

# Effective Surveys

## Learning Goals

- define important terms for surveys
- discuss validity and bias in questions and conclusions

## Collecting Data

### Survey

- » . in person
- » . observation
- » . on line
- » . phone

### Primary Data

- » data you collect yourself
- » ex: ask classmates about shoe size

### Secondary Data

- » data collected by other people
- » ex:
  1. More data
  2. Data from the "past"

**Frequency (Tally) Chart**

- » a table to organize the results of a survey

**Population**

- » collection of data from all people who are involved
- » this is also called a census
- » ex: how much students at MT spend on lunch

**Sample**

- » it is too time consuming to ask everyone so only a part of the population is surveyed
- » ex: one class from each grade
- » we use this information to make general predictions about the whole population

**Census**

- » survey done by Statistics of Canada every 5 years
- » All Canadians receive a survey through the **mail** that they are required to send back to the government
- » used to make decisions that affect the population at large

**Survey could be...****Reliable**

- » the results are reliable if the results can be duplicated by another research group

**Biased**

- » the population is not represented equally
- » ex: only ask grade 12s about lunch\$
- » the questions are not appropriate
- » ex: asking people coming out of Tim's if they like Tim's.

**Valid**

- » the results represent the population
- » ex: ask 30 or 200, the results should be the same

## Surveying and Questionnaires

**Population** Set of all things/people being studied.

**Sample Size** Part of the population.  
Should be at least 10% of the population.

**Sampling Technique** Method of obtaining info.  
Can be random or non-random.

**Bias** An emphasis on characteristics NOT typical for the entire population.

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### Case Study 1 What Drinks Should Be Sold in the School Vending Machine?

A high school vending machine can sell four different bottled drinks. The student council surveys the students to determine what drinks should be sold.

- There are 1200 students in the school.
- The student council prepares this interview script and tally sheet:

*Please help us select four bottled drinks for the vending machine by answering these questions.*

*What grade are you in?*

*Which drink would you be most likely to buy from a school vending machine? Please choose one.*

Vending Machine Survey

Student's grade	Drink choice					
	Cola	Diet cola	Sport drink	Iced tea	Cranberry juice	Apple juice

- Several council members gather outside the cafeteria during lunch one day. They interview students walking by and record the students' choices on tally sheets. They ask each student to participate only once.
- The council members stop when they have 100 responses.
- They tabulate the results and determine the four most popular drinks.

**pg 210 Case Study 2**  
**Are Part-time Jobs Related to Sleep Deprivation?**

A reporter wants to see if there is a correlation between the number of hours a high school student spends working at a part-time job and the number of hours of sleep the student gets. He designs this questionnaire.

1.  Male  Female

2.  Grade 9  Grade 10  
 Grade 11  Grade 12

3. Do you have a part-time job?  
 No  Yes  
 Number of hours you work in a typical week: \_\_\_\_\_

4. Doctors say teens require 8.0 h to 9.5 h of sleep each night. About how many hours of sleep do you get on a typical night?

Less than 6 h  
 Between 6 h and 7 h  
 Between 7 h and 8 h  
 Between 8 h and 9 h  
 Between 9 h and 10 h  
 10 h or more

He puts the questionnaire in his newspaper and invites students or their parents to e-mail or call in their responses. He collects 200 responses, then analyses the data.

In partners, analyze the validity of the surveys provided on page 209 and 210 of the textbook. Think about:

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What is the population? What is the population size?  
 Students at HS 1200

What is the sample size?  
 100 (too small)

What was the method of selecting the sample?  
 in person  
 => convenience

Does this method contain any bias?  
 yes -> non-random

Are the survey questions clear and free of bias?  
 yes

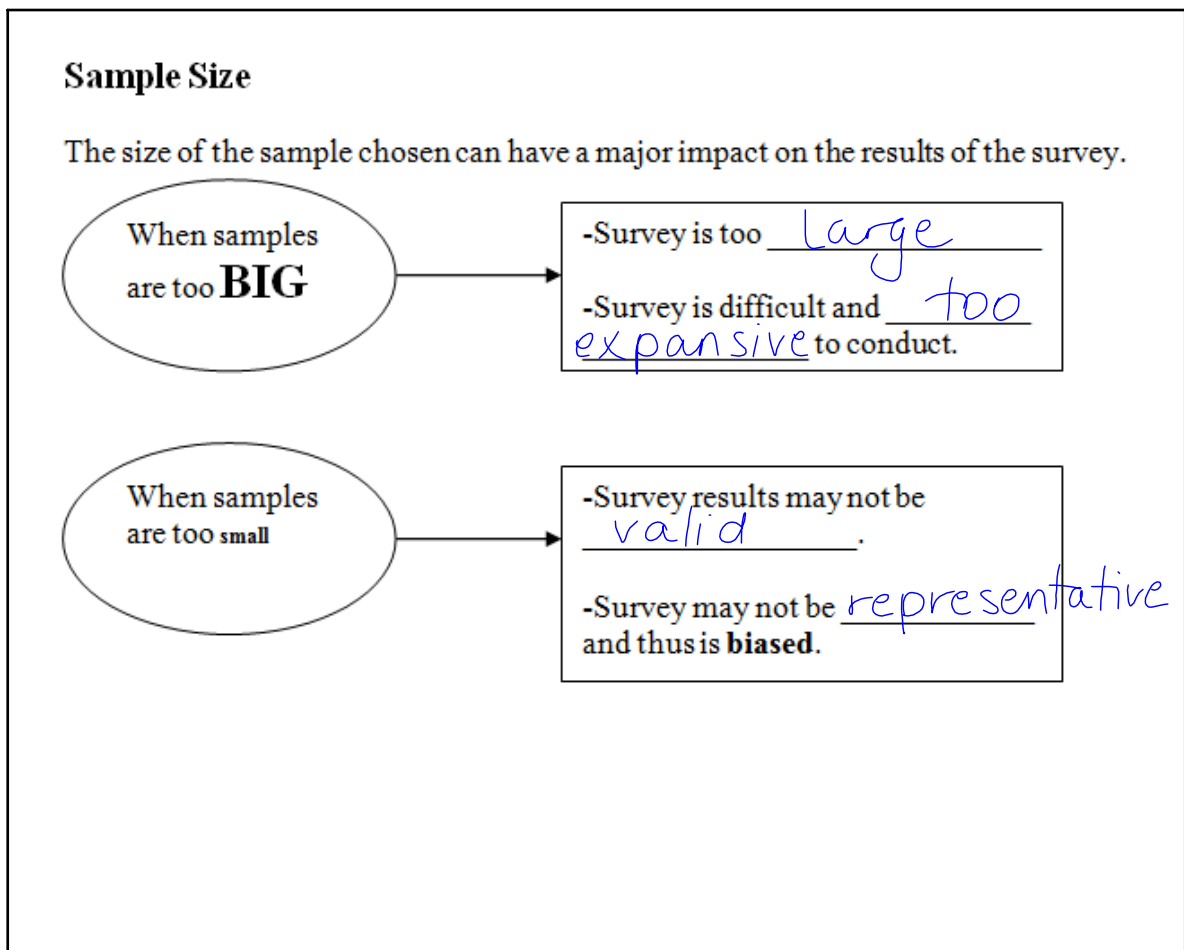
Was the method of conducting the survey biased?  
 interview

CONCLUSION: Will this survey lead to valid results? Why or why not?

NO  
 . sample size too small  
 . non-random

students and parents  
 -> Large  
 200 (too small)  
 voluntary  
 yes -> limits to people who read the newspaper  
 NO -> Doctors say...  
 no  
NO . sample selection  
 . sample size too small  
 . leading question

Sampling Techniques	
<p>A <b>random sample</b> is one that is chosen with every member of the population having an <u>equal</u> chance of being part of the sample. This is not true for non-random samples, and thus they <u>often</u> do not give a representative sample.</p>	
Random Sampling Techniques	
<p>Simple Random Sample Random from the whole population</p>	<p>Example pulling name out of a hat</p>
<p>Stratified Sample Population is divided into categories</p>	<p>Example grade</p>
<p>Cluster Sample Put people in groups.</p>	<p>Example Neighbourhoods</p>
<p>Systematic Sample Pattern is followed</p>	<p>Example choose every 10<sup>th</sup> person</p>
Non-Random Sampling Techniques	
<p>Convenience Sample survey people nearby</p>	<p>Example survey in Barrhaven only</p>
<p>Judgement Sample surveyer decides who to choose</p>	<p>Example choose a lunch table that <u>you</u> think is representative</p>
<p>Voluntary Sample answering is optional</p>	<p>Example · newspaper · radio/TV</p>



A survey is **representative** if it is 10% of the entire population.

**Biased Questions**

If a question unnecessarily prompts a respondent's answer or uses words that direct a respondent's answer, then it is biased and will lead to unreliable results.

**Survey Techniques**

There are usually two methods of survey techniques: written or interview.

- If a survey contains sensitive information, then a written technique is better.
- If a survey needs to be further explained, then a interview technique is best.

**Assessing the Survey Process**

To assess the entire survey process, ask the following questions:

1. Is the **sample size** large enough?
2. Is the **sample representative**?
3. Are the survey **questions unbiased**?
4. Was the **collection method** appropriate?

**Statistical Bias**

**statistical bias**

- external influences that may affect the accuracy of statistics
- results in error that cannot be corrected by repeating an experiment many times

**Investigate**

When you think of bias, you might generally think of a lack of objectivity. **Statistical bias** occurs when a systemic error contributes to the statistics for a sample being different from those of the population. Surveys and scientific studies can only be accurate if they are free from statistical bias. Bias can occur for many, often unintentional, reasons.

**Sources of Bias**

Each cartoon depicts a situation that could potentially provide inaccurate survey results. Describe each situation.



**Example 1****sampling bias**

- bias that occurs when the sample does not reflect the population being studied
- caused by the method of sampling or data collection
- examples of sampling bias include a non-random sampling method and too small a sample

**Sampling Bias**

Identify the **sampling bias** in each situation.

- To determine how people feel about a new product, 20 people were interviewed through a random selection of telephone numbers.
- A pollster in a shopping mall randomly selected people to interview as they walked by.

**Solution**

a., sample size is too small

b., not everyone in the population is represented

**Example 2****non-response bias**

- bias that occurs when specific groups are under-represented in a sample due to low rates of participation
- also occurs if there is a low overall response rate (below 80%), as non-responders may have different opinions than responders
- mail-in surveys tend to have a high level of non-response in comparison to telephone surveys

**Non-Response Bias**

A neighbourhood survey about children's playground equipment in a local park was sent to randomly selected households. Approximately 30% of the people responded and, in particular, people in condominiums tended not to respond. Explain how this situation represents **non-response bias** and suggest a way to correct it.

**Solution**

- low response rate
- people in condos may have a different opinion about the park

**Example 3****measurement bias**

- bias that occurs when the measurement technique has errors which cause unreliable results
- sources include improper measurements caused by the person conducting the study or improper calibration of measurement tools

**Measurement Bias**

Provide an example of **measurement bias** that involves human error. Suggest how to improve the accuracy of the survey.

**Solution**

- using the wrong units
- non-accurate measurements
- measuring tools are not calibrated properly

**Example 4****response bias**

- bias that occurs when survey participants purposely give false or misleading answers, perhaps because they do not want to be embarrassed or because they want to influence the survey results
- another source of response bias is leading questions, where the question favours one response over another

**Response Bias**

Explain the possible **response bias** in each situation. Suggest how to eliminate the bias.

- A class of grade 9 boys was asked by their physical education teacher to put up their hands if they have had a date with a girl.
- A survey question asks, "Do you think the Liberty government should be re-elected to continue its good work on the environment?"

**Solution**

- a., too personal  
∴ may lie
- b., leading question



Seatwork

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