LESSON MAKER PRO

# Gaps and Causes

*Compare results, then decide what they show.*

**HIGH SCHOOL · MT.PLUS.DATA.DES.2.a**

**MT.PLUS.DATA.DES.2.a** "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 by: Explaining the consequences..."

NAME _____ DATE _____

## TWO KINDS OF RANDOM

Randomly selecting students helps you use a sample to describe a larger group. Randomly assigning students to treatments helps you test cause and effect. If students choose their own groups, other differences between them could explain a gap in results.

## WORKED EXAMPLE

Students chose whether to use a quiz app. Find the gap in mean scores. Does it prove the app helped?

**QUIZ SCORES**

| Group | Mean score |
|---|---|
| Used app | 74 |
| Did not use app | 68 |

1. Subtract the means: 74 - 68 = 6.
2. App users scored 6 points higher on average.
3. Students chose their groups, so other differences could explain the gap.

**Answer: The gap is 6 points. It does not prove the app helped.**

## PRACTICE 4 problems

**1** Students chose whether to attend tutoring. Attendees averaged 82; others averaged 71. Find the gap. Does it prove tutoring raised scores?

**ANSWER** _____

**2** Students were randomly assigned to study with or without music. Their mean scores were 37 and 29. Find the gap. Does this give evidence that music affected scores?

**ANSWER** _____

**3** A random sample of 90 students included 54 who use a notes app. Estimate the percent of the school that uses it. Does this show the app raises grades?

**ANSWER** _____

**4** Students chose a morning or afternoon training session. Their mean gains were 14 and 9 points. Find the gap in gains. Why might the session time not be the cause?

**ANSWER** _____

## APPLY IT Show your work

**1** A school randomly selected 50 students, then randomly assigned them to stretch before a focus test or not stretch. Mean scores were 22 and 17. Find the gap. Can the results support a claim about the school and a claim that stretching affected scores?

WORK SPACE

**ANSWER** _____

**2** Students chose whether to lock their phones during homework. Use the table to find the gap in mean quiz scores. Does it prove locking phones improved scores? Name one other possible explanation.

**HOMEWORK CHOICES**

| Group | Mean quiz score |
|---|---|
| Locked phones | 83 |
| Did not lock phones | 75 |

**ANSWER** _____

## CHALLENGE One step up

Students chose one of two review plans. Find each group's gain from before to after and the gap between the gains. Does that gap prove Plan A caused a larger gain? Explain.

**REVIEW PLAN SCORES**

| Plan | Before | After |
|---|---|---|
| A | 48 | 70 |
| B | 65 | 75 |

WORK SPACE AND ANSWER

**ANSWER KEY**

# Gaps and Causes

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## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | Students chose whether to attend tutoring. Attendees averaged 82; others averaged 71. Find the gap. Does it prove tutoring raised scores? | **11 points; no, students chose their groups.** |
| 2 | Students were randomly assigned to study with or without music. Their mean scores were 37 and 29. Find the gap. Does this give evidence that music affected scores? | **8 points; yes, random assignment gives evidence of an effect for these students.** |
| 3 | A random sample of 90 students included 54 who use a notes app. Estimate the percent of the school that uses it. Does this show the app raises grades? | **60%; no, the survey cannot show whether the app raises grades.** |
| 4 | Students chose a morning or afternoon training session. Their mean gains were 14 and 9 points. Find the gap in gains. Why might the session time not be the cause? | **5 points; students who chose different times may differ in other ways.** |

## PART 2 · APPLY IT

1. **5 points; yes to both claims.** Subtract 17 from 22. Random selection supports an inference about the school's students, and random assignment supports a causal inference.
2. **8 points; no. Students who locked their phones may also have studied longer.** Subtract 75 from 83. Because students chose their groups, study time or another uncontrolled variable could explain the gap.

## CHALLENGE

**Plan A gained 22 points; Plan B gained 10 points. The gap in gains is 12 points. It does not prove Plan A caused the larger gain because students chose their plans and may have differed in other ways.**

Accept any plausible uncontrolled variable for a self-selected comparison. Random assignment supports causal evidence, but it does not guarantee that groups are identical.