Experimental Methods Test Causation

An experiment is a research method of investigation used to demonstrate cause-and-effect relationships by purposely manipulating one factor (independent variable) thought to produce change in another factor (dependent variable) (page 37). There must be at least two groups (an experimental and control group to compare).
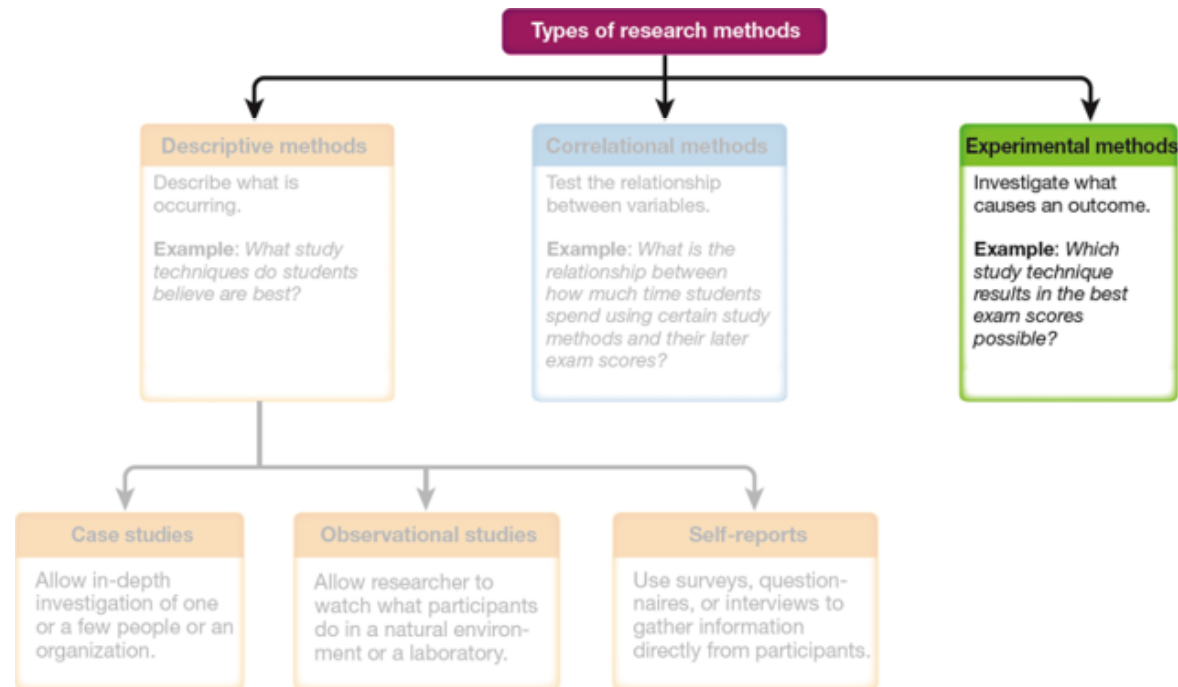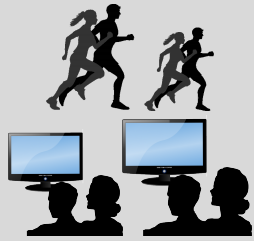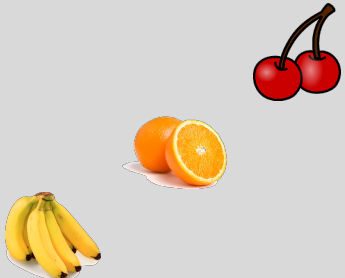
Types of research methods

Descriptive methods

Describe what is occurring.

Example: *What study techniques do students believe are best?*

Correlational methods

Test the relationship between variables.

Example: *What is the relationship between how much time students spend using certain study methods and their later exam scores?*

Experimental methods

Investigate what causes an outcome.

Example: *Which study technique results in the best exam scores possible?*

Case studies

Allow in-depth investigation of one or a few people or an organization.

Observational studies

Allow researcher to watch what participants do in a natural environment or a laboratory.

Self-reports

Use surveys, question-naires, or interviews to gather information directly from participants.

FIGURE 1.18

Experiments

To determine of eating more fruit causes lower cholesterol levels, we would need to do an experiment where we manipulate (or change) one of the variables and randomly assign participants to an experimental condition. Random assignment reduces any pre-existing variables we can't account for.
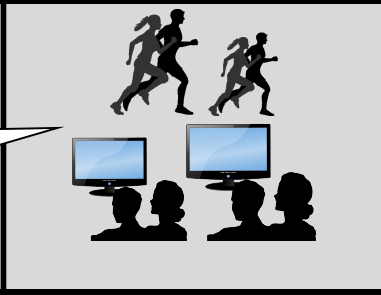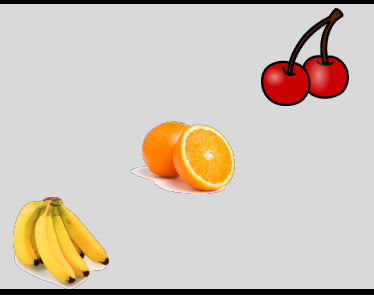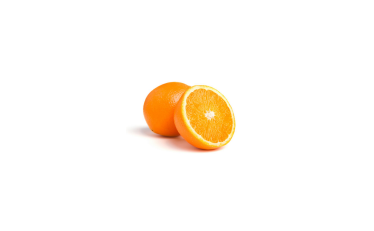
We randomly assign participants to either eat a lot of fruit, or eat a little bit of fruit (this is the variable manipulation) and measure their cholesterol levels.			
		have	Lower cholesterol
		have	Higher cholesterol

Experiments

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Experimental group

Control group

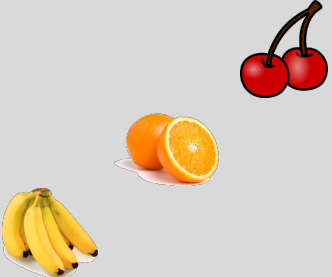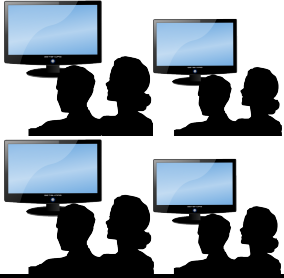| | | have | Lower cholesterol |
| | | have | Higher cholesterol |

Independent variable (amount of fruit eaten)

Dependent variable (cholesterol levels)

Correlations

We cannot determine cause and effect relationships with only a correlational study that measures/observes variables. In this case, a third variable could cause changes in both variables—the amount of fruit eating and cholesterol levels—such as lifestyle.

We measure or observe how much fruit they eat, and measure and observe their cholesterol levels, and can find that those who eat more fruit have lower cholesterol levels than those who eat less fruit.			
Amount of exercise	Amount of fruit eaten		Cholesterol level
		have	Lower cholesterol
		have	Higher cholesterol

Experimental Methods Test Causation

Experimental methods examine how one variable that is manipulated by researchers affects another variable.

Advantages — Provide control over the independent variable (which is manipulated), so can demonstrate that one thing causes another. Avoid the *directionality problem*.

Disadvantages — Varying something other than the independent variable (a *confound*) can affect the dependent variable (which is measured) and lead to inaccurate conclusions. Often take place in an artificial setting.
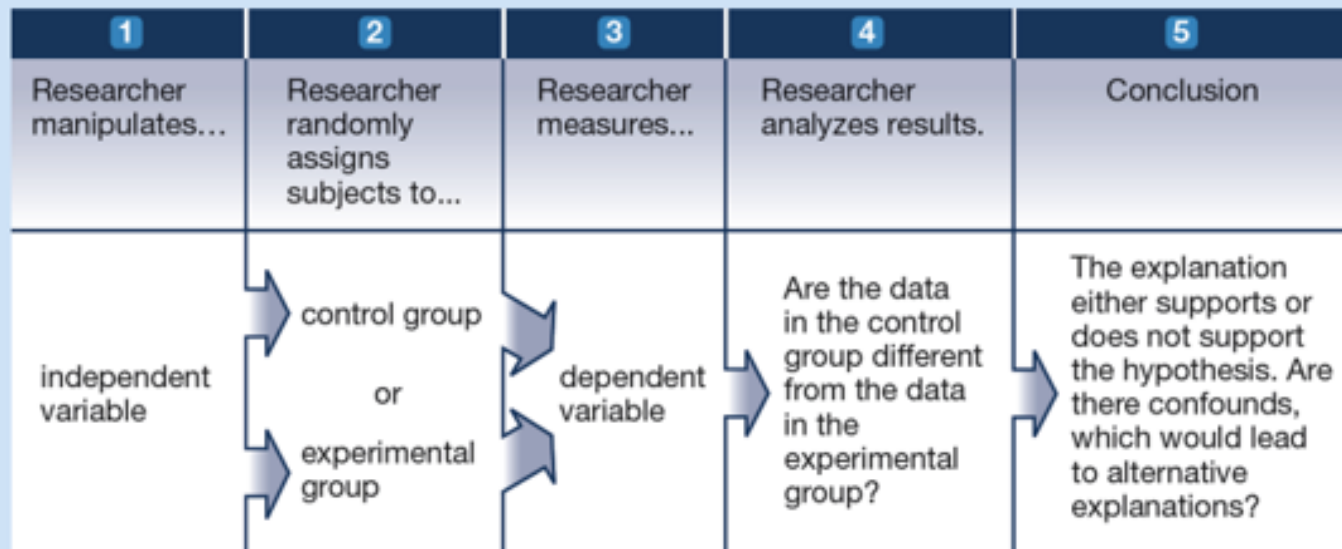
1	2	3	4	5
Researcher manipulates...	Researcher randomly assigns subjects to...	Researcher measures...	Researcher analyzes results.	Conclusion
independent variable	control group or experimental group	dependent variable	Are the data in the control group different from the data in the experimental group?	The explanation either supports or does not support the hypothesis. Are there confounds, which would lead to alternative explanations?

FIGURE 1.25

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Experiments: Examining Cause and Effect

An experiment is a research method that can reveal causality by manipulating (changing) independent variables and measuring the effects on dependent variables (page 37). There must be at least two groups (an experimental and control group to compare).

- Hypothesis: Studying by repeated practice improves exam scores more than repeated reading of the material.
- Independent Variable: Type of study method (repeated practice or repeated reading)
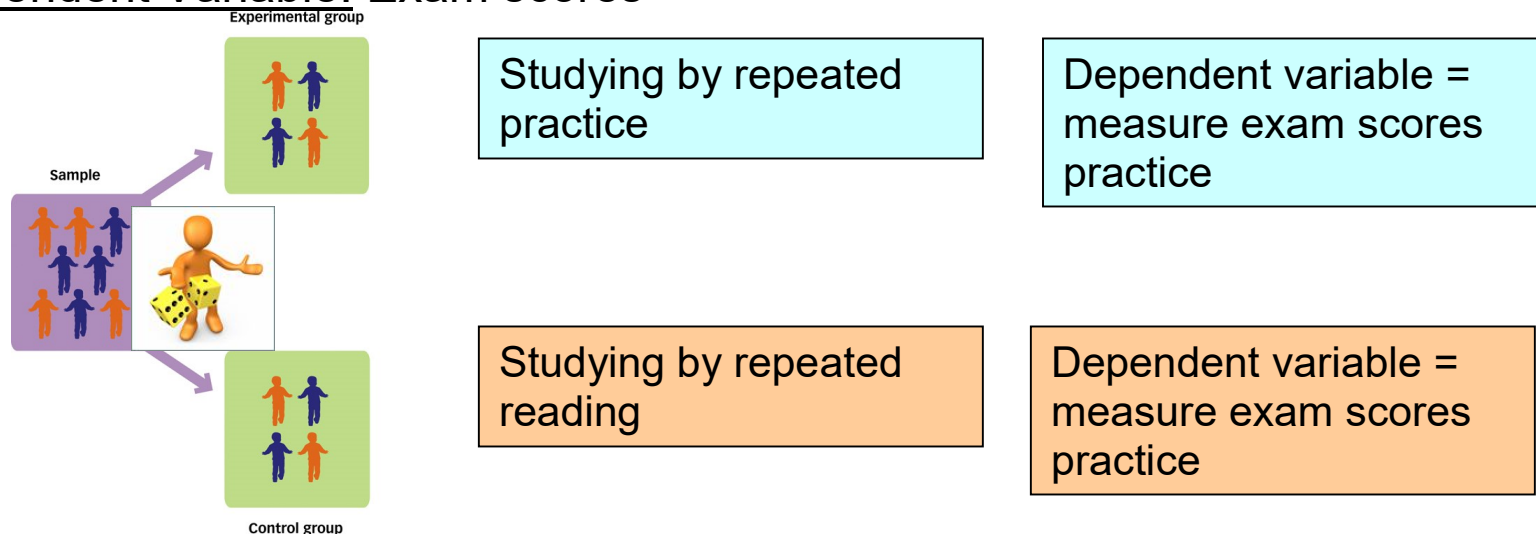- Dependent Variable: Exam scores

Experimental group

Sample

Studying by repeated practice

Dependent variable = measure exam scores practice

Studying by repeated reading

Dependent variable = measure exam scores practice

Control group

Image Source: Psychology (2009), Schacter, Gilbert and Wegner

Experiments: Examining Cause and Effect

- <u>Hypothesis:</u> Studying by repeated practice improves exam scores more than repeated reading of the material.
- <u>Independent Variable:</u> Type of study method (repeated practice or repeated reading)
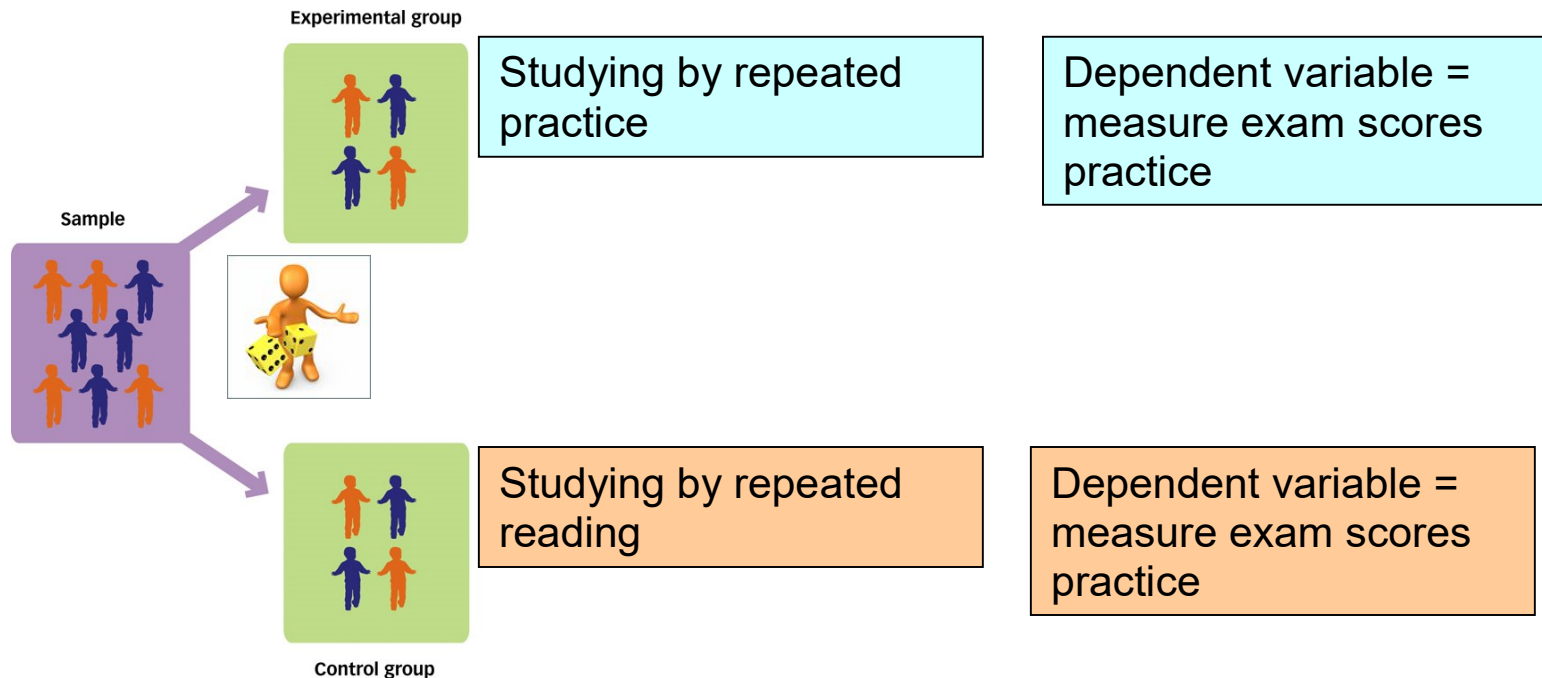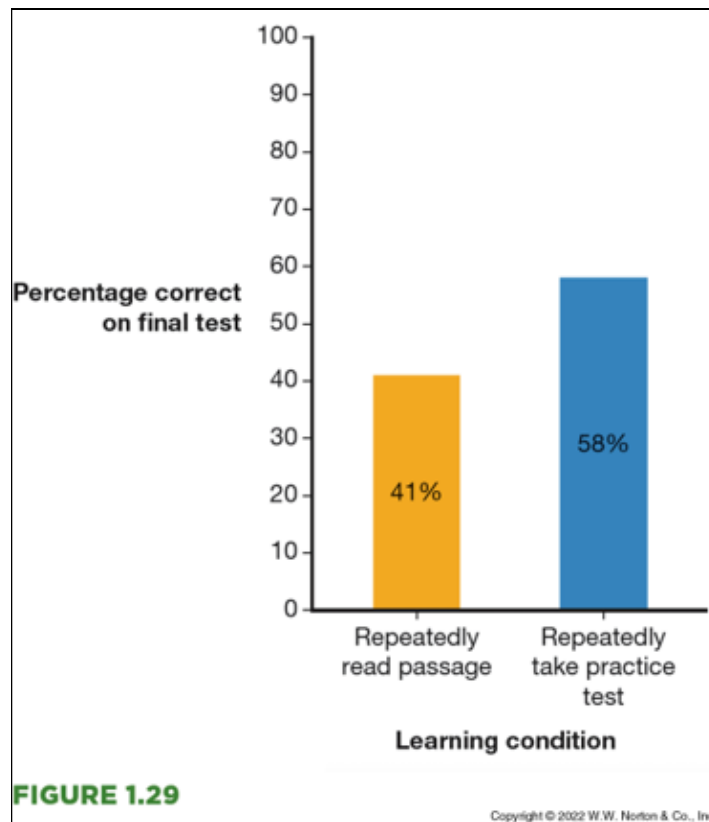- <u>Dependent Variable:</u> Exam scores

Experimental group

Sample

Studying by repeated practice

Dependent variable = measure exam scores practice

Studying by repeated reading

Dependent variable = measure exam scores practice

Control group

<u>Image Source:</u> Psychology (2009), Schacter, Gilbert and Wegner

Experiments: Examining Cause and Effect

When researchers performed the experiment, measured the performance on the final test, they concluded from the average test scores you are more likely to do better if you repeatedly test yourself than to repeatedly read/review the information.

Percentage correct on final test

41% — Repeatedly read passage
58% — Repeatedly take practice test

Learning condition

FIGURE 1.29

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Repeatedly reading can get you somewhere, but repeatedly taking testing yourself gets you further.

In addition, this was not known 20 years ago. Educators may have promoted a different strategy to retain information. This is because scientific knowledge changes with better data.
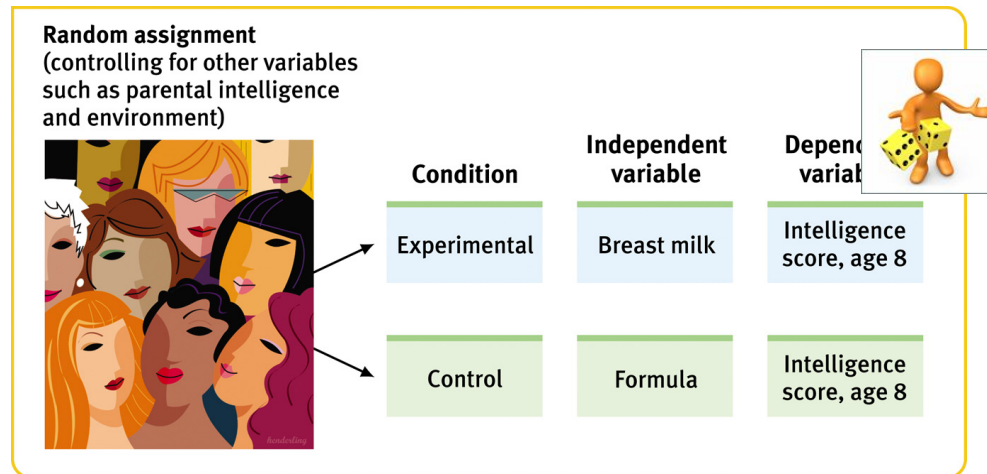
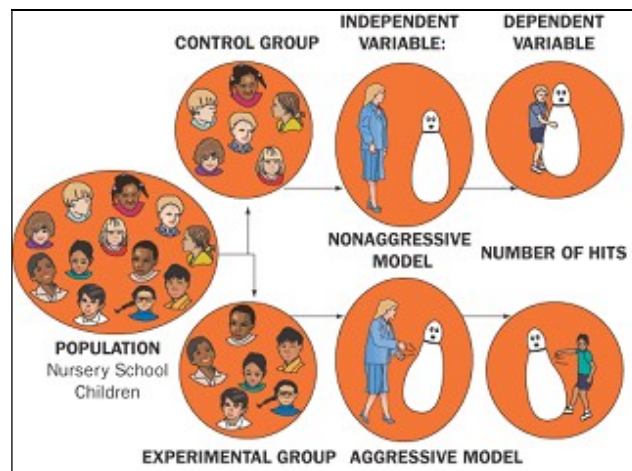# Examples of Experiments:

Image source:

Image source: Psychology (), David and Pallidino

- Does watching violent television lead to more aggressive behavior? Two groups randomly assigned: one group watches 24 (violent TV) and the other watches Sesame Street (nonviolent TV); compare the probability of violent behavior by members of the two groups
    - IV = type of television program
    - DV = violent behavior
- Does oat bran reduce cholesterol levels?
    - IV = presence or amount of oat bran
    - DV = cholesterol levels
- Does taking vitamin C reduce the number of colds?
    - IV =
    - DV =
- Which of two new anti-depressants is more effective in treating major depression?
- <u>Developmental psychologists</u> want to know if exposing children to public television improves their reading skills.
- A pizza parlor wants to know if changing the number of toppings increases sales.

<u>Advantages of Experiments:</u>
- Cause-and-effect relationships can be established.
- Precise control can be exerted over other, potentially confounding variables.

<u>Disadvantages of Experiments:</u>
- Results can be subject to several sources of bias (eg. experimenter effects or demand characteristics).
- Generalizability can be doubtful if behavior is observed under highly artificial conditions that may inhibit the natural behavior of subjects and may not generalize to the "real-world".
- In some cases, experimentation may be unethical, such as with patients with brain damage.
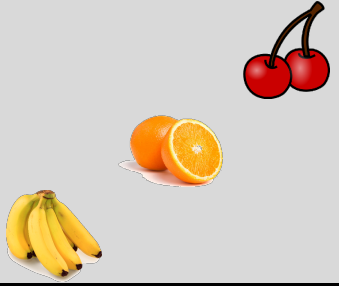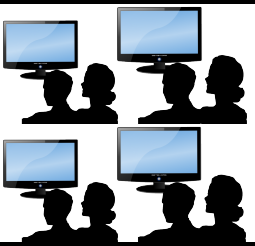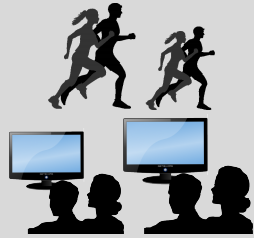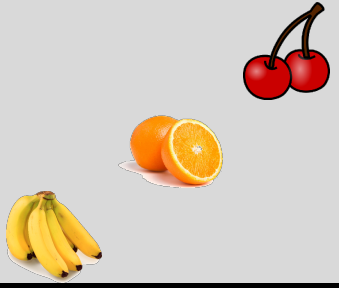
Experiment vs. Correlations

The main difference between experiments and correlations is how the data was collected in the study.

- Experiments: At least one variable was manipulated.
- Correlations: None of the variables were manipulated. All variables that we measured/assessed where naturally occurring.

Experiment vs. Correlations

	Correlations	Experiments
• Measures two or more variables	X	X
• Determines relations between variables	X	X
• Has a hypothesis	X	X
• Manipulates a variable to establish cause and effect		X
• Observes naturally occurring variables	X	
	• Do people who take vitamin C have fewer colds?	• Does taking vitamin C reduce the number of colds?
	• Do those who eat oat bran have lower cholesterol?	• Does eating oat bran reduce cholesterol levels?

Correlations versus Experiments

| Correlations measure pre-existing variables. If there is a relationship, it could be due to another variable. | | | have | Lower cholesterol |
| | | | have | Higher cholesterol |

| Experiments manipulate one variable to establish cause and effect relationships.

Think **cause**, think **experiments** | | | have | Lower cholesterol |
| | | | have | Higher cholesterol |

Is this an Experiment or Correlation?

A study was done with some safety equipment. Would the safety equipment interfere with how enjoyable participants engaged in the activity?

Does using a condom interfere with people experiencing pleasure during sex? A study was done that found that that whether or not you use a condom, there is no reported difference in pleasure
- Is it more likely that this study was an experiment or a correlation?

Before answering the question and just responding, think about the following:
  (1) What is an experiment?
  (2) What is a correlation?
  (3) What is the difference between an experiment and correlation?

How would you conduct an experiment to see if gender effects how many cats are adopted?