire

    b) interview   **d)** survey

11. Ms. Chan says that a census is the most accurate way to find out information about an entire population because each person in the population has an opportunity to respond. Why do you think a survey is used more often than a census?

12. When designing a survey, why should you be aware of bias? Explain one way to eliminate it.

⓰ Extending

13. A town council needs to determine whether to spend money on building a new sports arena or a new library for the town. The council members want to make sure that they have the support of most of the 15 000 residents of the town. Decide on the best method to collect the data by ranking the following methods from best to worst. Then explain advantages and disadvantages of each method.

    a) telephone survey

    b) census

    c) mail-in questionnaire

    d) presentations by citizens

    e) research

    f) door-to-door interviews

Mental Math

MULTIPLYING AND DIVIDING BY 10, 100, AND 1000

You can multiply or divide a whole number or a decimal number by 10, 100, or 1000 by thinking about place value.

For example, to multiply 21.34 by 100:
tens become thousands,
ones become hundreds,
tenths become tens,
hundredths become ones.

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths
		2	1 .	3	4

$$\times\ 100$$

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths
2	1	3	4 .	0	0

1. What happens to each digit in a number when the number is multiplied or divided by 10, 100, or 1000?

2. Calculate.

    a) 20×100 **c)** 10×0.425 **e)** 0.035×1000 **g)** 10.05×1000

    b) $4200 \div 10$ **d)** $14.55 \div 10$ **f)** $120.6 \div 100$ **h)** $1250 \div 1000$