LESSON MAKER PRO

Fair Group Comparisons

Look beyond the overall difference.

HIGH SCHOOL · A2S.DSP.F.29

A2S.DSP.F.29 "Explain the consequences, due to uncontrolled variables, of non-randomized assignment of subjects to groups in experiments."

NAME _____ DATE _____

CHECK BEFORE YOU CONCLUDE

When people choose their own groups, the groups may differ before an experiment begins. Calculate the overall difference, then check whether a preexisting difference could help explain it. An overall difference alone does not prove that the treatment caused the result.

WORKED EXAMPLE

Students chose whether to use a test-prep program. The table shows how many passed. Compare the overall pass rates, then check the rates for students with the same level of prior preparation.

TEST-PREP PROGRAM AND PASSING

Prior preparation	Used program: passed/total	Did not use: passed/total
High	21/28	9/12
Low	3/12	7/28

1. Add across preparation levels: 24/40 passed with the program, and 16/40 passed without it.
2. The overall pass rates are 60% and 40%, a difference of 20 percentage points.
3. Within the high-preparation level, both rates are 3/4. Within the low-preparation level, both rates are 1/4.

Answer: The program group had a 20-percentage-point higher overall pass rate, but the rates were equal within each preparation level. Prior preparation helps explain the overall difference, so these results do not show that the program caused it.

PRACTICE 6 problems

1 Students chose whether to attend study hall. How many points higher was the study-hall group's average score before study hall began? Explain why that matters when comparing the groups' final scores.

AVERAGE QUIZ SCORES

Group	Before	After
Chose study hall	65	85
Did not choose study hall	55	75

ANSWER _____

2 Students chose whether to use a vocabulary app. Find the difference between the groups' score gains. Why is the higher final score for app users not proof that the app worked?

AVERAGE VOCABULARY SCORES

Group	Before	After
Chose app	35	50
Did not choose app	30	45

ANSWER _____

3 Students chose between two review methods. Among students with high prior preparation, what is the difference in pass rates, in percentage points?

HIGH-PREPARATION STUDENTS WHO PASSED

Review method	Passed	Total
Method A	8	10
Method B	4	5

ANSWER _____

4 Students chose whether to join an after-school science club. What percentage of each group had high prior preparation? Find the difference in those percentages and explain why it matters when comparing later test results.

PREPARATION BEFORE THE CLUB BEGAN

Group	High preparation	Total students
Joined club	18	30
Did not join	8	25

ANSWER _____

5 Students chose whether to use a homework planner. Find the difference in on-time rates, in percentage points. Does that difference prove the planner caused students to finish on time? Explain.

HOMEWORK FINISHED ON TIME

Group	On time	Total students
Chose planner	5	10
Did not choose planner	18	30

ANSWER _____

6 Students chose a practice method. Imagine comparing groups with equal numbers of high-preparation and low-preparation students. Find each method's average pass rate across the two preparation levels. What is the difference?

PASS RATES BY PRIOR PREPARATION

Prior preparation	Method A	Method B
High	80%	70%
Low	30%	40%

ANSWER _____

APPLY IT Show your work

1 Students chose whether to use a video-editing app for a class project. The table shows how many finished on time. Find each group's overall on-time rate. Why can't you conclude from those rates that the app caused the difference?

PROJECTS FINISHED ON TIME

Home internet	Used app: on time/total	Did not use app: on time/total
High speed	8/10	4/5
Low speed	2/10	4/20

ANSWER _____

2 Students chose whether to join an optional running club. Their average sprint times are shown in seconds. How much did each group improve? Explain why the club members' faster final time alone does not show that the club caused the difference.

AVERAGE SPRINT TIMES IN SECONDS

Group	Before	After
Joined club	30	25
Did not join	35	30

ANSWER _____

CHALLENGE One step up

Students chose one of two test-prep courses. Calculate the overall pass rate for each course. Which course has the higher overall rate, and which has the higher rate within each preparation level? Explain how both statements can be true.

TEST-PREP COURSE RESULTS

Prior preparation	Course A: passed/total	Course B: passed/total
High	9/10	24/30
Low	12/30	3/10

WORK SPACE AND ANSWER

ANSWER KEY

Fair Group Comparisons

HIGH SCHOOL · A2S.DSP.F.29

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Students chose whether to attend study hall. How many points higher was the study-hall group's average score before study hall began? Explain why that matters when comparing the groups' final scores.	**10 points. The study-hall group already scored higher, so its higher final score alone does not show that study hall caused the difference.**
2	Students chose whether to use a vocabulary app. Find the difference between the groups' score gains. Why is the higher final score for app users not proof that the app worked?	**0 points. Both groups gained 15 points, and app users already scored 5 points higher before using the app.**
3	Students chose between two review methods. Among students with high prior preparation, what is the difference in pass rates, in percentage points?	**0 percentage points**
4	Students chose whether to join an after-school science club. What percentage of each group had high prior preparation? Find the difference in those percentages and explain why it matters when comparing later test results.	**60% of club members and 32% of nonmembers had high prior preparation, a difference of 28 percentage points. Prior preparation could affect later test results.**
5	Students chose whether to use a homework planner. Find the difference in on-time rates, in percentage points. Does that difference prove the planner caused students to finish on time? Explain.	**The no-planner group had a 10-percentage-point higher on-time rate. No, students chose their groups, and other differences between them could affect when they finished.**
6	Students chose a practice method. Imagine comparing groups with equal numbers of high-preparation and low-preparation students. Find each method's average pass rate across the two preparation levels. What is the difference?	**Method A: 55%. Method B: 55%. The difference is 0 percentage points.**

PART 2 · APPLY IT

1. **App users: 10/20 = 50%. Nonusers: 8/25 = 32%. App users had an 18-percentage-point higher overall rate, but the rates are equal within each internet-speed level. The groups had different access to high-speed internet, which could explain the overall difference.** Add the on-time counts and group totals across the two internet-speed levels. Compare the rates within each level before interpreting the overall difference.
2. **Each group improved by 5 seconds. Club members were already 5 seconds faster before joining, so their faster final time alone does not show that the club caused the difference.** Subtract each group's after time from its before time. Compare the improvements and the starting times.

CHALLENGE

Course A's overall rate is 21/40 = 52.5%; Course B's is 27/40 = 67.5%, so B is higher overall. A is higher within both preparation levels: 90% versus 80% for high preparation and 40% versus 30% for low preparation. Course B had a larger share of highly prepared students, which reverses the overall comparison. Because students chose their courses, the results do not establish which course caused better outcomes.

Accept equivalent fractions, decimals, or percentages where appropriate. Students should identify prior differences as possible explanations without claiming that the calculations prove a causal effect.