Sampling variation

Mana Maths

Te reo Māori terms

tauira
sample
Open in Te Aka

raraunga
data
Open in Te Aka

rerekētanga
variation
Open in Te Aka

tauanga
statistics
Open in Te Aka

Sampling variation — Foundation

1. What does sampling variation mean?

2. Two random samples from the same population give slightly different results. What idea does this show?

3. If you ask 30 students their favourite sport, will another random sample of 30 students always give exactly the same percentages?

4. Circle the larger sample size: 30, 100, 1000.

5. Which sample size usually gives the most stable results: 30, 100, or 1000?

6. Which sample size usually has the most sampling variation: 30, 100, or 1000?

7. A random sample of 30 students has 18 who walk to school. Write this as a proportion.

8. A second random sample of 30 students has 15 who walk to school. Do the two samples have the same result?

9. A sample of 100 students gives 42% choosing soccer. Another sample of 100 gives 39%. Is this possible because of sampling variation?

10. A sample of 1000 voters gives 51% support. Another sample of 1000 gives 50% support. Is a small difference like this surprising?

11. Complete: Bigger samples usually have _____ sampling variation.

12. Complete: Smaller samples usually have _____ sampling variation.

13. Why is a sample of 1000 usually more reliable than a sample of 30?

14. Give one reason why two fair random samples can still give different results.

Sampling variation — Proficient

1. A school surveys two random samples of 30 students about owning a bike. Sample A gives 40%. Sample B gives 53%. Explain why both results could still be reasonable.

2. Two random samples of 100 students are asked if they have a part-time job. One sample gives 18%, the other gives 21%. What does this suggest about sampling variation for samples of 100?

3. Two random samples of 1000 students are asked if they bring lunch from home. One sample gives 64%, the other gives 65%. Why are the results closer together?

4. Put these sample sizes in order from most expected sampling variation to least: 30, 100, 1000.

5. A true population proportion is close to 50%. Which sample size would you trust more for an estimate: 30 or 1000? Give a reason.

6. A class claims, "Our first sample gave 70%, so the population must be exactly 70%." Explain why this is poor reasoning.

7. Sample A of size 30 gives 12 students preferring basketball. Sample B of size 100 gives 38 students preferring basketball. Which sample gives the stronger estimate of the population proportion? Why?

8. A council takes three random samples on support for a new park: $17/30$, $56/100$, $548/1000$. Which result would you expect to be closest to the true population proportion?

9. Explain why increasing sample size usually reduces sampling variation, even when the sampling method stays random.

10. A poll of 30 people shows 60% support. Another poll of 30 shows 43% support. Should we be more worried about bias or accept that this might happen with small samples? Explain briefly.

11. A poll of 1000 people shows 49% support and another poll of 1000 shows 62% support. Does this large difference suggest sampling variation alone, or should you question the sampling process? Explain.

12. Write one sentence comparing the likely spread of results from repeated samples of size 30 and repeated samples of size 1000.

Sampling variation — Excellence

1. Three random samples estimate the proportion of students who own a laptop: $11/30$, $37/100$, $381/1000$. Which estimate would you report first, and why?

2. A student says, "If a sample is random, every sample should give the same result." Explain carefully why this is false.

3. Two schools run polls on the same issue. School A uses repeated random samples of 30. School B uses repeated random samples of 1000. Compare the likely spread of their sample proportions.

4. A survey result from 30 people is used in a newspaper headline as if it represents the whole city exactly. Write one criticism using the idea of sampling variation.

5. A random sample of 100 gives 48% support. A random sample of 1000 gives 51% support. Which one should carry more weight when estimating the population value? Explain.

6. Explain why a larger sample size does not remove sampling variation completely.

7. A sample of 30 gives 80% support, but three later samples of 1000 give 52%, 49%, and 51%. Which result is more believable for the population, and why?

8. A researcher gets these percentages for the same question from repeated random samples: $44\%, 61\%, 47\%, 58\%, 52\%$. What do these changing results suggest about sampling variation?

9. Another researcher gets $49\%, 50\%, 51\%, 50\%, 49\%$. What does this suggest about their sample size compared with the first researcher?

10. Explain the difference between sampling variation and bias.

11. A sample of 1000 and a sample of 30 both come from the same population. Which sample is more likely to give an estimate close to the true population proportion? Justify your answer without saying “because it is bigger” only.

12. Write a short statistical statement comparing how sample sizes of 30, 100, and 1000 affect sampling variation.