

AP Stats – Read Ahead Notes for Section 4.2_Day 1

Do the following before our next class.

1. Read the following

Types of Observational Studies: Retrospective and Prospective

For use at the beginning of Section 4.2 on page 241 (6e).

A **sample survey** aims to gather information about a population without disturbing the population in the process. Sample surveys are one kind of **observational study**. Other observational studies record the behavior of animals in the wild or track the medical history of volunteers to look for associations between variables such as type of diet, amount of exercise, and blood pressure. Observational studies that examine existing data for a sample of individuals are called **retrospective**. Observational studies that track individuals into the future are called **prospective**.

DEFINITION: Observational study

An **observational study** observes individuals and measures variables of interest but does not attempt to influence the responses.

For an example of a retrospective observational study, see the “Smoking and ADHD” example on page 243: In a study of more than 4700 children, researchers from Cincinnati Children’s Hospital Medical Center found that those children whose mothers smoked during pregnancy were more than twice as likely to develop ADHD as children whose mothers had not smoked. This was a retrospective observational study because the researchers used existing data about the children and asked the mothers about past behaviors.

For an example of a prospective observational study, see the “Observational Studies vs. Experiments” subsection on page 242: The study that found that teenage girls with higher vitamin D intakes were less likely to suffer broken bones was a prospective observational study. Researchers periodically recorded the girls’ intake of calcium, Vitamin D, and dairy products, along with stress fractures. The girls were followed for seven years.

2. Read pp. 241-247 in your textbook and then answer the following.

- a) What is the difference between an explanatory variable and a response variable?
- b) What does it mean for two variables to have an association?
- c) If there is an association between two variables, should we conclude that there is a cause-and-effect relationship?

Continue to back side

d) What is confounding?

e) What is an experiment? What is the primary benefit of using an experiment rather than an observational study?

f) What is a placebo?

g) Define the following terms:

- Treatment
- Experimental unit/subject
- Factor
- Level

Lesson 4.2: Day 1: Does SAT prep improve scores?

Suppose last year Sheldon HS offered an after school SAT prep class that students could volunteer to take. 44 students took the course and then took the SAT. The average SAT score for this group was 1220. The average SAT score for all students who did not take the prep class was 1050.

1. Is the situation described an observational study or an experiment?
2. Identify the explanatory variable and the response variable.
3. Can you conclude that taking the prep course will cause a student's SAT score to increase? Why or why not?
4. Identify as many other possible variables that you can that may explain why the SAT scores are higher for those who took the prep course than for those who did not.
5. Design an experiment that would allow us to determine if the SAT prep causes an increase in SAT scores. Be as thorough as possible.

Diagram:

6. **Alcohol and GPA** *Confounding*

In a recent study of about 13,900 college freshman, a researcher found that the more time students spent drinking alcohol, the lower their grade point averages (GPA). Explain how confounding makes it unreasonable to conclude that spending more time drinking causes a decrease in GPA for college freshman.

7. **The best test scores** ---- *Vocabulary of experiments*

Several AP[®] Statistics students wondered whether caffeine could improve test scores. They randomly assigned 30 student volunteers to either drink regular coffee or decaffeinated coffee the morning of the students' next test. At the end of the experiment, they recorded test scores for each student volunteer. Identify the treatments and the experimental units in this experiment.

8. **Growing the best tomatoes** ---- *Experiments with multiple explanatory variables*

Does adding fertilizer affect the productivity of tomato plants? How about the amount of water given to the plants? To answer these questions, a gardener plants 24 similar tomato plants in identical pots in his greenhouse. He will add fertilizer to the soil in half the pots. Also, he will water 8 of the plants with 0.5 gallon of water per day, 8 of the plants with 1 gallon of water per day, and the remaining 8 plants with 1.5 gallons of water per day. At the end of 3 months, he will record the total weight of tomatoes produced by each plant.

1. List the factors in this experiment and the number of levels for each factor.
2. If the researchers used every possible combination to form the treatments, how many treatments were included in the experiment?