**Chapter 1: Scientific Understanding of Behavior**

**Learning Objectives**

* Describe why it is important to understand research methods.
* Describe the scientific approach to understanding behavior, and contrast it with pseudoscientific research.
* Define and give examples of the four goals of scientific research: description, prediction, determination of cause, and explanation of behavior.
* Discuss the three elements for inferring causation: temporal order, covariation of cause and effect, and elimination of alternative explanation.
* Define, describe, compare, and contrast basic and applied research.

**Brief Chapter Outline**

I. Consuming Research

A. Why Learn About Research Methods?

II. Ways of Knowing

A. Intuition and Anecdote

B. Authority

C. Empiricism

D. The Scientific Approach

E. Integrating Intuition, Anecdote, and Authority with Skepticism

F. Being a Skilled Consumer of Research

III. Goals of Behavioral Science

A. Description of Behavior

B. Prediction of Behavior

C. Determining the Causes of Behavior

D. Explanation of Behavior

IV. Basic and Applied Research

A. Basic Research

B. Applied Research

C. Comparing Basic and Applied Research

**Extended Chapter Outline**

*Please note that much of this information is quoted from the text.*

I. **Consuming Research**

We are continuously bombarded with research results. Articles, books, websites, and social media posts make claims about the beneficial or harmful effects of particular diets or vitamins on one’s sex life, personality, or health. There are frequent reports of survey results that draw conclusions about our views on a variety of topics—who we will vote for, what we think about a product, where we stand on political hot topics of the day.

A. **Why Learn About Research Methods?**

Beyond learning to think critically about research findings, there are many ways that research impacts today’s society, and so many reasons why learning research methods is important. First, many occupations require the use of research findings. It is also important to recognize that scientific research has become increasingly prominent in public policy decisions. Research is also important when developing and assessing the effectiveness of programs designed to achieve certain goals—for example, to increase retention of students in school, influence people to engage in behaviors that reduce their risk of contracting HIV, or teach employees how to reduce the effects of stress. Finally, research methods can be the way to satisfy our native curiosity about ourselves, our world, and those around us.

II. **Ways of Knowing**

People have always observed the world around them and sought explanations for what they see and experience. However, instead of using a scientific approach, many people rely on **intuition** and **authority** as ways of knowing.

A. **Intuition and Anecdote**

When people rely on intuition, they accept unquestioningly what their own personal judgment or a single story (anecdote) about one person’s experience tells them. The intuitive approach takes many forms. Often, it involves finding an explanation for one’s behavior or the behaviors of others. For example, one might develop an explanation for why he or she keeps having conflicts with his or her roommate, such as “He hates me” or “Having to share a bathroom creates conflict.” A problem with intuition is that numerous cognitive and motivational biases affect one’s perceptions, and so one may draw erroneous conclusions about cause and effect.

B. **Authority**

Many people are all too ready to accept anything they learn from the Internet, news media, books, government officials, celebrities, religious figures, or even a professor. They believe that the statements of such authorities must be true. The problem is that the statements may not be true. The scientific approach rejects the notion that one can accept *on faith* the statements of any authority; more evidence is needed before people can draw scientific conclusions.

C. **Empiricism**

Scientific skepticism means that ideas must be evaluated on the basis of careful logic and results from scientific investigations. The fundamental characteristic of the scientific method is **empiricism**—the idea that knowledge is based on observations.

D. **The Scientific Approach**

**Data Play a Central Role**

For scientists, knowledge is primarily based on observations. Scientists enthusiastically search for observations that will verify or reject their ideas about the world. They develop theories, argue that existing data support their theories, and conduct research that can increase their confidence that the theories are correct.

**Scientists Are Not Alone**

Scientists make observations that are accurately reported to other scientists and the public. Many other scientists will follow up on the findings by conducting research that replicates and extends these observations.

**Science Is Adversarial**

Science is a way of thinking in which ideas do battle with other ideas in order to move ever closer to truth. Research can be conducted to test any idea; supporters of the idea and those who disagree with the idea can report their research findings, and these can be evaluated by others. Some ideas, even some very good ideas, may prove to be wrong if research fails to provide support for them. Good scientific ideas can be supported or they can be falsified by data—the latter concept is called **falsifiability**.

**Scientific Evidence Is Peer Reviewed**

Before a study is published in a top-quality scientific journal, other scientists who have the expertise to carefully evaluate the research review it. This process is called **peer review**.

E. **Integrating Intuition, Anecdote, and Authority with Skepticism**

There is nothing wrong with having opinions or beliefs as long as they are presented simply as opinions or beliefs. However, people should always ask whether the opinion can be tested scientifically or whether scientific evidence exists that relates to the opinion. People should also be skeptical of pseudoscientific research. **Pseudoscience** is the use of seemingly scientific terms, and demonstrations are used to substantiate claims that have no basis in scientific research.

F. **Being a Skilled Consumer of Research**

Sometimes study authors overreach, coming to conclusions that are not justified. Four questions can be asked of any research study that will reveal a lot about how much the study should be trusted:

1. “What was measured?”

2. “How do they know that one thing caused another?”

3. “To what or whom can we generalize the results?”

4. “Have other researchers found similar results?”

III. **Goals of Behavioral Science**

Scientific research on behavior has four general goals:

* To describe behavior
* To predict behavior
* To determine the causes of behavior
* To understand or explain behavior

A. **Description of Behavior**

The scientist begins with careful observation because the first goal of science is to describe behavior—which can be something directly observable or something less observable. Also, researchers are often interested in describing the ways in which events are systematically related to one another.

B. **Prediction of Behavior**

Once it has been observed with some regularity that two events are related to one another, it becomes possible to make predictions. We can anticipate events.

C. **Determining the Causes of Behavior**

Cook and Campbell describe three types of evidence (drawn from the work of philosopher John Stuart Mill) used to identify the cause of a behavior. To conclude causation, three things must occur:

* There is a temporal order of events in which the cause *precedes* the effect. This is called **temporal precedence**.
* When the cause is present, the effect occurs; when the cause is not present, the effect does not occur. This is called **covariation of cause and effect**.
* Nothing other than a causal variable could be responsible for the observed effect. This is called elimination of **alternative explanations**.

D. **Explanation of Behavior**

A final goal of science is to explain the events that have been described. The scientist seeks to understand *why* the behavior occurs.

IV. **Basic and Applied Research**

A. **Basic Research**

**Basic research** tries to answer fundamental questions about the nature of behavior. Studies are often designed to address theoretical issues concerning phenomena such as cognition, emotion, motivation, learning, personality, development, and social behavior.

B. **Applied Research**

**Applied research** is conducted to address issues in which there are practical problems and potential solutions. A major area of applied research is called **program evaluation**, which assesses the social reforms and innovations that occur in government, education, the criminal justice system, industry, health care, and mental health institutions.

C. **Comparing Basic and Applied Research**

Both basic and applied research are important, and neither can be considered superior to the other. In fact, progress in science is dependent on an interconnection between basic and applied research. Much applied research is guided by the theories and findings of basic research investigations.

**Illustrative Article: Introduction**

After reading the article, answer the following questions:

1. “What was measured?” All studies in the behavioral sciences start with measurement: identifying the important concepts to be studied, and figuring out how to measure them. This is related to the concept of construct validity, which will be covered in depth in later chapters.

Student answers will vary. They should describe aspects of age-at-encoding (AaE) and fictional first memories and the researchers’ analysis.

2. “How do they know that one thing caused another?” Many times—particularly in popular media—there will be the claim that one thing causes another. It’s always important to ask: How do they know? This is related to the concept of internal validity, which will be covered in later chapters.

Student answers will vary. They should address the three things that must hold true to conclude causation (temporal precedence, covariation of cause and effect, and alternative explanations) as described in the chapter.

3. “To what or whom can we generalize the results?” This is related to the concept of external validity, which will be covered in later chapters.

Student answers will vary. They should address how the researchers explained the behavior they observed in the study.

4. “Have other researchers found similar results?” A single study can be interesting, but scientific progress involves the accumulation of studies. We can be more confident in a study if other studies have found the same thing.

Student answers will vary. They should address whether the study aligns with or diverges from previous studies and what explanations of behavior could be either discarded or revised.

5. Finally, answer the following questions:

A. Would you describe this study being applied research or basic research? Why?

Student answers will vary, but they should explain their choice based upon the definitions in the chapter. (Basic research tries to answer fundamental questions about the nature of human behavior; applied research is conducted to address issues in which there are practical problems and potential solutions.)

B. Which goal of science (description, prediction, causation, explanation) do you think is primarily targeted by this article? Why?

Student answers will vary. They should rely upon the definitions of each goal found in the text and apply that in their answer. The key, of course, is “*primarily* targeted.”

**Sample Answers for Review Questions**

1. Why is it important for anyone in our society to have knowledge of research methods?

A background in research methods will help people read research reports critically, evaluate the methods employed, and decide whether the conclusions are reasonable. Learning about research methods will help people think critically. Many occupations require the use of research findings. It is also important to recognize that scientific research has become increasingly prominent in public policy decisions. Research is also important when developing and assessing the effectiveness of programs designed to achieve certain goals. Research methods can be the way for people to satisfy their native curiosity about ourselves, our world, and those around us.

2. Why is scientific skepticism useful in furthering our knowledge of behavior?

Scientific skepticism means that ideas must be evaluated on the basis of careful logic and results from scientific investigations. The fundamental characteristic of the scientific method is *empiricism*—the idea that knowledge comes from observations. Data are collected that form the basis of conclusions about the nature of the world.

3. How does the scientific approach differ from other ways of gaining knowledge about behavior?

In the scientific approach, data are collected and shared with peers. Adversarial conclusions are drawn from the data, and those conclusions are also shared with and reviewed by peers.

4. Provide (a) definitions and (b) examples of description, prediction, determination of cause, and explanation as goals of scientific research.

Description of behavior is based on careful observation and can be something directly observable, such as running speed, or something less observable, such as self-perception. Researchers often try to describe the ways in which events are systematically related to one another. Prediction of behavior involves anticipating events based on observations and descriptions, such as predicting that a physically attractive defendant in a criminal trial will receive a more lenient sentence than an unattractive defendant guilty of the same offense. Determination of cause involves correctly identifying the underlying reason for a behavior, such as determining if the correlation between the level of a child’s violent behavior and the amount of violent television programming the child has been exposed to is actually caused by exposure to violent programming or is caused by some other element. Explanation is very closely related to determining cause, and it seeks to explain reasons for observed behaviors. The previous example about violent television programming would also be applicable to explanation; however, the explanation may require modification if another cause or causes of the behavior are identified.

5. Describe the three elements for inferring causation. Describe the characteristics of scientific inquiry, according to Goodstein (2000).

The three elements for inferring causation include temporal precedence, which is an order of events in which the cause precedes the effect; covariation of cause and effect, in which an effect occurs if the cause is present and does not occur if the cause is absent; and elimination of alternative explanations, in which nothing other than a causal variable can be responsible for an observed effect. Goodstein’s (2000) characteristics for scientific inquiry are that data play a central role, scientists are not alone, science is adversarial, and scientific evidence is peer reviewed.

6. How does basic research differ from applied research?

Basic research differs from applied research because basic research tries to answer fundamental questions about the nature of behavior, and applied research tries to address issues in which there are practical problems and potential solutions.

**Sample Answers for Critical Thinking: Being a Skilled Consumer of Research**

1. Read several editorials in the *New York Times, Wall Street Journal, USA Today, Washington Post,* or other major metropolitan news source, and identify the sources used to support the assertions and conclusions. Did the writer use intuition, appeals to authority, scientific evidence, or a combination of these? Give specific examples.

Students’ answers will vary based on the examples that they choose. For instance, if a student selects a story regarding the outbreak of a disease in a city, its purpose would be to generate awareness, and it might use appeal to authorities to help contain this situation.

2. Imagine a debate on the following statement: Behavioral scientists should only conduct research that has immediate practical applications. Develop “pro” and “con” arguments—arguments that support or oppose the assertion.

Students’ answers will vary. Some may say that conducting research that would have immediate practical applications would act as a source of relief for some people with an obsessive–compulsive disorder. However, a disadvantage can be the fact that having a consensus on what is meant by important would vary among scientists. Another disadvantage is the people cannot always predict which research will have practical applications in the future.

3. Imagine a debate on the following statement: Knowledge of research methods is unnecessary for students who intend to pursue careers in clinical and counseling psychology. Develop “pro” and “con” arguments—arguments that support or oppose the assertion.

Students’ answers will vary. Some may argue that sound theoretical knowledge in clinical and counseling psychology would be adequate for students, and knowledge related to research methods wouldn’t be necessary. However, others might argue that students who are not aware of research methods would find it difficult to understand the methods used and its implications while referring to other research papers.

4. You read an article that says, “Eating disorders may be more common in warm regions.” It also says that a researcher found that the incidence of eating disorders among female students at a university in Florida was higher than at a university in Pennsylvania. Assume that this study accurately describes a difference between students at the two universities. Discuss the finding in terms of the issues of identification of cause and effect and explanation.

There are three elements to consider when looking at cause and effect. First is a need to ask about temporal precedence: Did living in a warm climate precede having the eating disorder? Second is a need to look at covariation of cause and effect: Do female students in a warm climate experience eating disorders more than do people in cold climates? Third, one would want to eliminate alternative explanations: Could something besides the warm climate be responsible for the higher incidence of eating disorders in Florida?

**Laboratory Demonstration: The False Consensus Effect**

People often believe that others are more like them than they really are. Thus, one’s predictions about others’ beliefs or behaviors, based on casual observation, are very likely to err in the direction of one’s own beliefs or behavior. For example, college students who preferred brown bread estimated that over 50% of all other college students preferred brown bread, while white-bread eaters estimated more accurately that 37% showed brown bread preference (Ross et al., 1977). This is known as the false consensus effect (Mullen et al., 1985; Ross et al., 1977). The false consensus effect provides the basis for the following demonstration, which emphasizes the need for systematic rather than casual observation.

Before describing the false consensus effect, have students answer the questions listed below. Next, have students predict the *class mean* for each question. Collect the data sheets. According to the false consensus effect, students’ predictions about the class mean should be influenced by their own positions. Consequently, a student whose position is below the class mean is likely to make a prediction that will be below the class mean as well.

To demonstrate the effect statistically, compute the class mean for each question using the students’ personal data. To involve the students in this process, divide the class into six groups and assign one question to each. Have them tabulate the answers for that question and calculate the mean. (Be sure each group has access to all the data sheets—rotating six batches of data sheets from one group to another until all groups have recorded data from all batches.) Put the means on the board. Next, have students compute a score for each participant in the following way: For each question, score a +1 if the participant’s personal answer and predicted class mean are either both below or both above the actual class mean; score a −1 if the participant’s personal score and predicted class mean are on opposite sides of the actual class mean. Sum all six questions so that each participant now has a single score that ranges between −6 and +6. If people err randomly, the average score for all students should be zero. In contrast, if people err in the direction of their own beliefs, the average should be greater than zero. A simple, one-group *t*-test can be calculated using *m* = 0 for the null hypothesis.

### Behavior Questions

**Personal prediction answer for class**

1. How many loads of laundry do you wash per week?

2. How many times per year do you attend services at a place of worship?

3. How many times per week do you eat a meal from a fast-food restaurant?

4. How many times per year do you wash your car?

5. How many times per year do you see a movie at a theater?

6. How many times per week do you consume alcohol?

Mullen, B., Atkins, J. L., Champion, D. S., Edwards, C., Hardy, D., Story, J. E., & Vanderlok, M. (1985). The false consensus effect: A meta-analysis of 115 hypothesis tests. *Journal of Experimental Social Psychology*, *21*, 262–283.

Ross, L., Greene, D., & House, P. (1977). The false consensus phenomenon: An attributional bias in self-perception and social perception processes. *Journal of Experimental Social Psychology*, *13*, 279–301.

# Laboratory Demonstration: Single Versus Multiple Observations

The systematic observation employed by scientists generally relies on many independent instances, while casual observation is often based on only a few instances. The following demonstration is designed to show how misleading a small sample of observations may be. Divide the class into groups of three or four students each. Fill a bowl or basket with a “population” of poker chips or simple slips of paper. On each chip or piece of paper there should be written a single score. (An approximate normal distribution of 200 numbers is provided below.) Have each group draw five samples from the population and compute the mean for each sample. Each group, however, should draw samples of a different size from the other groups. For instance, group one draws five samples of Size 1, group two draws five samples of Size 3, group three draws five samples of Size 5, and so on. The rate of progression from small to large samples depends on the number of groups. It is a good idea to have the last group draw fairly large size samples (e.g., *N* = 20 or 25). Once the means for each sample are computed, have each group plot the means on a graph on the board. It should be obvious that with small samples we can easily get a distorted picture of the population mean. Note how the variability from sample mean to sample mean decreases dramatically as we increase the sample size. Discuss how many of our casual observations are based on relatively few observations.

The following population of scores yields a population mean of 17 and a standard deviation of 4.66.

|  |  |  |  |
| --- | --- | --- | --- |
| *X* | *f* | *X* | *f* |
| 5 | 1 | 23 | 7 |
| 6 | 2 | 24 | 5 |
| 7 | 2 | 25 | 4 |
| 8 | 3 | 26 | 3 |
| 9 | 4 | 27 | 2 |
| 10 | 5 | 28 | 2 |
| 11 | 7 | 29 | 1 |
| 12 | 9 | 200 |  |
| 13 | 10 |  |  |
| 14 | 13 |  |  |
| 15 | 16 |  |  |
| 16 | 18 |  |  |
| 17 | 10 |  |  |
| 18 | 13 |  |  |
| 19 | 16 |  |  |
| 20 | 13 |  |  |
| 21 | 10 |  |  |
| 22 | 9 |  |  |

Note: This population of scores can be used for demonstrations suggested in Chapters 8 and 12.

# Activity: Observing Behavior

It is often useful to have students immediately begin making observations of behaviors. In class, students might generate a list of possible behaviors to observe on campus. For example, observe the age, ethnicity, and dress of students in various campus locations, such as different eating/gathering places, the library, and the computer center. How many students are alone, in groups of two, or groups of three or more; are these same- or mixed-gender groups? Check door cards on faculty offices to see whether the occupant is an assistant, an associate, or a full professor, and note whether the office has a window. Categorize restroom graffiti; how much is aggressive, sexual, humorous, or political? A discussion based on these observations in class can introduce students to many topics and procedures of research methods.

**Activity: Setting up a Research News Group**

Research-related stories often appear on a variety of web-related sources. A news group may be set up containing research-related stories from the American Psychological Association and American Psychological Society Press releases, Yahoo news health section, and regional psychological association press releases. Students could sign up for the newsgroup and receive e-mails with stories relevant to topics dealing with *research methods*.

**Additional Discussion Topics**

**Discussion: The Gambler’s Fallacy**

Another way to illustrate the limitations of intuition is to discuss the gambler’s fallacy. Ask students the following: If they were in Vegas and they pulled a slot machine arm 25 times with no payout, would there be a greater probability that the next pull would pay out? Or if one flips a coin 20 times and gets heads each time, is one more likely to get tails on the next trial? Even though students may understand probability intellectually, a part of their brain says, “Yes, it is more likely!” That would imply that each trial is not independent, but rather it is dependent on prior trials.

**Discussion: Operational Definitions**

Most students have not discussed operational definitions since Introduction to Psychology. Explain that research hinges on an operational definition that specifically includes AND excludes things from the definition. For example, ask students to define aggression. One can expect the usual examples of hitting, pushing, punching, kicking, and so on; now ask about indirect forms, such as spreading rumors, keying someone’s car, and so on. Now what about sports? Are hockey players aggressive? What about football? What about consensual sex between adults that involves harm to one of the participants? Remind students that the role of definitions is to both include things, such as hitting and spreading rumors, while excluding other things, such as sports and other consensual adult behaviors.

**Suggested Readings**

**Articles in the Handbook for Teaching Statistics and Research Methods (2nd ed.)**

Brems, C. (1994). Taking the fear out of research: A gentle approach to teaching an appreciation for research. *Teaching of Psychology 21*, 241–243.

Johnson, D. E. (1996). A “handy” way to introduce research methods. *Teaching of Psychology, 23*, 168–170.

**Also recommended:**

Lakin, J. L., Giesler, R. B., Morris, K. A., & Vosmik, J. R. (2007). HOMER as an acronym for the scientific method. *Teaching of Psychology, 34*, 94–96.

Marek, P., Christopher, A. N., & Walker, B. J. (2004). Learning by doing: Research methods with a theme. *Teaching of Psychology, 31*,128–131.