
Research Methods

I. THE EXPERIMENTAL METHOD

A. DEFINITION

1. An experiment is a carefully controlled method of investigation used to establish a cause-and-effect relationship.
2. The experimenter purposely manipulates and controls selected variables in order to determine cause and effect.

B. TESTABLE HYPOTHESIS

1. A hypothesis is a tentative statement that describes the relationship between two or more variables. A hypothesis must be testable, verifiable, and refutable.
2. The independent variable is the factor that is manipulated or controlled by the experimenter.
3. The dependent variable is the factor that is measured by the experimenter. It is affected by and thus dependent on the independent variable.
4. Examples
 - ▶ *An experimenter wants to determine if playing violent video games increases the frequency of aggressive behavior in children. The independent variable in this study is the type of video game played. The dependent variable in this study is the amount of aggressive behavior exhibited by the children.*
 - ▶ *An experimenter wants to determine the relationship between rehearsal/repetition of a list of definitions of difficult SAT vocabulary words and later recall of these definitions. The independent variable in this study is the*

amount of rehearsal/repetition. The dependent variable in this study is the recall of correct definitions.

- ▶ An experimenter wants to determine if a new drug reduces hyperactivity in children. The independent variable in this study is the drug. The dependent variable in this study is the level of hyperactivity.

5. Operational Definitions

- ▶ An operational definition is a precise description of how the variable in a study will be manipulated and measured.
- ▶ For example, in a study measuring the relationship between rehearsal/repetition and recall of difficult SAT vocabulary words, rehearsal might be operationally defined as the number of times the subject reads aloud a list of words. The difficult words might be operationally defined as answers to Level 5 SAT sentence completion questions. The recall might be operationally defined as the percentage of words that are correctly defined.



Independent and dependent variables are two of the most frequently tested concepts on the AP Psychology exam. Every released exam contains multiple-choice questions asking you to identify independent and dependent variables in a sample research design. In addition, as noted in Chapter 1, there is a better than 50–50 chance that your exam will include a free-response question asking you to design and/or describe an experiment. Your description must include a discussion of independent and dependent variables.

C. PARTICIPANTS: EXPERIMENTAL AND CONTROL GROUPS

1. The experimental group comprises the participants who are exposed to the independent variable.
2. The control group comprises the participants who are exposed to all experimental conditions except the independent variable. This enables the experimenter to make comparisons with the experimental group.
3. Confounding variables
 - ▶ In a controlled experiment, confounding or extraneous variables are differences between the experimental

group and the control group other than the independent variable. Confounding variables have an unwanted influence on the outcome of an experiment.

- ▶ For example, in a study measuring the impact of playing violent video games on the frequency of aggression in children, confounding variables could include the income level of the children's parents and the incidence of child abuse.

D. EXPERIMENTAL CONTROLS

1. Purpose

- ▶ Controls are used to ensure that all groups in the experiment are treated exactly the same, except for the independent variable.

2. Problems

- ▶ *Experimenter bias* occurs when a researcher's expectations or preferences about the outcome of a study influence the results in a hoped-for direction.
- ▶ *Sample bias* occurs when research participants are not representative of the larger population.

3. Solutions

- ▶ *Random assignment*—procedure by which participants are assigned to experimental and control groups by chance. This minimizes pre-existing differences between those assigned to the different groups.
- ▶ *Placebo*—an inactive substance or fake treatment often used as a control technique in drug research.
- ▶ *Single-blind study*—a procedure in which the subjects do not know whether they are in the experiment or control group.
- ▶ *Double-blind study*—a procedure in which neither the researcher nor the participant knows which group received the experimental treatment. This procedure reduces experimenter bias.

E. ADVANTAGES OF EXPERIMENTS

1. Enable researchers to identify cause-and-effect relationships.
2. Enable researchers to distinguish between real and placebo effects.

3. Enable researchers to control bias by using a double-blind study.
4. Enable researchers to manipulate the independent variable and measure the dependent variable.
5. Enable researchers to replicate a study thus increasing confidence that the independent variable influences the dependent variable.

F. DISADVANTAGES OF EXPERIMENTS

1. Create artificial laboratory conditions that do not correspond to real-life situations.
2. Can be compromised by confounding variables that are difficult to identify and control.
3. Susceptible to researcher and participant biases.
4. Raise ethical concerns when subjects are deceived.

II. DESCRIPTIVE RESEARCH

A. DEFINITION

1. Descriptive research includes methods that enable researchers to observe and describe behaviors and mental processes without manipulating variables.
2. Descriptive methods do not enable researchers to establish cause-and-effect relationships.

B. SURVEYS

1. A research technique that uses questionnaires or interviews or a combination of the two to assess the behavior, attitudes, and opinions of a large number of people.
2. The entire group that a researcher wants to study is called a population.
3. Researchers generally question only a sample of the population whose opinions they seek to assess. A random sample, in which every person in the population has an equal chance of participating, helps minimize bias and ensure that the sample is representative.

4. It is important to note that survey respondents often report that they are healthier, happier, and less prejudiced than would be expected based upon the results of other types of research. This phenomenon is known as the social desirability bias.

C. NATURALISTIC OBSERVATION

1. In a naturalistic observation, researchers unobtrusively observe the behavior of subjects as it occurs in a real social setting.
2. Naturalistic observation provides a slice of life that can be very revealing. However, it is important to remember that naturalistic observations are descriptive and do not explain behavior.

D. CASE STUDIES

1. A case study is an in-depth examination of a single research participant.
2. Case studies enable researchers to obtain detailed knowledge about a person. They also provide an opportunity to conduct in-depth studies of rare and unusual cases.
3. Case studies cannot be used to establish cause-and-effect relationships. They are susceptible to inaccurate reporting and the subject's biased views.

E. STUDIES OF DEVELOPMENT

1. The longitudinal method measures a single individual or group of individuals over an extended period of time. For example, a longitudinal study of intelligence would retest the same people over a period of years. Longitudinal studies provide in-depth information but can be expensive and time-consuming.
2. The cross-sectional method compares individuals of various ages at one point in time. For example, a cross-sectional study of achievement motivation would test eighth, tenth, and twelfth grade students at the beginning of the school year. Cross-sectional studies provide information about age differences. However, it is very difficult to make

generalizations since cross-sectional studies measure behavior at only one point in time.

III. CORRELATION STUDIES

A. DEFINITION

1. In correlation studies researchers observe or measure a relationship between variables in which changes in one variable are reflected in changes in the other variable.
2. It is important to note that in correlation studies researchers do not directly manipulate the variables.
3. Correlations can be used to analyze the data gathered in any type of descriptive method.

B. CORRELATION COEFFICIENT

1. A correlation coefficient is a numerical value that indicates the strength and direction of the relationship between two variables.
2. Correlation coefficients are calculated by a formula that produces a number ranging from +1.00 to -1.00.
3. A positive correlation
 - ▶ *Indicates that two variables move or vary in the same direction.*
 - ▶ *For example, studies have found a positive relationship between smoking and the incidence of lung cancer. That is, as frequency of smoking increases so does the incidence of lung cancer.*
4. A negative correlation
 - ▶ *Indicates that two variables move or vary in opposite directions.*
 - ▶ *For example, studies have found a negative correlation between level of education and anger. That is, as level of education increases expressions of anger decrease.*
5. A zero correlation
 - ▶ *Indicates that there is no relationship between two variables.*

- ▶ For example, a study by Isabelle Deltour for the Danish Cancer Society found no correlation between cell phone use and incidence of brain tumors.



Which of the following is the strongest correlation coefficient: -0.83 , $+0.10$ or $+0.64$? The answer is -0.83 . Remember that correlations become stronger as they approach either -1.0 or $+1.0$. A negative correlation of -0.83 means that there is a very strong inverse relationship. Remember, the strength of the correlation weakens as the correlation coefficient approaches 0.00 .

C. CORRELATION AND CAUSATION

1. Correlation studies indicate the possibility of a cause-and-effect relationship.
2. Remember that correlation does not prove causation. For example, research studies have found a moderate correlation of $+0.4$ between SAT scores and college grades. However, this correlation does not tell us if high SAT scores cause high college grades. Other known and unknown factors, such as the level of achievement motivation and the presence or absence of tutors, could be responsible for both the SAT scores and the college grades.

D. ADVANTAGES OF CORRELATION STUDIES

1. They can be used to describe or clarify a relationship between two variables.
2. They can be an efficient way to utilize preexisting data.
3. They can be used to dispel illusory correlations. Although widely believed, an illusory correlation is in fact non-existent. For example, it is widely, but erroneously, believed that there is a correlation between date of birth and personality traits.

E. DISADVANTAGES OF CORRELATION STUDIES

1. They cannot be used to establish cause-and-effect relationships.

2. They cannot be used to establish the direction of causal influence.
3. They do not allow researchers to actively manipulate the variables.
4. They make it difficult to identify the impact of confounding variables.

IV. DESCRIPTIVE STATISTICS

A. MEASURES OF CENTRAL TENDENCY

1. Mean
 - ▶ *The sum of a set of scores in a distribution divided by the number of scores. The mean is the average score.*
 - ▶ *Extreme scores have a greater impact on the mean than on the mode or the median.*
 - ▶ *Any change in the highest score in any distribution must result in a change in the mean.*
2. Median
 - ▶ *The score that divides a frequency distribution exactly in half, so that the same number of scores lie on each side of it.*
3. Mode
 - ▶ *The most frequently occurring score in a distribution.*

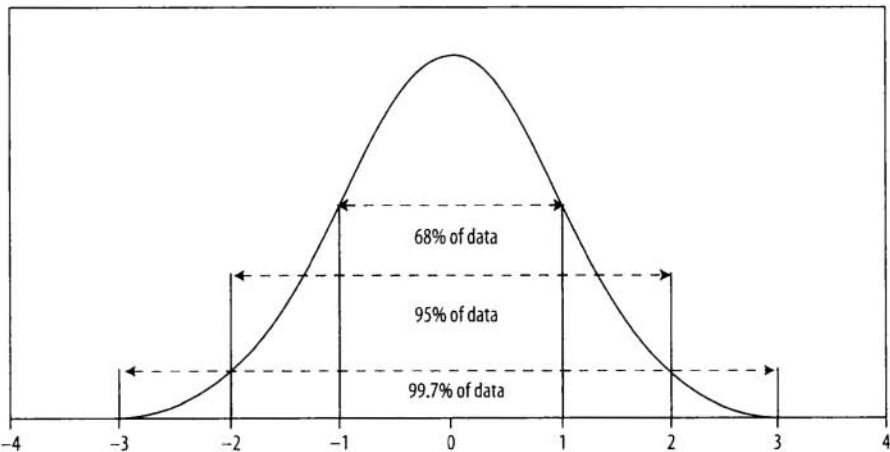
B. MEASURES OF VARIATION

1. Definition
 - ▶ *A measure of variation is a single score that presents information about the spread of scores in a distribution.*
2. Range
 - ▶ *The highest score in a distribution minus the lowest score.*
3. Standard deviation
 - ▶ *The most widely used measure of variation.*
 - ▶ *A standard measurement of how much the scores in a distribution deviate from the mean.*

4. Normal distribution

- ▶ Normal distributions form a bell-shaped or symmetrical curve.
- ▶ In a normal distribution of test scores, the percentage of scores that fall at or above the mean score is 50. The percentage of test scores that fall at or below the mean score is also 50.
- ▶ In a normal distribution, approximately one-third of the scores fall one standard deviation below the mean and one-third of the scores fall one standard deviation above the mean. For example, the Wechsler IQ tests have a mean of 100 and a standard deviation of 15. This means that one-third of the people taking these tests will have scores between 85 and 100 and another third will have scores between 100 and 115.
- ▶ All score-based normal curves have the following 68–95–99.7 rule in common:
 - ▶ Approximately 68% of all scores fall within one standard deviation of the mean.
 - ▶ Approximately 95% of all scores fall within two standard deviations of the mean.
 - ▶ Approximately 99.7% of all scores fall within three standard deviations of the mean.
 - ▶ This distribution is shown in the following diagram:

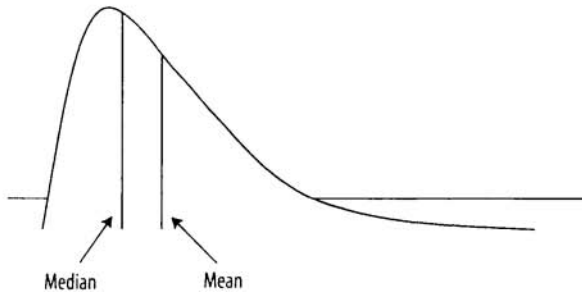
68–95–99.7 Rule for Normal Distribution



C. SKEWED DISTRIBUTIONS

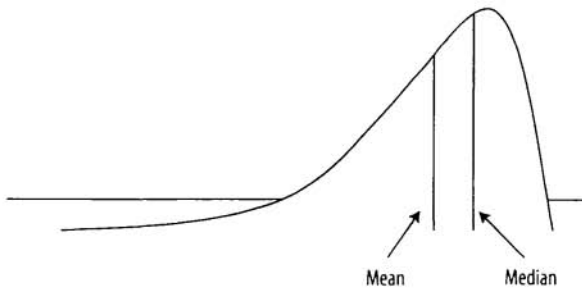
1. Positively skewed distributions

- ▶ A positively skewed distribution contains a preponderance of scores on the low end of the scale.
- ▶ The mean will be higher than the median in a positively skewed distribution. The median is thus a better representation of central tendency than the mean in a positively skewed distribution.



2. Negatively skewed distributions

- ▶ A negatively skewed distribution contains a preponderance of scores on the high end of the scale.
- ▶ The mean will be lower than the median in a negatively skewed distribution. The median is thus a better representative of central tendency than the mean in a negatively skewed distribution.



Positive and negative skewed distributions are easy to confuse. One way to remember what a positively skewed curve looks like is to visualize a “p” lying on its back. The preponderance of scores are to the left or the low end of the scale.

V. INFERENCE STATISTICS

A. KEY POINTS

1. Most experiments are conducted with a small sample of subjects.
2. Psychologists want to generalize the results from their small sample to a larger population.
3. Inferential statistics are used to determine how likely it is that a study's outcome is due to chance and whether the outcome can be legitimately generalized to the larger population from which the sample was selected.

B. THE P-VALUE

1. The p-value is the probability of concluding that a difference exists when in fact this difference does not exist.
2. A statistically significant difference is a difference not likely due to chance. By consensus, a statistically significant difference is one that would show up only 5 percent of the time or less.
3. The smaller the p-value, the more significant the results. A p-value can never equal 0 because researchers can never be 100 percent certain that the results did not occur due to chance.

VI. ETHICAL GUIDELINES

A. HUMAN RESEARCH STUDIES

1. Informed consent
 - ▶ *Informed consent is the participant's agreement to take part in a study after being told what to expect.*
 - ▶ *Researchers must obtain the participant's permission, or their parent's or guardian's permission before the study begins.*
2. Voluntary participation
 - ▶ *All participation must be voluntary.*
 - ▶ *Participants should be told that they are free to withdraw from the research at any time.*

3. Deception

- ▶ *The American Psychological Association (APA) recognizes the need for some deception in certain research areas.*
- ▶ *Deception is only justified when there is no alternative and the findings justify the use of deception because of scientific, educational, or applied value.*
- ▶ *When deception is used, subjects must be debriefed to explain the true purpose of the study and clear up any misconceptions or concerns.*

4. Confidentiality

- ▶ *All information about participants must remain private.*
- ▶ *Researchers may not compromise the privacy of their participants.*

5. Alternative activities

- ▶ *Many college courses include research participation as a course requirement or opportunity for extra credit.*
- ▶ *All students must be given an option to choose an alternative activity of equal value.*

B. ANIMAL RESEARCH STUDIES

1. Must have a clear scientific purpose.
2. Must provide humane living conditions for animal subjects.
3. Must legally acquire animal subjects from accredited companies.
4. Must employ the least amount of suffering feasible.
5. Note that less than 10 percent of research is done with nonhuman animals. Ninety percent of the nonhuman animals are rats, mice, and pigeons.