U4D5_T Statistical Bias

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U4D5_T Statistical...

A valid conclusion is one that is supported by unbiased data that has been interpreted properly.

Statistical Bias can occur in the collecting of the data and/or in the analyzing and reporting of the data.

Biases in Collecting Data

Statistical bias occurs when a systemic error contributes to the statistics of a sample being different from those of the population being sampled.

- **Sampling Bias**

  - **Bias occurs when the sample does not reflect the population being studied.**
  - **Sample size too small OR not random**
  - Example – a pollster in a mall randomly selected people to interview as they walked by.

See Ex. 1 Pg. 237

Sampling Bias

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

a) To determine how people feel about a new product, 20 people were interviewed through a random selection of telephone numbers.

b) A pollster in a shopping mall randomly selected people to interview as they walked by.

Solution

a) Although the people were randomly selected, the sample size was too small. A good poll needs to have hundreds or even thousands of participants to ensure all groups are represented in the sample proportionate to their size in the population.

b) The pollster may have thought the participants were randomly selected, but not everyone in the target population had an equal chance of being interviewed. The survey may generate valid opinions, but all the people in the shopping mall were not proportionately represented.

- **Non-Response Bias**
  - **Bias occurs when specific groups are under-represented in a sample due to low rates of participation**
  - Example – a mail-in survey was sent to randomly selected households to ask them their opinions about a new playground in the neighbourhood.

See Ex. 2 Pg. 237

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

There is non-response bias because there was a very low response rate. The people in the neighbourhood might not care about the issue enough to return the survey. People living in condominiums may have different opinions about the park, so the pollsters would need to contact these people again to improve the response rate.

- **Measurement Bias**
  - Bias occurs due to the measurement technique having errors which cause unreliable results.
  - Example – when measuring the height of students in our class some students mistakenly measured in inches instead of in cm.

See Ex. 3 Pg. 238

Measurement Bias

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

Solution

When recording the volume of solution after a chemical reaction, the lab assistant wrote some of the units using the abbreviated form "ML" instead of "mL." The abbreviation ML could be mistaken for megalitres. This error could be avoided by having all the people in the study use the same recording table, which has the correct units of measurement written in the column headings.

- **Response Bias**
  - **Bias occurs when survey participants give false or misleading answers (may be embarrassed or want to skew results).**
  - **A "leading" survey question can also result in response bias.**
  - Example – a class of grade 9 students was asked by their gym teacher to put up their hands if they have had a date with a girl.

See Ex. 4 Pg. 238

Response Bias

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

a) 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.

b) A survey question asks, "Do you think the Liberty government should be re-elected to continue its good work on the environment?"

Solution

a) This poll contains response bias, because the question is personal and some students may lie about their dating habits. The teacher could ask students to answer the question by submitting their answer anonymously on a slip of paper.

b) This is a leading question that emphasizes the Liberty government's achievements. The surveyors should only ask for the participants' opinions, not provide an opinion of their own. A non-biased question would be: "Do you think the Liberty government should be re-elected?"

Read Page 239 "Key Concepts" and Answer "Discuss the Concepts"

Key Concepts

- A systemic error that influences the difference between the statistical values of a population and those of a sample is called statistical bias.
- Sampling bias occurs when the sample does not accurately reflect the general population. This could be caused by the sampling method.
- Non-response bias occurs when certain groups in the population are under-represented in the rate of response. For example, rural residents of a county might be under-represented in a poll, causing the results to be more representative of urban dwellers.
- Measurement bias occurs when there are errors in the measurement technique. Improper calibration of equipment and human error in reading and recording measurements are two sources of measurement bias.
- Response bias occurs when respondents purposefully give inaccurate answers, such as lying to avoid embarrassment, or when a survey uses leading questions that cause respondents to favour a certain answer.

Discuss the Concepts

D1. Radio call-in shows about controversial topics such as gun control and youth crime generally have an over-representation of people with strong opinions. What type of bias would this represent? Explain.

D2. A school board survey contains non-response bias, showing a low rate of responses from immigrant families.

a) What might cause the non-response bias? How could it be reduced?

b) Explain why it is important to reduce the non-response bias.

Practice: Pgs. 239-243 # 1-6, 9, 12, 13 Answers on pg. 550