LESSON MAKER PRO

What Can Data Say?

Use how a study was designed to decide what its results mean.

HIGH SCHOOL · A2S.DSP.E.28

A2S.DSP.E.28 "Describe differences between randomly selecting samples and randomly assigning subjects to experimental treatment groups in terms of inferences drawn regarding a population versus regarding cause and effect."

NAME _____ DATE _____

TWO KINDS OF RANDOM

Randomly selecting students from a population helps you use their results to make estimates about that population. Randomly assigning students to treatment groups helps you judge whether a treatment caused a difference. To find a difference in group averages, subtract the comparison group's average from the treatment group's average.

WORKED EXAMPLE

A school randomly selects 52 students from its grade 10 roster. It randomly assigns them to solve puzzles with a playlist or in silence. What is the difference in average scores, and what kinds of conclusions does this design support?

PUZZLE SCORES

Group	Students	Average score
Playlist	26	81
Silence	26	69

1. Subtract the silence average from the playlist average: 81 - 69 = 12 points.
2. Random selection supports an estimate about the school's grade 10 students.
3. Random assignment supports a cause-and-effect conclusion about the playlist.

Answer: The playlist group's average was 12 points higher. The study supports estimating the effect for the school's grade 10 students and judging whether the playlist caused a difference.

PRACTICE 6 problems

1 A school randomly selects 25 students from its roster. Of those students, 15 prefer a later start time. What fraction of the sample prefers a later start? Can the school use this result to estimate the preference of all its students?

ANSWER _____

2 Forty-two volunteers are randomly assigned to use a tutoring app or not use it. Find the difference in average scores, app minus no app. Does random assignment support a cause-and-effect conclusion?

QUIZ SCORES

Group	Average score
App	77
No app	71

ANSWER _____

3 A school randomly selects 48 students from its grade 11 roster and randomly assigns them to review with an app or on paper. Find the difference in average scores, app minus paper. Does the design support conclusions about the school's grade 11 students, cause and effect, both, or neither?

REVIEW SCORES

Group	Students	Average score
App	24	88
Paper	24	80

ANSWER _____

4 A school randomly selects 36 students from its grade 9 roster. Twenty-seven say they would attend an after-school event. What fraction of the sample would attend? Does this survey show that offering the event causes students to stay after school?

ANSWER _____

5 Forty volunteers choose whether to stretch before gym class. The 20 who stretch average 9 laps, and the 20 who do not average 7 laps. Find the difference in averages, stretch minus no stretch. Does this study support a causal conclusion or an estimate for all students at the school?

ANSWER _____

6 A school randomly selects 35 students from its grade 10 roster. Students choose their own study plan. Those who choose practice questions average 84 on a quiz; those who choose rereading average 78. Find the difference, practice questions minus rereading. Can the school describe an association for its grade 10 students, claim a causal effect, or both?

ANSWER _____

APPLY IT Show your work

1 A school randomly selects 72 students from its grade 10 roster to watch a short video for class. It randomly assigns some to watch with captions and the rest without captions. The caption group averages 85 on a follow-up quiz; the no-caption group averages 76. Find the difference, captions minus no captions. Explain which conclusions the school can draw.

WORK SPACE

ANSWER _____

2 Fifty students volunteer to test a new game setting. Researchers randomly assign them to play with the setting on or off. The setting-on group averages 46 points, and the setting-off group averages 41 points. Find the difference, on minus off. Can the researchers conclude that the setting caused a difference? Can they extend the result to every student at the school?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Two studies at the same school compare digital flashcards with paper cards. In Study A, 54 students are randomly selected from the school roster, then choose which method to use. In Study B, 54 volunteers are randomly assigned a method. In each study, the flashcard group averages 90 and the paper-card group averages 82. Find the difference in each study. Explain why the same difference supports different conclusions.

WORK SPACE AND ANSWER

What Can Data Say?

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A school randomly selects 25 students from its roster. Of those students, 15 prefer a later start time. What fraction of the sample prefers a later start? Can the school use this result to estimate the preference of all its students?	**15/25 = 3/5. Yes, random selection supports an estimate for all students at the school.**
2	Forty-two volunteers are randomly assigned to use a tutoring app or not use it. Find the difference in average scores, app minus no app. Does random assignment support a cause-and-effect conclusion?	**77 - 71 = 6 points. Yes, random assignment supports a cause-and-effect conclusion for these volunteers.**
3	A school randomly selects 48 students from its grade 11 roster and randomly assigns them to review with an app or on paper. Find the difference in average scores, app minus paper. Does the design support conclusions about the school's grade 11 students, cause and effect, both, or neither?	**88 - 80 = 8 points. Both: random selection supports an estimate for the school's grade 11 students, and random assignment supports a cause-and-effect conclusion.**
4	A school randomly selects 36 students from its grade 9 roster. Twenty-seven say they would attend an after-school event. What fraction of the sample would attend? Does this survey show that offering the event causes students to stay after school?	**27/36 = 3/4. No, the survey does not test whether offering the event causes students to stay.**
5	Forty volunteers choose whether to stretch before gym class. The 20 who stretch average 9 laps, and the 20 who do not average 7 laps. Find the difference in averages, stretch minus no stretch. Does this study support a causal conclusion or an estimate for all students at the school?	**9 - 7 = 2 laps. Neither: students chose their groups, and the sample consisted of volunteers.**
6	A school randomly selects 35 students from its grade 10 roster. Students choose their own study plan. Those who choose practice questions average 84 on a quiz; those who choose rereading average 78. Find the difference, practice questions minus rereading. Can the school describe an association for its grade 10 students, claim a causal effect, or both?	**84 - 78 = 6 points. The school can describe an association for its grade 10 students, but it cannot claim a causal effect.**

PART 2 · APPLY IT

1. **85 - 76 = 9 points. The design supports estimating the effect of captions for the school's grade 10 students and judging whether captions caused a difference.** Subtract the two averages. Random selection supports an inference about the grade 10 population, and random assignment supports a causal inference.
2. **46 - 41 = 5 points. Random assignment supports a causal conclusion for the volunteers. Because the students volunteered rather than being randomly selected, the study does not support extending the result to every student at the school.** Subtract 41 from 46. Use random assignment to assess cause and effect, then check how participants were selected before extending the result to a population.

CHALLENGE

Both differences are 90 - 82 = 8 points. Study A supports an estimate of the association between method choice and score for students at the school, but not a causal conclusion. Study B supports a causal conclusion for the volunteers, but not an estimate for all students at the school.

Accept equivalent fractions and wording that correctly separates population inference from causal inference. A difference in averages alone does not establish either kind of inference.