



AP Statistics FRQ Practice · Unit 3

Designing a Flipped-Classroom Experiment · numberbender.com

Name: _____

Date: _____

Score: / 4

What this question practices

- Random assignment in a completely randomized design
- Blocking, and why it helps
- Scope of inference: cause and effect versus generalization
- Confounding

Show all your work. Answer each part in complete sentences, in the context of the problem. The data are hypothetical. Suggested time: 13 minutes.

A high school math department wants to know whether assigning short pre-class videos (a flipped approach) leads to higher unit test scores than a traditional in-class lecture. Eighty Grade 10 students at the school have volunteered to take part for one unit. Every student will take the same unit test at the end.

(a) Describe how to randomly assign the 80 students to the two treatments so that each treatment has 40 students.

(b) The department suspects that students' prior math grades (A or B, compared with C or below) are related to unit test scores. Describe how to use blocking in this experiment and explain why blocking is helpful here.

(c) Suppose the video group's mean unit test score is significantly higher than the lecture group's. Can the department conclude that the video approach caused the higher scores? Can the results be generalized to all Grade 10 students in the country? Explain both answers.

(d) A teacher suggests letting each student choose which approach to use instead of assigning them. Explain how this could lead to confounding.





Each part is scored *E* (essentially correct), *P* (partially correct) or *I* (incorrect), the way AP readers score free-response questions. Compare your work with the model solution, then with the scoring note.

(a) Describe how to randomly assign the 80 students to the two treatments so that each treatment has 40 students.

- Number the students from 1 to 80.
- Use a random number generator to select 40 different integers from 1 to 80, ignoring repeats.
- Students whose numbers are selected get the pre-class video approach; the remaining 40 students get the in-class lecture. (Writing the names on 80 identical slips, mixing them in a bag and drawing 40 also works.)

Scoring. Essentially correct: a random method that produces two groups of exactly 40, described clearly enough that two people could carry it out the same way.

(b) The department suspects that students' prior math grades (A or B, compared with C or below) are related to unit test scores. Describe how to use blocking in this experiment and explain why blocking is helpful here.

- Separate the students into two blocks: those with a prior grade of A or B, and those with C or below.
- Within each block, randomly assign half of the students to the video approach and half to the lecture, then compare the treatments within each block.
- Because prior grade is related to test scores, blocking removes that source of variation from the comparison. This makes it easier to detect a difference in scores caused by the teaching method.

Scoring. Essentially correct: blocks by prior grade, randomizes within blocks, and explains that blocking accounts for variation in scores due to prior grade. Partially correct: correct design but a weak explanation.

(c) Suppose the video group's mean unit test score is significantly higher than the lecture group's. Can the department conclude that the video approach caused the higher scores? Can the results be generalized to all Grade 10 students in the country? Explain both answers.

- **Cause and effect:** yes, for students like these. The treatments were randomly assigned, so the groups should be similar in every other way, and a significant difference can be attributed to the teaching method.
- **Generalization:** no. The 80 students were volunteers from one school, not a random sample of Grade 10 students in the country, so the results apply only to students like these volunteers.

Scoring. Essentially correct: both conclusions, each tied to its reason (random assignment for causation, random sampling for generalization). Partially correct: one of the two.

(d) A teacher suggests letting each student choose which approach to use instead of assigning them. Explain how this could lead to confounding.

- Students who choose the video approach may be more motivated or more organized than students who choose the lecture.
- Motivation is related to unit test scores and to the choice of method, so if the video group scores higher, we could not tell whether the method or the students' motivation caused the difference.

Scoring. Essentially correct: names a variable, explains how it is linked both to the choice of method and to test scores, and says the effects cannot be separated.

