

Statistics
Observational vs. Experiment Practice

1. Jamie is a hard-core computer programmer. She and all her friends prefer Jolt cola (caffeine equivalent to two cups of coffee) to either Coke or Pepsi (caffeine equivalent to less than one cup of coffee). Explain why Jamie's preference is not good evidence that most young people prefer Jolt to Coke or Pepsi?

2. One study of cell phones and the risk of brain cancer looked at a group of 469 people who have brain cancer. The investigators matched each cancer patient with a person of the same age, sex, and race who did not have brain cancer, then asked about the use of cell phones. Result: "Our data suggest that the use of hand-held cellular phones is not associated with risk of brain cancer."
 - a. Is this an observational study or an experiment? Justify your answer.

 - b. Based on this study, would you conclude that cell phones do not increase the risk of brain cancer? Why or why not?

3. An educational software company wants to compare the effectiveness of its computer animation for teaching biology with that of a textbook presentation. The company gives a biology pretest to each of a group of high school juniors, and then divides them into two groups. One group uses the animation, and the other studies the test. The company retests all students and compares the increase in biology test scores in the two groups.
 - a. Is this an observational study or an experiment? Justify your answer.

 - b. If the group using the computer animation has a much higher average increase in test scores than the group using the textbook, what conclusions, if any, could the company draw?

4. What is the best way to answer each of the questions below: a survey, an experiment, or an observational study? Explain your choices. For each, write a few sentences about how such a study might be carried out.
 - a. Are people generally satisfied with how things are going in the country right now?

 - b. Do college students learn basic accounting better in a classroom or using an online course?

 - c. How long do your teachers wait on average after they ask the class a question?

5. Twenty overweight females have agreed to participate in a study of the effectiveness of four weight-loss treatments: A, B, C, and D. The researcher first calculates how overweight each subject is by comparing the subject's actual weight with her "ideal" weight. The subjects and their excess weights in pounds are

Birnbaum	35	Hernandez	25	Moses	25	Smith	29
Brown	34	Jackson	33	Nevesky	39	Stall	33
Brunk	30	Kendall	28	Obrach	30	Tran	35
Cruz	34	Loren	32	Rodriguez	30	Wilansky	42
Deng	24	Mann	28	Santiago	27	Williams	22

The response variable is the weight lost after 8 weeks of treatment. We know that a person's excess weight will influence the response, the more they have to loose, the faster it will come off. Design this experiment.

6. An industrial machine requires an emergency shutoff switch that must be designed so that it can be easily operated with either hand. Design an experiment to find out whether workers will be able to deactivate the machine as quickly with their left hands as with their right hands. Be sure to explain the role of randomization in your design.
7. Can special study courses actually help raise SAT scores? One organization says that the 30 students they tutored achieved an average gain of 60 points when they retook the test.
- Explain why this does not necessarily prove that the special course caused the scores to go up.
 - Propose a design for an experiment that could test the effectiveness of the tutorial course.
 - Suppose you suspect that the tutorial course might be more helpful for students whose initial scores were particularly low. How would this affect your proposed design?
8. Hoping to learn how to control crop damage by a certain species of beetle, a researcher plans to test two different pesticides in small plots of corn. A few days after application of the chemicals, he'll check the number of beetle larvae found on each plant. The researcher wants to know if either pesticide works, and whether there is a significant difference in effectiveness between them. Design an appropriate experiment.