Research Strategies

LESSON PLANNING CALENDAR

Use this Lesson Planning Calendar to determine how much time to allot for each topic.

Schedule	Day One	Day Two	Day Three	Day Four	Day Five
Traditional Period (50 minutes)	Why Is Research Important?	Observation and Bias Case Studies	Correlation Surveys Longitudinal and Cross-Sectional Studies	Experiments	Research Ethics
Block Schedule (90 minutes)	Why Is Research Important? Observation and Bias Case Studies	Correlation Surveys Longitudinal and Cross-Sectional Studies Experiments	Experiments (continued) Research Ethics		

ACTIVITY PLANNER FROM THE TEACHER'S RESOURCE MATERIALS

Use this Activity Planner to bring active learning to your daily lessons.

Topic	Activities
Why Is Research Important?	**Getting Started:** Critical Thinking Activity: Fact or Falsehood? (15 min.) **Building Vocabulary:** Exploring Root Words (15 min.) **Building Vocabulary:** Matching (15 min.) **Graphic Organizer:** Making Sense of Research Methods (15 min.) **Digital Connection:** *Scientific American Frontiers* (2nd ed.), Segment 3: "Aliens Have Landed?" (15 min.) **Critical Thinking Activity:** The Limits of Human Intuition (20 min.) **Critical Thinking Activity:** Value of Empirical Investigation (20 min.) **Critical Thinking Activity:** Astrology and the Scientific Method (20 min.) **Evaluation Activity:** The Scientific Approach (20 min.)
Observation and Bias	**Critical Thinking Activity:** The Overconfidence Phenomenon (15 min.) **Critical Thinking Activity:** The Confirmation Bias (15 min.) **Application Activity:** A Field Experiment in Helping (15 min.) **Cooperative Learning Activity:** Naturalistic Observation (15 min.)
Case Studies	**Enrichment Lesson:** Genie and the Wild Child: Case Studies in Focus (20 min.)
Correlation	**Digital Connection:** Technology Application Activity: *PsychSim:* "Correlations" (15 min.) **Critical Thinking Activity:** Correlating Test-Taking Time and Performance (15 min.) **Critical Thinking Activity:** Evaluating Media Reports of Research (15 min.) **Application Activity:** Correlation and the *Challenger* Disaster (15 min.) **Enrichment Lesson:** Understanding Correlations (15 min.)
Surveys	**Critical Thinking Activity:** The Wording of Survey Questions (20 min.) **Cooperative Learning Activity:** Designing and Distributing Surveys (20 min.)
Longitudinal and Cross-Sectional Studies	**Digital Connection:** *Scientific American Frontiers* (2nd ed.), Segment 4: "Return to the Wild" (15 min.)
Experiments	**Digital Connection:** *Scientific American Frontiers* (2nd ed.), Segment 1: "Tackling a Killer Disease" (10 min.) **Digital Connection:** Technology Application Activity: Psychological Research on the Inter net (15 min.) **Critical Thinking Activity:** Demonstrating Experimental Design Logic (15 min.) **Critical Thinking Activity:** Finding Meaning in the Method (15 min.) **Application Activity:** Writing Experimental Hypotheses (15 min.) **Application Activity:** Writing Operational Definitions (15 min.) **Application Activity:** Identifying Independent and Dependent Variables (15 min.) **Cooperative Learning Activity:** A Tasty Sample(r): Teaching About Sampling Using M&Ms® (15 min.) **Application Activity:** Selecting Appropriate Research Methods (15 min.) **Evaluation Activity:** More Cases Are Better Than Fewer (15 min.) **Critical Thinking Activity:** Sample Size (15 min.)
Research Ethics	**Digital Connection:** *Perception and Action: The Contribution and Importance of Nonhuman Animal Research in Psychology* (15 min.) **Digital Connection:** *The Importance of Lab Animal Research in Psychology: Psychopharmacology* (15 min.) **Application Activity:** Ethics in Research (20 min.) **Role-Playing Activity:** Animal Care and Use Committee (20 min.) **Portfolio Project:** Applying Research Skills

MODULE 2

Research Strategies

Psychological scientists use a variety of tools to learn about behavioral and mental processes.

How do you know what you know? You can know something because a friend told you or because you read it. You can also know something because it "seems obvious"—in other words, through common sense. These and many other ways of knowing may be right. But they may also be wrong. Psychologists use the **scientific method,** a method of learning about the world through the application of critical thinking and tools such as observation, experimentation, and statistical analysis. Psychologists rely on the scientific method because it is more likely to answer certain kinds of questions correctly. In this module, we explore some research tools available to scientists seeking knowledge. It is because psychologists use these tools that psychology is considered a science.

scientific method A method of learning about the world through the application of critical thinking and tools such as observation, experimentation, and statistical analysis.

INTRODUCE THE MODULE

Getting Started TRM

Show students any psychology-related research that was on television or radio and in books, newspapers, or magazines in the last two weeks. **Ask:**

- What does this research tell us about human behavior?
- How can you tell if the study is a good one?

Have students complete **Critical Thinking Activity: Fact or Falsehood?** This prereading strategy evaluates what students already know about research methods and will prime students to note terms and concepts in the text that confirm or dispel their preconceptions about these methods.

Building Vocabulary TRM

Two **Building Vocabulary** exercises in the Teacher's Resource Materials offer students opportunities to improve their understanding of the module's terms.

- **Exploring Root Words** breaks down terms into their roots so students can understand where the jargon of the scientific method originates.
- **Matching** offers students an opportunity to work with many of the definitions found at the end of the module.

Resource Manager

Activities	TE	Web/Multimedia	TE	Film/Video	TE
Application	24, 27, 31, 33, 36	Digital Connection	37	*Scientific American Frontiers* (2nd ed.), Segment 3	23
Cooperative Learning	24, 28, 29	Technology Application	26, 30	*Scientific American Frontiers* (2nd ed.), Segment 4	28
Critical Thinking	21, 22, 24, 26, 27, 28, 30, 32, 33, 38			*Scientific American Frontiers* (2nd ed.), Segment 1	34
Enrichment	25, 27			*Perception and Action: The Contribution and Importance of Nonhuman Animal Research in Psychology*	37
Evaluation	22, 35			*The Importance of Lab Animal Research in Psychology: Psychopharmacology*	37
Graphic Organizer	23, 38				
Portfolio Project	38				
Role-Playing	36				
Vocabulary	21				

TEACH

Beyond the Classroom TRM

Critical Thinking As students read the section "Why Is Research Important?" emphasize that the concepts used in research methodology underlie the science of psychology. Challenge students to use research terms during class discussions.

Have students complete **Critical Thinking Activity: Astrology and the Scientific Method** and **Critical Thinking Activity: The Limits of Human Intuition.**

Beyond the Classroom TRM

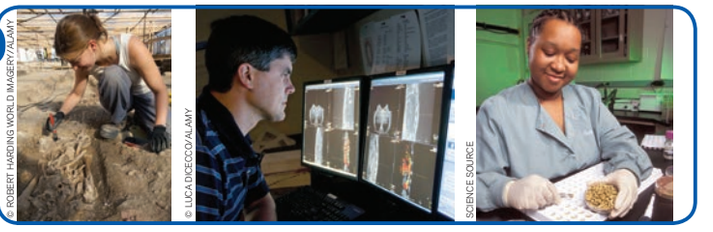
Bellringers Use the following prompts as discussion starters:

- Why should people rely on the scientific method to understand human behavior? Think of at least two different reasons and explain them.
- Which of your questions about human behavior might psychology be able to address?

Ask students to further explore the scientific method with **Evaluation Activity: The Scientific Approach** and **Critical Thinking Activity: Value of Empirical Investigation.**

The Scientific Method at Work

What do these individuals have in common? They are researchers who rely on the scientific method to learn about their chosen area of study. By using the tools of science and critical thinking, they can help us understand how the world operates.



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Why Is Research Important?

WHAT'S THE POINT?

2-1 What advantage does research have over other ways of knowing things?

Many students sign up for their first psychology class hoping to cover the "good stuff" associated with the psychology they've seen on TV and in popular magazines. How do I analyze my dreams? Does my friend have an eating disorder? What makes the opposite sex tick? Too often, the "answers" we find in the media are more myth than reality. Psychology can answer these questions, but without research there would be no way to know which answers are correct.

Even if you don't believe you're interested in research, give it a chance. Do you like solving problems and figuring out the answers to puzzles? If so, research should be right up your alley because research is not just a series of experiments. It's a set of methods, a way of asking questions about the world and drawing logical, supported conclusions. These are important life skills for everyone. Headlines trumpet the latest findings about caffeine, and news anchors are forever introducing segments on new ways to treat depression and on how the brain works. If you don't know enough about research to decide when conclusions are reasonable and when they are not, you leave yourself at the mercy of the media (see **Figure 2.1**). We surely won't all conduct research, but we will all be called on to evaluate its relevance. Just as modern civilization requires people to be computer literate to function well, it requires people to be research literate to make informed decisions.

Figure 2.1
How Do You Know What to Believe?

Critical thinking and knowledge of research help us evaluate competing claims.

In this module, we will see how psychologists conduct research by considering an example. Suppose your school is about to institute a new policy banning the use of iPods and other music players in study halls. How might we predict the effect of this new policy?

One way is to use common sense. Perhaps the common sense of school

Table 2.1

The Limits of Common Sense

Common sense leaves us unsure of the truth, but research helps us apply principles appropriately in different situations.

Common sense says . . .		
Opposites attract	but	Birds of a feather flock together
Out of sight, out of mind	but	Absence makes the heart grow fonder
Nothing ventured, nothing gained	but	A penny saved is a penny earned

administrators told them that students can concentrate better if they are not distracted by music. But wait! *Your* common sense might lead you to the opposite conclusion. Maybe you feel that the music allows you to block out distracting noises and focus more effectively on your homework. That's the trouble with common sense; too often, it can lead you to whatever conclusion you want (see **Table 2.1**). Scientific methods that psychologists use can help you evaluate the competing hunches.

PAUSE NOW OR MOVE ON

Turn to page 38 to review and apply what you've learned.

confirmation bias The tendency to focus on information that supports preconceptions.

Observation and Bias

WHAT'S THE POINT?

2-2 What are some ways that bias can influence research?

Listen Up!

Does listening to your iPod affect studying? Science can provide answers to questions like this.

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The simplest scientific technique is *observation.* In our example, you might watch students using music players and compare them with students not using music players. Which students look more focused and more intent on their work?

Observation, however, does present a problem: the potential for bias. The most common bias on the part of the researcher is called **confirmation bias,** a tendency to search for information that confirms a preconception. As you might imagine, researchers try to avoid bias as they would the plague. In our example, you and an administrator might observe the same students listening to music while studying and come to opposite conclusions. You want the research to

2

Beyond the Classroom TRM

Evaluate Have students address the following questions as they brainstorm the different ways people obtain knowledge and draw conclusions:

- What is intuition? Why might it be wrong at times?
- What is common sense? When can common sense mislead people?
- How much do people rely on anecdotes (personal narratives) to solidify their knowledge?

Students interested in learning more can use ***Scientific American Frontiers* (2nd ed.), Segment 3: "Aliens Have Landed?"**

Differentiation TRM

Graphic Organizer Graphic organizers provide learning opportunities for students at all levels. Learners can choose one of the following options when using the graphic organizer for this module.

- **Independent learners** can fill out the organizer on their own or follow along in class during discussion and lecture.
- **Cooperative learners** can use the textbook as a resource and work in groups to find the answers that fit in the blanks.
- **Exceptional learners** can fill in the blanks independently, with a tutor, or during class discussion and lecture.

TEACHING TIP TRM

Confirmation bias occurs when researchers look for information that confirms their expectations. Such bias can be detrimental to the outcome of a study. If researchers look only for answers that will confirm their initial hypothesis, then they might overlook even glaring evidence that disproves the hypothesis.

Have students complete **Critical Thinking Activity: The Confirmation Bias** and **Critical Thinking Activity: The Overconfidence Phenomenon.**

Differentiation TRM

Point out the famous experiment that demonstrated the **Hawthorne effect,** which is identified as the effect researchers have on their volunteer workers. Simply by observing workers, researchers changed worker productivity. In the original study, as researchers changed various conditions of the work environment, productivity increased. The independent variable did not seem to cause the increases; instead, the cause seemed to be the workers' belief that they were special because they were participants in an experiment. The original Hawthorne effect, however, seemed to result from experimenter bias. Only five female workers participated in the study, and two were replaced during the study for insubordination and low output.

At this point, you may want to use **Application Activity: A Field Experiment in Helping** and **Cooperative Learning Activity: Naturalistic Observation.**


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Confirmation Bias

Both the administrator and a student tend to notice examples that support their points of view.

demonstrate that music is helpful, so you may be especially sensitive to behaviors that support this conclusion. An administrator may be more likely to miss the behaviors you notice and may instead pay closer attention to actions that seem to indicate music is distracting. Both you and the administrator are being influenced by your biases.

There are many ways to reduce confirmation bias, and the best method depends on the particular study. In our example, we might try to make the observations more *objective* (that is, less biased) by finding ways to rely less on the observer's opinion. For example, we could compare the grades of students who listen to music while studying with the grades of students who don't. Or perhaps we could have the observers count specific behaviors, like how many times in a 10-minute period students look away from their work or how many pages students read in 10 minutes. If you're thinking these methods could have flaws as well (just because students are turning pages does not mean they are learning anything), congratulations! You're using **critical thinking.** Psychologists use critical thinking to examine assumptions, discern hidden values, evaluate evidence, and assess conclusions.

The point is that there is no perfect way to eliminate bias. The goal of psychological research is to minimize bias and maximize the probability of obtaining a reliable, meaningful conclusion.

Researchers must also watch for **participant bias,** a tendency for research participants to behave in a certain way because they know they are being observed or they believe they know what the researcher wants. For example, the students might study harder because the administrator is in the room, which might lead the administrator to conclude that they are studying more effectively because they are not distracted by music. To minimize participant bias, psychologists often use **naturalistic observation,** observing and recording behaviors without manipulating or controlling the situation. To avoid influencing participants' behavior simply because of their presence, observers in a lab setting may use hidden cameras or one-way mirrors.

Naturalistic Observation

Under which circumstances do you think the principal's observations are more accurate? Naturalistic observation requires that the behavior not be unduly influenced by the observer. Can you see that this might sometimes produce ethical concerns?

PAUSE NOW OR MOVE ON

Turn to page 38 to review and apply what you've learned.


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Case Studies

WHAT'S THE POINT?

2-3 Why do psychologists use case studies?

In the previous section, we looked at observation and bias. Now we turn our attention to a specific technique that relies on observational skills. Researchers who study single individuals in depth in the hope of revealing universal principles are using the **case study** method. It is important to keep in mind that the case study method is prone to bias, and it may not be possible to extend the results of one case study to other people or situations. For example, an in-depth study of just one iPod-using student in study hall could provide some very unrepresentative results because that student could naturally be exceptionally focused or distractible.

Sometimes, however, a case study is all that is ethically possible. Child abuse, for example, is usually researched with case studies. Obviously, it would be unethical for researchers to abuse a sample of children, so they must wait until authorities discover a case of abuse and then attempt to study the effects of that abuse. "Genie" was the subject of just such a study. She was discovered in California in 1970, a 13-year-old victim who had spent her life in such isolation that she had not even learned to speak. Since 1970, psychologists have intensively studied Genie's behavior and progress to learn about the development of language and social skills. Researchers who study cases such as Genie's hope that they can glean important knowledge from these tragic situations that can help explain general truths about human development and behavior.

Because no two cases of abuse are exactly alike, there is always some doubt about the conclusions of any one case study. But as similar case studies accumulate, researchers gain increasing confidence in the accuracy of their conclusions.

critical thinking Thinking that does not blindly accept arguments and conclusions.

participant bias A tendency for research participants to behave in a certain way because they know they are being observed or they believe they know what the researcher wants.

naturalistic observation Observing and recording behavior in naturally occurring situations without manipulating or controlling the situation.

case study A research technique in which one person is studied in depth in the hope of revealing universal principles.

correlational study A research project strategy that investigates the degree to which two variables are related to each other.

PAUSE NOW OR MOVE ON

Turn to page 39 to review and apply what you've learned.

Correlation

WHAT'S THE POINT?

2-4 Why is it impossible to conclude cause-and-effect relationships from correlational data?

Another technique available to researchers is to collect and examine correlational data. Is there a relationship between diet and health? Between communication style and divorce? Between training techniques and success at the Olympics? To answer these kinds of questions, researchers use a **correlational study,** a

ACTIVE LEARNING TRM

Some disciplines like anthropology, sociology, and zoology rely heavily on case studies and observational research. Have students contact working researchers in these fields to assess how they use these techniques to increase basic knowledge in their fields. Students may also explore the lives and work of some famous researchers like Jane Goodall and Dian Fossey, who used observational field research extensively.

Students interested in learning more can use **Enrichment Lesson: Genie and the Wild Child: Case Studies in Focus.**

FYI TRM

Some of the most famous psychological phenomena are based on case study research:

- **Psychoanalysis** Sigmund Freud and Carl Jung used case studies to develop and support much of their theories of human personality.
- **Behaviorism** John B. Watson and Rosalie Rayner conducted an intensive experiment, known as the "Little Albert" study, to demonstrate classically conditioned emotions. Little Albert was trained to fear white, furry objects by associating those objects with a loud noise.
- **Neuroscience** Paul Broca studied the brain of one of his patients who could only utter one syllable, "tan." Upon Tan's death, Broca studied the patient's brain, hypothesizing that the damaged area was where our ability to speak lies.

Have the students use **Enrichment Lesson: Genie and the Wild Child: Case Studies in Focus.**

ACTIVE LEARNING TRM

Ethics in Experimentation

Have students use library resources to find case studies that discuss psychological phenomena on which it would be unethical to conduct experiments. Have them compile a list of behaviors to which the case studies commonly refer. Students might explore the following phenomena:

- Child or elder abuse
- Brain disorders (strokes, tumors, and so forth)
- The impact of criminal behavior on perpetrators or victims

Have students use **Enrichment Lesson: Genie and the Wild Child: Case Studies in Focus.**

Beyond the Classroom TRM

Apply Students may benefit from knowing some technical terms for positive and negative correlations:

- **Positive correlations** are also known as direct correlations. These variables are directly related—as one increases or decreases, so does the other.
- **Negative correlations** are also known as inverse correlations. These variables have an inverse relationship—as one increases, the other decreases.

Have students explore this topic further with **Technology Application Activity: *PsychSim:* "Correlations."**

TEACHING TIP TRM

Emphasize to students that the term **correlation** does not mean "causation." Remind them that correlation means certain variables are related but does not explain why they are related. As students learn more details about the experimental method, their ability to distinguish correlation from causation will become very important, especially when they must think critically about research reports in the media.

At this point, you may want to use **Critical Thinking Activity: Correlating Test-Taking Time and Performance.**

research project designed to discover the degree to which two variables are related to each other. In the question we are examining, there are two variables:

1. Whether or not a student listens to music
2. Studying effectiveness

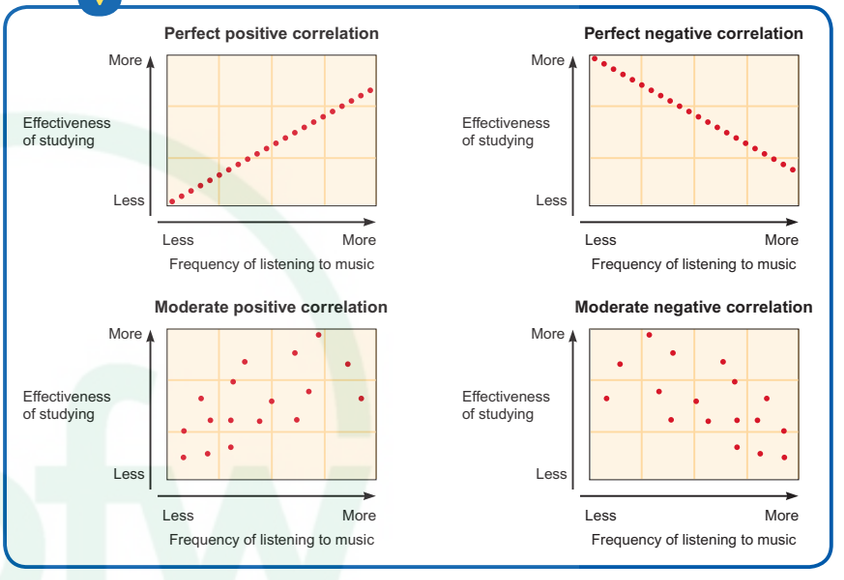
If studying effectiveness increases when students listen to music and decreases when students do not, then we can say that the two variables are *positively correlated*. That is, both variables increase (or decrease) together. But if studying effectiveness decreases when students listen and increases when they do not, then the variables are *negatively correlated*—one variable increases while the other decreases (see **Figure 2.2**).

It is very important to remember that the discovery of a correlation *does not prove that a cause-and-effect relationship exists*. Results from correlational studies can tell us that two variables are related but not *why* they are related. Suppose a researcher discovered a negative correlation between TV watching and grade point average (GPA): Students who watched more television had lower GPAs. Based on this correlation alone, can we conclude that TV watching *causes* grades to suffer? The answer is *No*. It is indeed *possible* that watching television causes one's grades to decline, but there are other possible explanations as well. It may be that having low grades causes one to watch more TV. There could even be some other variable—say, low intelligence—that could cause both a lot of TV watching and low grades. Correlation does not tell us which of these explanations is correct (see **Figure 2.3**).

Correlations cannot establish cause-and-effect relationships, but they are useful for making predictions. If you know there is a strong negative

Figure 2.2
Positive and Negative Correlations

The two top graphs show what perfect positive and negative correlations would look like for listening to music and studying effectiveness. In the positive correlation, as music use increases, so does effectiveness of studying. In the negative correlation, effectiveness of studying decreases as music use increases. Actual data would surely look more like one of the two bottom graphs, which show moderate positive and negative correlations.



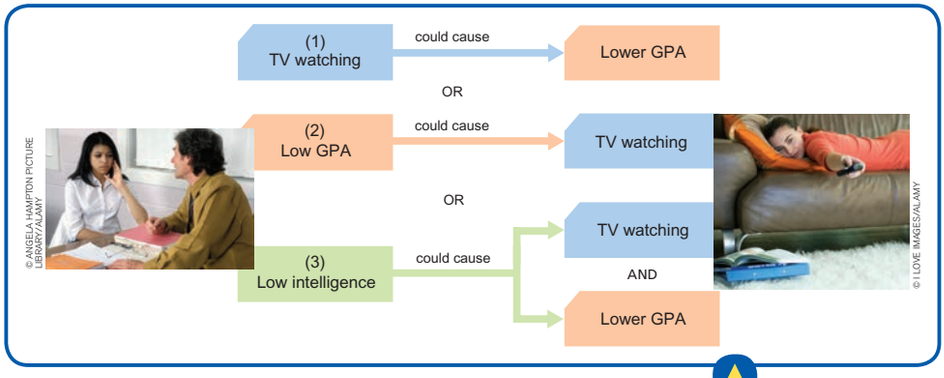


Figure 2.3
Correlation Is Not Causation

The discovery of a negative correlation between TV watching and grade point average (GPA) would not provide any information about what caused the correlation. Here are three equally plausible explanations.

correlation between TV watching and grades, and if you know a student watches several hours of television each day, then you can predict that the student will have a relatively low GPA. This is true even if more TV watching does not directly cause the low grades. The stronger the correlation, the more accurate your prediction will be.

PAUSE NOW OR MOVE ON

Turn to page 39 to review and apply what you've learned.

Surveys

WHAT'S THE POINT?

2-5 Why should we be cautious when applying data obtained from surveys?

How do researchers go about collecting data to establish a correlation? One way is to use the **survey method,** a research technique that questions a sample of people to collect information about their attitudes or behaviors. In the music example, you might have students fill out a short questionnaire about the effect of iPod use in study hall. Surveys allow researchers to collect large amounts of data efficiently through the use of such questionnaires and interviews.

There is no doubt about the efficiency of surveys or about the value of being able to collect data from large numbers of people relatively inexpensively. The problem is that surveys are almost seductively efficient. It seems so simple to create a survey that people often don't consider how easily bias can influence the wording of the questions. "Do you like flowers?" for example, will not get the same response as the question "Do you like horticulture?" Surveys also raise the problem of *social desirability.* For example, a student

survey method A research technique that questions a sample of people to collect information about their attitudes or behaviors.

2

Beyond the Classroom TRM

Apply At this point, you may want to use **Enrichment Lesson: Understanding Correlations** and **Application Activity: Correlation and the *Challenger* Disaster.**

TEACHING TIP

Likert scale questions, named after Rensis Likert, present a range of numbers paired with anchors or labels. For example, the number 1 might be paired with the anchor "strongly agree," while number 5 might be paired with the anchor "strongly disagree." The respondent chooses the number that corresponds with his or her attitude about the statement. Likert scales work best when the number range ends in an odd number, so if the respondent doesn't feel strongly either way, he or she can indicate a median position.

Active Learning TRM

Correlations

Press reports on psychological studies are often designated "experiments" when they actually present correlations. Have students collect media reports of studies and evaluate whether they correctly interpret the studies' conclusions.

- Does the report represent a correlational study as an experimental study? Why or why not?
- What variables does the study evaluate? What does the article suggest are the conclusions of this study?
- Were the researchers interviewed? If so, do they caution to interpret a correlational study appropriately? Why or why not?

Have students use **Enrichment Lesson: Understanding Correlations** and **Critical Thinking Activity: Evaluating Media Reports of Research.**

Differentiation

Potential problems with survey questions include the following:

- **Vocabulary** In one survey, 48 percent were interested in fossils, but only 39 percent were interested in paleontology.
- **Respondent bias** When interviewed by whites, 62 percent of whites agreed that "The problems faced by blacks were brought on by blacks themselves." When interviewed by blacks, only 46 percent agreed.
- **Wording** In a 1992 survey, 1 out of 5 Americans doubted the Holocaust had occurred. The question posed by the research firm was confusing: "The term Holocaust usually refers to the killing of millions of Jews in Nazi death camps during World War II. Does it seem possible or does it seem impossible to you that the Nazi extermination of the Jews never happened?" Problems include using a double negative, lots of wording, and the word "extermination," which might imply that all Jews were eliminated. When asked, "Do you doubt that the Holocaust happened, or not?" only 9 percent said they doubted it had occurred.
- **Response order** Asked to compare the relative excitement of tennis to soccer, 65 percent of respondents said soccer is more exciting. Asked to compare the relative excitement of soccer to tennis, 77 percent said tennis is more exciting.

FYI

Obtaining **random samples** for any purpose can be difficult. In the 1970 draft lottery, the 31 capsules for January birthdays were placed in the bin first, then each subsequent month's capsules until December's 31 were included. Apparently, there was not enough turning of the bin, because December dates were disproportionately represented among the early draws.

TEACHING TIP TRM

At this point, you may want to use ***Scientific American Frontiers*** **(2nd ed.), Segment 4: "Return to the Wild."**

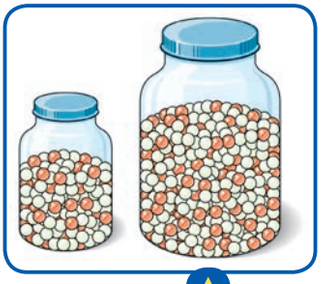


Figure 2.4
Sample and Population

The larger jar contains a population—in this case, a mixture of two colors of marbles. You can efficiently learn the percentage of each color in this larger group of marbles by randomly removing a sample (represented by the marbles in the smaller jar) and counting the two colors.

may say that she can study effectively while listening to music even though she doesn't really believe it. She answers that way because she thinks that her classmates would want that to be the answer.

But assume you have carefully designed your survey questions to avoid bias. You still must be sure your survey results will be relevant to the **population,** the entire group of people about which you would like to know something. To do this, you must draw an adequately sized **random sample,** a sample that fairly represents a population because each member of the population has an equal chance of being included (see Figure 2.4).

If the population you wish to study is the students in study halls at your school, you could, for example, draw a random sample by selecting every tenth name from a list of students registered for study halls. But is this number adequate? Researchers answer that question with mathematical formulas, but, in general, larger samples are better—if they are random. If the sample is not random, it is said to be biased and will not be a good sample no matter how large it is.

PAUSE NOW OR MOVE ON

Turn to page 39 to review and apply what you've learned.

Longitudinal and Cross-Sectional Studies

WHAT'S THE POINT?

2-6 Why do psychologists conduct longitudinal and cross-sectional studies?

population The entire group of people about whom you would like to know something.

random sample A sample that fairly represents a population because each member of the population has an equal chance of being included.

longitudinal study A research technique that follows the same group of individuals over a long period.

cross-sectional study A research technique that compares individuals from different age groups at one time.

Are you ready to examine still more research tools? Longitudinal and cross-sectional studies are techniques of particular use to developmental psychologists, who study how individuals change throughout the life span. **Longitudinal studies** follow the same group of individuals over a long period of time. In the 1920s, psychologist Lewis Terman began a famous longitudinal study of a group of highly intelligent California children. He, and later other researchers, studied these individuals for 70 years to discover what happens to bright children as they grow up. The researchers learned that, in general, these gifted people had successful careers (Holahan & Sears, 1995). Longitudinal studies provide a rich source of data as time passes, but they are quite expensive and difficult to conduct. As a result, they tend to be pretty rare. Imagine the challenges of keeping track of a group of study hall students throughout their lifetimes to determine the long-term effects of listening to (or not listening to) music with headphones.

It is more common to conduct **cross-sectional studies,** which compare people of different ages at one time. A psychologist interested in how creativity changes over the life span could gather a random sample of people from

ACTIVE LEARNING TRM

Surveys

Have students use **Cooperative Learning Activity: Designing and Distributing Surveys** to apply the principles of survey research. Surveys provide an easy way to apply research methods to real life. In this activity, students work in groups to develop a survey and distribute it to their peers.

Use **Critical Thinking Activity: The Wording of Survey Questions** to help students construct their surveys. This activity demonstrates quickly how bias in survey questions can change the answers to a question.

different age groups and administer a test of creativity to all of them. Cross-sectional studies are more efficient than longitudinal studies, but they have their own problems. If the test showed that the older groups were less creative than the younger groups, that *could* mean that creativity declines as people age. But this difference could also be explained by other factors, such as changes over time in the educational system or the introduction of computers (or headphones).

PAUSE NOW OR MOVE ON

Turn to page 39 to review and apply what you've learned.

Experiments

WHAT'S THE POINT?

2-7 Why are experiments the most powerful research technique of all, and what factors contribute to the design of an experiment?

Observation, case studies, correlational studies, surveys, longitudinal studies, and cross-sectional studies are all important research techniques. Psychologists often use these different techniques in combination—for example, by using naturalistic observations to do a case study or by conducting surveys to establish correlations. But for establishing *cause and effect,* there is only one game in town, and researchers prefer it above all others. The **experiment** is the *only* method that allows us to draw conclusions about cause-and-effect relationships. Because experiments require researchers to control the variables in a study, the chances of isolating the variable causing a particular effect are much greater.

Let's design an experiment to find out if banning listening to music in study halls would affect grades.

Hypotheses and Operational Definitions

In designing our experiment, the first thing we would do is generate a **hypothesis**—a testable prediction about the outcome of research. Researchers often start with general expectations ("Music influences concentration in study halls") but then put their variables in a more specific form that allows them to be precisely measured. In the language of research, they provide **operational definitions** of the variables—explanations of the exact procedures used to define research variables. One way to operationalize our hypothesis is to put it in this form: "Students assigned to listen to music each day in study hall will have higher average grades at the end of the quarter than students banned from listening to music." Notice that we could have

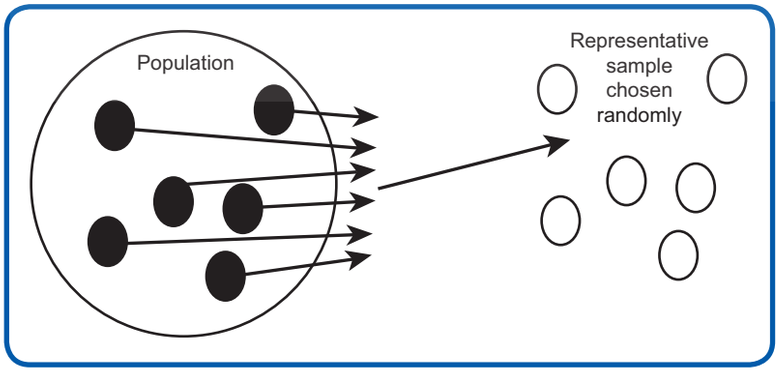
experiment A research method in which the researcher manipulates and controls certain variables to observe the effect on other variables.

hypothesis A testable prediction about the outcome of research.

operational definition An explanation of the exact procedures used to make a variable specific and measurable for research purposes.

Reteach

Use the following diagram to reinforce the concepts of randomization, representative sample, and population:



FYI

One of the most fascinating longitudinal studies in recent memory is the **Nun Study.** This study followed the living and thinking habits of a large group of nuns over a long period. Several insights into the value of this study include the following:

- The nuns' lives were relatively similar, posing fewer confounding variables. The nuns ate in convent cafeterias, usually taught in Catholic schools, did not smoke, drink, or get pregnant, and were all the same race (Caucasian).
- Cognition and health later in life were positively correlated. Nuns who showed more "idea density" and used more words in essays written in their twenties were less likely to develop Alzheimer's disease later in life.
- Genetic differences cannot be discounted in the study. Four siblings who became nuns each showed different outcomes late in life. While two out of the four were healthy and vital into their nineties, one sibling succumbed to Alzheimer's disease, and a fourth died in her eighties.

TEACHING TIP

The need for two **sample groups** can be overlooked in some cases. Richard Sprinthall cites that a common argument against capital punishment is that it has no deterrent effect. Support for this argument can be found in the fact that, years ago, pickpockets worked the very crowds observing the public hangings of other convicted pickpockets. The fallacy is that there is no comparison group. How about the number of pockets picked in crowds at a horse race or a carnival? If pocket picking was lower at the public hangings, then perhaps capital punishment did have a deterrent effect.

Source: Sprinthall, R. (1997). *Basic statistical analysis* (5th ed.). Needham Heights, MA: Allyn & Bacon.

Beyond the Classroom TRM

Collaborate At this point, you may wish to use **Cooperative Learning Activity: A Tasty Sample(r): Teaching About Sampling Using M&Ms®.**

Beyond the Classroom TRM

Evaluate Have students go to a news website and find reports about a psychological study. Have them evaluate the article using the following questions as guidelines:

- What was the hypothesis of the study?
- Who were the subjects? Is this population representative of people in general?
- Is this study correlational? If so, what factors are related? Does the article imply that the results are due to a cause-and-effect relationship?

At this point, you may want to use **Technology Application Activity: Psychological Research on the Internet.**

Beyond the Classroom TRM

Critical Thinking Technically speaking, researchers actually try to *disprove* the **null hypothesis** in experiments. The null hypothesis states that no relationship exists between the variables being studied. Laypeople are more familiar with the term **alternative hypothesis,** which describes the relationship between variables that the researcher hopes to confirm.

Have students use **Critical Thinking Activity: Demonstrating Experimental Design Logic.**

TEACHING TIP

Students often confuse independent and dependent variables. To help students keep the terms straight, suggest they identify the dependent variable (DV) first, then the independent variable (IV).

- The DV is the behavior the participant exhibits, which is often easier to identify.
- The IV causes the DV to happen.

Differentiation

Alternative Explanations In their book *Rival Hypotheses,* Schuyler Huck and Howard Sandler provide 100 short summaries of research studies and the conclusions drawn from the data. In each case, Huck and Sandler believe that some problem with design, methodology, or analysis makes it possible to account for the findings through one or more rival hypotheses. The student's task is to detect the plausible alternative explanation. Solutions at the back of the book provide logical hypotheses that might invalidate the original claim.

Source: Huck, S. W., & Sandler, H. M. (1979). *Rival hypotheses.* New York, NY: HarperCollins.

operationalized the hypothesis in many other ways. We could have said, "Students who are banned from listening to music each day in study hall will read fewer pages each day than students who are not banned from listening to music," or "Students who use iPods each day in study hall will have fewer conversations with other students than students who are not allowed to use iPods." Each of these versions has slightly different implications. Researchers must settle on the one operational definition that they believe does the best job of accurately reflecting the general hypothesis.

This is an important point to understand, even if you never conduct an experiment of your own. When you are evaluating research done by others, you should consider whether the operational definitions are appropriate or inappropriate. For example, every year *Money* magazine publishes an article about the "best places" to live in the United States. How do these researchers operationalize "best"? You have to read the article to learn that they use a complex formula to score each place on a variety of variables, including climate, unemployment rate, cultural opportunities, crime, and so on. If you don't agree with these criteria that operationalize "best," then you won't find the conclusions acceptable, either. If you like snowstorms, already have a steady job, and don't care much for theater and the ballet, you may end up seriously disappointed in a highly rated community. (To see how operational definitions are important in positive psychology, see Thinking About Positive Psychology: Operational Definitions and Positive Psychology.)

Independent and Dependent Variables

Back to our experiment. Let's assume we have agreed on this hypothesis: "Students assigned to listen to music each day in study hall will have higher average grades at the end of the quarter than students banned from listening." To discuss this hypothesis, you should know a little more about how variables are labeled. Trying to discuss experiments without knowing the different names for variables is like trying to discuss skateboarding without knowing the names of the tricks. It may be possible to describe a "kickflip backside tailslide" without knowing the phrase, but it sure is difficult.

You already know that the purpose of an experiment is to establish a cause-and-effect relationship. Every hypothesis for an experiment reflects this cause-and-effect pattern, and when you read a hypothesis, you should be able to identify two variables, the independent variable and the dependent variable:

- The variable that should cause something to happen is the **independent variable (IV).**
- The variable that should show the effect (or the outcome) of changing the IV is the **dependent variable (DV).**

independent variable (IV) The variable that the researcher will actively manipulate and, if the hypothesis is correct, that will cause a change in the dependent variable.

dependent variable (DV) The variable that should show the effect of the independent variable.

Whenever you think about an experiment, a good first step is to identify the IV and the DV. If you are unable to figure this out, you will almost certainly not understand the point of the experiment.

So, what is the IV—the "cause variable"—for our example? In our hypothesis, the variable that we predict will make a difference—our IV—is the presence or absence of music. The DV, or the variable that shows the effect, is the participants' average end-of-quarter grades.

Thinking About POSITIVE PSYCHOLOGY

Operational Definitions and Positive Psychology

Positive psychologists have research problems similar to those faced by all scientists. One of them is to develop adequate operational definitions. Like many things, this is often more difficult than it appears.

For example, positive psychologists are interested in happiness. They recognize that it's not exactly the opposite of, or even the absence of, depression. So, what is it? And more importantly, how do you measure it for research purposes? There are many ideas about how to do this, and none of them are perfect.

- Perhaps you could measure happiness with some physiological measure. Wouldn't it be nice if it were as easy to measure happiness as it is to measure blood pressure or cholesterol level? Yes, it would be nice, but so far we haven't been able to discover a direct physiological measure.
- Maybe you could measure happiness using observation. One way to do this would be to look for evidence that a person is smiling. However, people don't always agree about what a smile is—another operational definition problem! Smiles aren't always genuine, either, and it's also possible to be happy without smiling.
- Another way to measure happiness would be to administer surveys, and survey results, in fact, are often used as the operational definition of happiness. One such survey is the **Satisfaction With Life Scale** (Diener et al., 1985). Why don't you give it a try!

Satisfaction With Life Scale

Directions: Below are five statements with which you may agree or disagree. Using the 1–7 scale below, indicate your agreement with each item by placing the appropriate number in the line preceding that item. Please be open and honest in your responding.

1 = strongly disagree
2 = disagree
3 = slightly disagree
4 = neither agree nor disagree
5 = slightly agree
6 = agree
7 = strongly agree

__ 1. In most ways my life is close to my ideal.
__ 2. The conditions of my life are excellent.
__ 3. I am satisfied with my life.
__ 4. So far I have gotten the important things I want in life.
__ 5. If I could live my life over, I would change almost nothing.

Source: Diener et al. (1985).

Scores on this **Satisfaction With Life Scale** can range from 5 to 35, with scores above 20 generally indicating satisfaction with life. Does your overall score seem accurate? Does it match your impression of what it means to be happy? If so, that means you believe that scores on this survey are a good operational definition of happiness.

Groups, Random Assignment, and Confounding Variables

To make the independent variable vary (take on different values), researchers set up groups of participants. Typical experiments have at least two groups: an experimental group and a control group (sometimes referred to as the experimental and control conditions). In the **experimental group,** the participants are exposed to the treatment (the IV). In the **control group,** the participants are not exposed to the treatment (the IV). Control group participants function as a comparison for the experimental group participants. In our example, the experimental group will comprise all students assigned to listen to music and the control group will comprise all students who are not

experimental group The participants in an experiment who are exposed to the independent variable.

control group The participants in an experiment who are not exposed to the independent variable.

Beyond the Classroom TRM

Apply Emphasize to students that experiments are more likely to be replicated effectively if clear **operational definitions** are used. Operational definitions attempt to define clearly the behaviors that the researchers are looking for. If the operational definitions are clear enough, then others can more easily and accurately replicate the study.

At this point, you may wish to use **Application Activity: Writing Operational Definitions.**

TEACHING TIP

Explain to students that **operational definitions** do not have to include every possible behavior to be accurate. Remind students that, to create a good definition, they should come up with a few behaviors that can be observed. Replication of experiments allows for definitions to be refined or changed.

Differentiation TRM

Point out the different kinds of hypotheses students can generate:

- **Two-tailed hypotheses** state that the independent variable affects the dependent variable—for example, "Studying affects students' grades." This hypothesis provides the most flexibility because it allows for grades to be affected negatively or positively.
- **One-tailed hypotheses** state a directional relationship between the independent and dependent variables—for example, "Studying improves students' grades." Data analysis on one-tailed hypotheses is very limited. The reported outcome can relate only to whether or not a positive relationship was found.

At this point, you may want to use **Application Activity: Writing Experimental Hypotheses.**

Reteach TRM

Distinguishing Variables Use **Application Activity: Identifying Independent and Dependent Variables** to solidify students' knowledge of these important concepts. In this activity, students choose independent and dependent variables from a hypothesis presented in the activity handout.

random assignment A procedure for creating groups that allows the researcher to control for individual differences among research participants.

confounding variable In an experiment, a variable other than the independent variable that could produce a change in the dependent variable.

allowed to listen. These two groups will permit us to compare the effect of music on two groups of similar students.

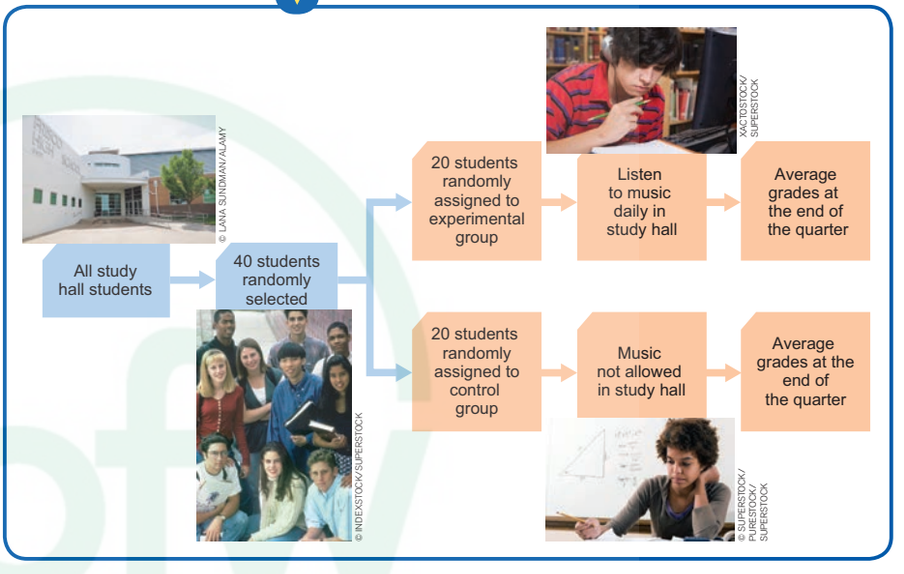
The number of participants assigned to each group depends on some complicated statistical factors, but usually there are at least 20 participants per group. Therefore, we need to select 40 students for the experiment. We need to draw these students randomly from the entire population of 400 study hall students (for example, by selecting every tenth name from a complete list of study hall students). If the selection is not random, the sample may be biased, and we would not be able to apply the results to the whole study hall population.

Now comes one of the most important steps: How do we decide which 20 students in the pool of participants should be in the experimental group and which 20 should be in the control group? An absolutely critical feature of experimental design is that the participants are placed in groups by **random assignment.** Because chance alone determines group assignment, we can assume individual differences among participants will be equally distributed between the two groups. You could use a computer program to do the random assignment or a low-tech method like drawing names out of a hat. Figure 2.5 summarizes the various components of our design.

These individual differences among participants are the largest category of a special kind of variable known as **confounding variables** (from a Latin word that means "to confuse"), or variables other than the IV that could produce a change in the DV. To draw cause-and-effect conclusions from an experiment, researchers must adequately control for confounding variables. To see how this works, imagine for a moment that the students in our experimental group (those assigned to listen

Figure 2.5
Experimental Design

The hypothesis is that students who are assigned to listen to music in study hall will have higher average grades at the end of the quarter than students banned from listening to music. To create different levels of the IV, the presence or absence of music, 40 randomly sampled students will be randomly assigned to an experimental group that listens to music and a control group that does not. Later we will determine the effect of this manipulation by measuring the DV, average grades at the end of the quarter, for each group. The hypothesis leads us to predict that the experimental group will have higher average grades.



FYI

Groups in an experiment can be compared in several different ways:

- **Within-groups** occur when the group of subjects is compared to itself. This is often found in "pre-post" designs. The group of subjects serves as both the experimental and control group.
- **Between-groups** occur when one group is the control group and another separate group is the experimental group.
- **Matched-subjects** occur when the between-subjects design is used, with a twist, to control for individual differences. For example, each group may have the same number of men and women to control for gender, which may confound the study.

TEACHING TIP TRM

- **Random sample** and **representative sample** refer to the same sample. Randomly choosing participants from the population helps make a sample representative.
- **Random sampling** involves choosing participants at random from a population.
- **Random assignment** involves taking the participants in the random sample and assigning them to experimental groups randomly.

At this point, you may want to use **Critical Thinking Activity: Sample Size.**

Active Learning

Random Assignment

Show students the importance of random assignment by gathering data that would be skewed without randomly assigning students to groups. Examples of data include GPA, height, or shoe size.

1. Begin by selectively dividing students into two groups, such as only boys and only girls.
2. Gather the data and discuss the results with the students.
3. Now randomly assign students into two new groups and collect the data again.
4. Compare results from the skewed selection and random selection groups. Emphasize to students how random assignment helps limit the effect of individual differences.

to music) are also healthier than the students in the control group (those banned from music). If the experimental group does have higher average grades at the end of the quarter, how would we know what caused this? The cause could have been the IV—music—but it could also have been the higher level of health in the experimental group. We really don't know because the health variable *confounds* the music variable.

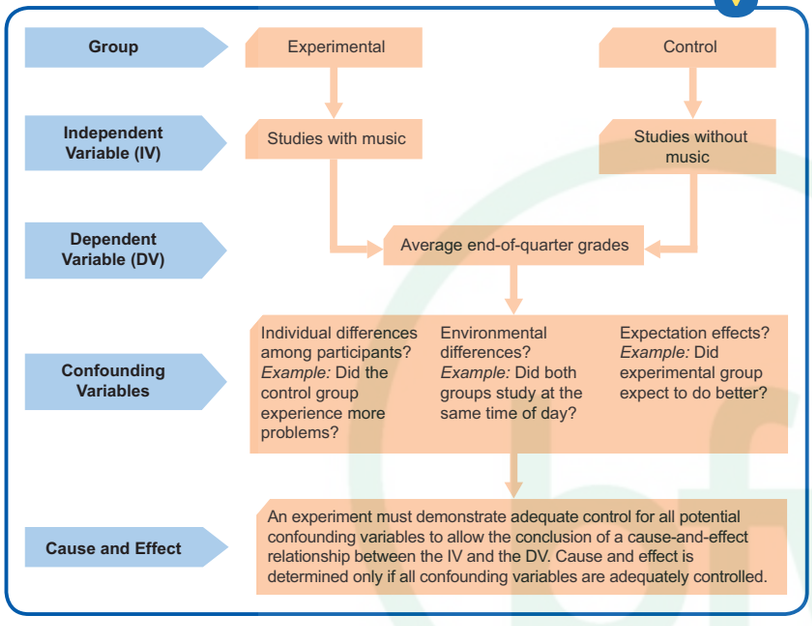
We have to be careful about how we set up the two groups so that we can eliminate confounding variables that could influence our experimental group's performance. Potential confounding variables include the amount of sleep participants get, the number of personal problems they're experiencing, and the quality of the teachers they have. This is why random assignment of participants to groups is so critical: It enables the researcher to assume that these potentially confounding factors will balance almost evenly across the two groups, just as 40 coin flips will usually balance fairly evenly between heads and tails. (Go ahead. Try it!) Without random assignment, there is a much greater likelihood that a confounding variable will bias the results of the research. You have to randomly assign participants to groups to conduct a true experiment and identify the cause-and-effect relationship between the IV and the DV.

Control for Other Confounding Variables

In addition to controlling for individual differences, a good experimental design must control for two other types of confounding variables: environmental differences and expectation effects (see **Figure 2.6**). It is relatively easy to control

Figure 2.6
The Challenge of Confounding Variables

Experimenters use a variety of techniques to minimize the disruptive effects of confounding variables. There are two challenges involved: anticipating what the confounding variables will be, and then deciding on the best method of dealing with each of them.



Beyond the Classroom TRM

Apply Using Figure 2.5, have students supply different hypotheses and populations as you guide them through how an experiment testing hypotheses would look. You may even challenge your students to go through the process of conducting an actual experiment with one of their proposed hypotheses. Set up an in-house institutional review board (IRB) to go over the projects to ensure ethical standards are met.

Use **Application Activity: Selecting Appropriate Research Methods.**

Differentiation

Help students who struggle with vocabulary by pointing out the definition of the word *confound.* As Charlie points out, *to confound* means "to confuse," so confounding variables are variables that can be confused with the independent variable. Experiments with confounding variables leave researchers confused about whether the independent variable caused the dependent variable.

Active Learning TRM

Confounding Variables

Using Figure 2.6, lead students through other hypotheses and variables, brainstorming about what **confounding variables** might surface as explanations for a study's results. If students are pursuing their own experimental design projects, have them do this activity with their own hypotheses so they can avoid confounding variables.

Use **Critical Thinking Activity: Finding Meaning in the Method.**

TEACHING TIP

Placebos are easiest to understand when discussing drug research, but the placebo effect can occur with any type of treatment. Studies have shown that even when people merely decide to seek therapy, their problems seem to dissipate whether or not they actually complete the therapy. Researchers must take care to have all patients in a study participate in some sort of "treatment," even if the control treatment seems an exercise in futility.

Beyond the Classroom TRM

Bellringers The use of placebos is standard practice for medical and psychological efficacy studies. Use the following prompts as discussion starters:

- If a drug shows effectiveness during a research study, are researchers ethically responsible for providing the benefits to all patients in the study? *(If a drug shows significant promise during a study, then researchers halt the study and provide all patients with an opportunity to receive the treatment.)*
- How might patients feel if their doctors, outside a research setting, gave them a placebo instead of medicine? Is this practice ethical? Why or why not?

At this point, you may wish to use ***Scientific American Frontiers*** **(2nd ed.), Segment 1: "Tackling a Killer Disease."**

Differentiation

Understanding Blind Research Help students understand how the word *blind* can be used in the context of experimental research.

- A person who is blind cannot see the surrounding world. In a blind experiment, research participants are unaware of which group they are in and, therefore, cannot see their true place in the experiment.
- Double-blind experiments involve two different groups of people—the experimenters and the research participants—who are unaware of which group the research participants are in.

double-blind procedure A research procedure in which both the data collectors and the research participants do not know the expected outcome of the experiment.

placebo An inactive substance or condition used to control for confounding variables.

for environmental differences. In our music example, you would want to make sure that all participants were in a study hall with the same temperature, lighting, and noise conditions.

Researchers must take special care, however, to control for expectation effects. They begin by making sure that participants are not aware of the hypothesis of the experiment. If participants were aware, then their expectations could influence the outcome. In our example, students in the experimental group might do better because their knowledge of the hypothesis raised their confidence. To control for expectation effects, experimenters often use a *blind* (or masked) procedure, which means that they do not tell participants what the hypothesis is until after the data are collected. Sometimes researchers use a **double-blind procedure,** in which both the data collectors and the research participants do not know the expected outcome of the experiment. Using a double-blind procedure is particularly important when the researchers collecting data are asked to make judgments about the dependent variable (for example, judging whether or not students are studying effectively). Without the double-blind procedure, researchers might be inclined to see what they expected to see and not see what they didn't expect.

In experiments where a drug is the independent variable, researchers deal with expectation effects by using a **placebo,** an inactive pill that has no known effect. Imagine that you want to test the effectiveness of a new drug that may enhance memory. To set up this experiment, you would form an experimental group and a control group to manipulate whether participants would receive the drug, the IV. You would measure the effect of the drug by comparing the two groups' performance on, say, a memory task, the DV. However, if the experimental group receives a pill and the control group does not, you will not be able to successfully interpret better performance by the experimental group. Why? Because our expectations have a profound and well-documented effect on our responses. People receiving a pill of any sort will expect to experience change, and they will work harder to achieve the expected results. Given this extra effort, you would not know whether the drug caused the enhanced memory in the experimental group or whether the expectations created by taking that drug enhanced people's memory (Kirsch & Sapirstein, 1998). You could control for this, however, by giving a placebo pill, containing no active substances, to the control group. Now, because all participants in both groups receive a pill and neither group knows whether the pill contains active or inactive substances, you can be sure that the expectations produced by taking a pill did not account for any improvement in memory.

Let's return to our music example and review what we've accomplished so far. We are conducting an experiment to test this hypothesis: "Students assigned to listen to music each day in study hall will have higher average grades at the end of the quarter than students banned from listening." We have identified the independent variable as the presence or absence of music and created this variable by establishing an experimental group and a control group. We have randomly selected the participants for the experiment from the entire study hall population, so we can be sure that the sample is not biased and the results will apply to all study hall students. We randomly assigned the participants to the two groups to control for any individual differences among them, and we controlled for

FYI

- The **placebo effect** is a medical phenomenon in which patients believe a treatment will work simply because their doctor tells them it will. In this case, a patient who is simply being treated derives a health benefit.
- The **halo effect** is a phenomenon in which a person's belief that a particular treatment is effective causes it to work.

other confounding variables by making sure the environmental conditions and expectation effects for the two groups are as similar as possible. The only thing we want to differ between the two groups is the IV—whether or not students listen to music—because we want to be able to conclude that there is a cause-and-effect relationship between music and end-of-quarter grades.

Data Analysis

Now we run the experiment and collect the data. Then we analyze the numbers, using statistics, to find out if the hypothesis is supported.

Let's say the average end-of-quarter grade for the experimental group is a B and for the control group is a C. Is this enough of a difference to conclude that there is a cause-and-effect relationship between listening to music (or not) and grades? Maybe. But what if the difference was between a B and a B–? How different must the values of the dependent variable be for the two groups? Perhaps you've heard the phrase *statistically significant*. Most researchers have agreed that we can consider a result statistically significant if the possibility that the difference between groups would occur by chance alone is no more than 5 percent. To determine this likelihood, we must consider three questions:

1. How big is the difference between the groups?
2. How uniform are the results within each group?
3. How many participants are in each group?

If we find a big difference *between* two large groups of students and small variations in results *within* each group (for example, mostly As and Bs in one group and mostly Cs and Ds in the other), we can be confident that the results are statistically significant.

The steps of the experimental method are summarized for you in **Table 2.2.**

Table 2.2

The Experimental Method Step by Step

1. Develop the *hypothesis*.
2. Create *operational definitions* for the *independent variable (IV) and dependent variable (DV)*.
3. *Randomly select* a sample of participants from the population.
4. *Randomly assign* the participants to the *experimental and control groups*.
5. Expose the experimental group, but not the control group, to the IV. If necessary, use a *placebo* with the control group to balance expectations.
6. Control for other *confounding variables* by using a *double-blind procedure* and treating both groups the same except for exposure to the IV.
7. Learn the effect of the IV by measuring the DV for both groups.
8. Use *statistical analysis* to discover whether the difference in the DV between the two groups is likely to have been caused by the manipulation of the IV.

Replication

There is one other safeguard required for an experiment. Researchers must be able to **replicate** the results—that is, repeat an experiment to see whether the results can be reliably reproduced. Unless a study can be replicated, the results are likely to be a fluke occurrence. If an experimental result can be obtained only once, we must conclude that it was caused by some chance variable and not by the independent variable. This means there is no apparent cause-and-effect relationship between the IV and the DV. In our study hall experiment, replication studies might involve repeating the experiment at different schools or under slightly different conditions. Replication helps us know that the results apply in a variety of

replicate To repeat the essence of a research study to see whether the results can be reliably reproduced.

FYI

- One of the goals of research is to be able to generalize findings to the public at large. A study has little value if the findings apply only to a specific group of people.
- The more a study is **replicated,** the more likely the findings can be applied to the general public.

Beyond the Classroom TRM

Evaluate At this point, you may wish to use **Evaluation Activity: More Cases Are Better Than Fewer.**

Interconnections

Point out to students that Module 3: Psychology's Statistics goes into greater detail about the use of statistics in data analysis in psychology. Help students see that the mathematical discipline of statistics is used in the real world to make sense of the data generated by studies in psychological science.

Beyond the Classroom TRM

Apply Have students discuss any other **ethical** considerations that experimenters might find necessary to consider before conducting experiments on human beings and animals. Challenge students to develop an **ethics code** for conducting their own experiments:

- What considerations might need enhancing?
- What additional ethical considerations must be observed when working with minors?
- How does the use of deception affect the ethics of a study?

At this point, you may wish to use **Application Activity: Ethics in Research.**

FYI TRM

Some famous studies in **social psychology** have spurred a tightening of ethical standards. Stanley Milgram's obedience study and Philip Zimbardo's prison-guard study forced researchers to consider the long-term psychological effects on research participants having committed acts they didn't realize they were capable of committing. You may want to highlight these two studies and discuss how different they might look if conducted today.

At this point, you may wish to use **Application Activity: Ethics in Research.**

situations, and it underlines the importance of clear operational definitions for all our variables. It is no accident that our topic in this module is *re*search—not search. Researchers have to demonstrate their findings again and again and again!

PAUSE NOW OR MOVE ON

Turn to page 39 to review and apply what you've learned.

Research Ethics

WHAT'S THE POINT?

2-8 What ethical guidelines are in place to protect the rights of human research participants and animal research subjects?

There are ethical considerations with all research, especially when the participants are humans. These ethical issues extend well beyond the methodological issues we have been discussing so far. For moral reasons, many hypotheses cannot be tested experimentally, even though we could design sound experiments that would provide good answers. For example, suppose that you have a hypothesis that children who are disciplined by being whipped with a belt will not behave as well as children disciplined without physical punishment. This experiment would be quite simple to set up. The IV would be exposure to whippings, and the DV would be some measure of behavior, such as number of broken rules. You would then choose a sample of participants and randomly assign them to two groups. Those in the experimental group would be whipped by their parents, and those in the control group would be disciplined by their parents in other ways. Here we have a straightforward experimental design, but you can see why it would be unethical to conduct this experiment. You would be exposing your experimental group participants to a procedure that you believe would harm them.

Human Research

Most research takes place on university campuses, where ethics committees screen all research proposals in advance. The committee checks that the research will comply with the strict ethical guidelines for research with human participants set by the American Psychological Association (APA, 2002). There are four basic principles:

- *Informed consent.* Researchers must inform potential participants in advance about the general nature of the research and any potential risks involved. Participants must understand that they have a right to refuse to participate or to withdraw at any time.
- *The right to be protected from harm and discomfort.* Researchers may conduct studies that involve harm and discomfort only under certain circumstances and only with the participants' informed consent.

ACTIVE LEARNING TRM

Animals in Experimental Studies

The APA Ethics Code requires that institutions allowing animal experimentation establish an Animal Care and Use Committee to review whether animal studies follow ethical standards.

Divide students into groups and, using **Role-Playing Activity: Animal Care and Use Committee,** have them apply their knowledge of animal research ethics by pretending to be on an Animal Care and Use Committee that must determine whether a series of experiments should be allowed to go forward.

- *The right to confidentiality.* Researchers must never release data about individual participants, and members of the research team may not gossip or spread information about the participants.
- *The right to debriefing.* Participants must receive a full explanation of the research when their involvement is done. This is especially important if the research has included deception.

Animal Research

The four ethical principles discussed here help protect the rights of human research participants, but what about animals? We sometimes hear media reports of research that seems to subject animals to unwarranted cruelty, pain, and suffering. Why are animals used in research? What is done to protect them?

Psychologists use animals in research for several reasons:

- Many psychologists are simply interested in animal behavior. It is a fascinating and legitimate field of study.
- There are biological and behavioral similarities between animals and humans. Therefore, by studying animals, we can learn things that apply to humans.
- Because many species of animals develop more rapidly and therefore have shorter life spans than humans do, we can study genetic effects over generations much more rapidly in animals than in humans.
- It is often possible to exercise more control over experiments with animals than over those with humans. For example, researchers can observe animals 24 hours a day and control their diet completely. Humans usually will not agree to such conditions.
- Procedures that are not ethical to perform on humans may be considered acceptable when performed on animals. My sister-in-law once had a job in a medical laboratory, where she performed surgery on unclaimed dogs that had been slated to be killed at a local animal shelter. She tied off an artery and created heart attacks in these dogs so that researchers could run controlled tests of experimental drugs designed for human heart attack patients. Is it right to place the needs of humans above those of animals? It's a difficult question, but we live in a society where some animals (cows and chickens) are raised for food and others (rats and insects) are exterminated to reduce the threat of disease. Since it has given rise to so many valuable findings, supporters of animal research argue that it's permissible to use or even sacrifice animals for the good of humans.

So, what is done to protect animals from abuses? Federal legislation has been passed to protect animals used in research. This legislation, which has the support of the vast majority of researchers (Plous & Herzog, 2000), says that animals must have clean housing, adequate ventilation, and appropriate food and that they must be otherwise well cared for. Certain media accounts portraying animals in psychological research as "victims of extreme pain and stress, inflicted upon them out of idle curiosity" appear to be untrue. One study checked every animal study published in all of the APA's journals for five years (Coile & Miller, 1984). That study was unable to identify a single instance of abuse.

Digital Connection

Have students explore the APA's website to see the **APA Ethics Code** in more detail. They can see what specific considerations researchers must observe when conducting experiments with both human and animal research participants. You can find the code at www.apa.org/ethics.

Active Learning

Contact a local university or medical school to see what types of animal research are conducted at that institution. **Ask:**

- What are the goals of research studies being conducted on animals? Is the goal to learn more about animal or human behavior?
- How does the institution ensure that animals are treated ethically?
- Has the institution had trouble with animal-rights protests? Why or why not?

Active Learning

Laboratory Animal Regulations

Have students explore what specific federal regulations exist to ensure animals are treated well in experimental laboratories. **Ask:**

- How big do living quarters need to be for different types of animals? Why are there differences in sizes of living quarters?
- What is "adequate ventilation"?
- Should more stringent measures be in place to protect animal rights? Why or why not?

TEACHING TIP TRM

At this point, you may want to use the video resources ***Perception and Action: The Contribution and Importance of Nonhuman Animal Research in Psychology*** and ***The Importance of Lab Animal Research in Psychology: Psychopharmacology.***

ASSESS

Check for Understanding TRM

Review and confirm concepts about research methods using **Critical Thinking Activity: Fact or Falsehood?** Suggest that students take turns reading items from the handout to partners, who should answer the item with either "true" or "false." The respondent should explain the reason for the answer. Partners can then check each other's responses together by referring to the text.

Review TRM

Have students fill out and use **Graphic Organizer: Making Sense of Research Methods** as a tool for reviewing concepts related to research. Encourage students to fill in the graphic organizer on their own at first, without referring to the text or organizers they filled out earlier in the module. Next, have them work with partners to complete items on the organizer and, when necessary, look up information in the text to clarify concepts.

CLOSE

Summarize

Emphasize that research methodology underlies the entire discipline of psychology. Scientific principles of control, integrity, and ethics are at the heart of the findings studied in this text. What we know about human behavior relies on how well scientific studies follow these principles. When students hear about studies, remembering the concepts in this module will help them be better thinkers and consumers.

Answers Why Is Research Important?: Apply What You Know

1. (b)
2. Research leads to logical, supported conclusions. It is important for people to be research literate so that they can make informed decisions.

Answers Observation and Bias: Apply What You Know

3. Confirmation
4. naturalistic

PAUSE NOW OR MOVE ON

Turn to page 40 to review and apply what you've learned.

Just as every marathon runner is also an athlete and every pianist is also a musician, every psychologist is also a scientist. This means psychologists use a particular set of research strategies to learn about behavior and mental processes. All the factual information you will read in this book was gathered using these research methods. Your knowledge of these methods will deepen your understanding of psychology and help prepare you to think critically in a world where research can (and should) drive many decisions. Now, what will you say when your school administrators announce that new study hall music policy?

SUMMARY AND FORMATIVE ASSESSMENT

MODULE 2

Thinking About Research Strategies

Why Is Research Important?

WHAT'S THE POINT?

2-1 What advantage does research have over other ways of knowing things?

- Well-designed research produces data-supported conclusions.
- Research is better than common sense at providing reliable, logical answers to questions.

Apply What You Know

1. One advantage of the scientific method over other ways of understanding the world is
   a. the scientific method can answer any question.
   b. the scientific method leads to more reliable, reproducible answers.
   c. people are more likely to agree with scientific answers than other kinds of answers.
   d. scientific answers are more likely to fit with our common sense.
2. Briefly describe why it is important for all people to have an understanding of the scientific method.

Observation and Bias

WHAT'S THE POINT?

2-2 What are some ways that bias can influence research?

- Bias is any influence that unfairly increases the possibility that we will reach a particular conclusion.
- Research can be negatively influenced by a researcher's confirmation bias and by participant bias.

Apply What You Know

3. _____ bias exists when a researcher only looks for information that supports his or her point of view.
4. One way to minimize participant bias is to use _____ observation to collect data.

PORTFOLIO PROJECT TRM

Applying Research Skills

Leading students through their own research experiment provides a valuable critical thinking and learning experience. Help students research and showcase their work.

- Choose topics with a rich research background. This will help with literature review and generating hypotheses.
- Have students work cooperatively in groups to encourage teamwork and to decrease the number of studies you must monitor.
- Insist on following ethical guidelines. No research should be conducted without obtaining informed consent from the research participants.
- Create a rubric that places emphasis on critical thinking, good research skills, and ethics.

At this point, you may want to use **Alternative Assessment/Portfolio Project: Applying Research Skills.**

Case Studies

WHAT'S THE POINT?

2-3 Why do psychologists use case studies?

- Case studies collect in-depth information on a single person or situation. However, researchers cannot know from the case study alone if the conclusions are true for other people or situations.

Apply What You Know

5. If a researcher wanted to study a unique situation, such as a child growing up in a household in which four languages are spoken, what research method is most appropriate?
   a. case study
   b. survey
   c. correlational study
   d. cross-sectional study
6. Why must researchers be cautious about the results of a case study?

Correlation

WHAT'S THE POINT?

2-4 Why is it impossible to conclude cause-and-effect relationships from correlational data?

- A correlational study tells us the extent to which two variables are related. If the variables change in the same direction, then it's a positive correlation; if the variables change in opposite directions, then it's a negative correlation. Correlations do not establish that there is a cause-and-effect relationship between the two variables. We do not know if one of the two variables caused the change or even if a third variable caused the change in each of the correlated variables.

Apply What You Know

7. A _____ correlation exists when one variable increases while another variable decreases.
8. If variable A is correlated with variable B, what are the three possibilities in terms of cause and effect?

Surveys

WHAT'S THE POINT?

2-5 Why should we be cautious when applying data obtained from surveys?

- Surveys are an efficient way to collect information about people's attitudes or behaviors by asking questions on a questionnaire or in an interview. Researchers must be careful to construct unbiased questions and to use a random sample to draw adequate conclusions about their populations.

Apply What You Know

9. What is the most important caution you would give to a researcher interested in using a survey?
10. To be useful, a survey must be administered to a _____ sample pulled from a larger _____.

Longitudinal and Cross-Sectional Studies

WHAT'S THE POINT?

2-6 Why do psychologists conduct longitudinal and cross-sectional studies?

- These techniques allow psychologists to study how individuals change across the life span. Longitudinal studies follow the same group for many years. Cross-sectional studies compare people of different ages at one time.

Apply What You Know

11. _____ studies compare individuals from different age groups at one time.
12. Why are more cross-sectional studies conducted than longitudinal studies?

Experiments

WHAT'S THE POINT?

2-7 Why are experiments the most powerful research technique of all, and what factors contribute to the design of an experiment?

Using the Test Bank

The **Test Bank** that accompanies this textbook offers a wide variety of questions in different formats and levels of complexity. Use the software to construct whole tests or to integrate standardized questions into teacher-made tests.

Answers Case Studies: Apply What You Know

5. (a)
6. The case study method is prone to bias, and it may not be possible to extend the results of one case study to other people or situations.

Answers Correlation: Apply What You Know

7. negative
8. Variable A could cause variable B, variable B could cause variable A, or a third variable could cause variable A and variable B.

Answers Surveys: Apply What You Know

9. Be careful not to write questions that lead people to answer in a certain way.
10. random, population

Answers Longitudinal and Cross-Sectional Studies: Apply What You Know

11. Cross-sectional
12. Cross-sectional studies are less expensive, less difficult to conduct, and more efficient than longitudinal studies.

- Only experiments can establish cause-and-effect relationships. They do this by generating a hypothesis with operationalized independent and dependent variables, by randomly selecting participants and randomly assigning them to the experimental and control groups to control for confounding variables, and by controlling for other confounding variables relating to expectations and environmental differences.
- Data from experiments must be analyzed to reveal statistically significant conclusions.
- It must be possible to replicate experimental results before a cause-and-effect relationship can be concluded.

Apply What You Know

13. Why are placebos used in some experiments?
    a. They provide a way for the dependent variable to vary.
    b. They allow for statistical analysis of results.
    c. They are necessary for observational studies.
    d. They help control for some confounding variables.
14. Explain why random assignment is a critical feature of experimental design.

Research Ethics

WHAT'S THE POINT?

2-8 What ethical guidelines are in place to protect the rights of human research participants and animal research subjects?

- Ethical guidelines for research require that human participants have the rights of informed consent, protection from harm, confidentiality, and debriefing.
- Federal guidelines protect the health and safety of animals used in research.

Apply What You Know

15. _____ occurs when a research participant knows the general nature of the research and agrees to participate.
16. _____ is when a participant receives a full explanation at the conclusion of the research.

KEY TERMS

scientific method, p. 21
confirmation bias, p. 23
critical thinking, p. 24
participant bias, p. 24
naturalistic observation, p. 24
case study, p. 25
correlational study, p. 25
survey method, p. 27
population, p. 28
random sample, p. 28
longitudinal study, p. 28
cross-sectional study, p. 28
experiment, p. 29
hypothesis, p. 29
operational definition, p. 29
independent variable (IV), p. 30
dependent variable (DV), p. 30
experimental group, p. 31
control group, p. 31
random assignment, p. 32
confounding variable, p. 32
double-blind procedure, p. 34
placebo, p. 34
replicate, p. 35

Answers Experiments: Apply What You Know

13. (d)
14. Because chance alone determines group assignment, we can assume individual differences among participants will be equally distributed.

Answers Research Ethics: Apply What You Know

15. Informed consent
16. Debriefing