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1 INTRODUCTION TO RESEARCH METHODOLOGY

LEARNING OBJECTIVES

Upon completion of this chapter, the reader should be able to do the following:

1.1 Explain why an understanding of research methods is important.

1.2 Describe the four goals of science.

1.3 Describe the steps of the research process.

1.4 Identify four characteristics of science.

Consider the following questions:

- Is a relationship more exciting when you keep it a secret?
- What is your prospective employer likely to think of your new tattoo?
- Does drinking alcohol affect the extent of our self-disclosure?
- Are people more likely to lie for a friend or a stranger?
- Does the amount of sleep you get affect your test performance the next day?

Research can answer questions like these. In fact, each of the above questions is addressed somewhere in this textbook, which is designed to teach you how to understand research. I'll use this chapter to give you a brief introduction to research and an introduction to many of the topics you'll encounter in this book.

WHY DO I NEED TO KNOW ABOUT RESEARCH METHODS?

Early in my college career, I read a newspaper headline that said, "Peanut butter causes cancer." This really worried me because I ate peanut butter multiple times a week. Was this report true, I wondered? Now that I know how to be a critical consumer of research, I realize I didn't have much to worry about. The statement that peanut butter *caused* cancer was very much an overstatement. In fact, the investigation of peanut butter and cancer relied on what we call correlational research, and you cannot determine causation from correlational research. (We'll talk more about correlational research in Chapter 6.)

Why is it important to understand research? Well, for one thing, without that understanding, I would have missed out on an additional 40 years of peanut butter. But there are other reasons. For one, the media often provide us with research results, and it's important that we understand how to evaluate them. For example, as I was writing this chapter, I took a look online and found the following headlines:

- Research Suggest Having a Cat Makes Humans More Susceptible to Schizophrenia (LaFrank, 2023)
- Pasta Actually Doesn't Make You Gain Weight, Says a New Study (Wingfield, 2023)

Do I just accept these findings? Should I go back to eating a lot of pasta and rethink any plans I might have to adopt a cat? Not necessarily. If you learn how to critically evaluate the way the researchers did their research, you will be able to decide whether the conclusions they, or the media, put forth are warranted.

Understanding research methods can also help you in your work as a college student. Throughout your college career, you'll learn a lot about what scholars have discovered in your field. How do they know all they know? Research! It's important to recognize a well-executed study from one that is severely flawed so you will know when to accept and when to question the research findings you learn about.

You may also have opportunities to conduct some research yourself. Then, of course, it is important that you know what you are doing so you can understand which methods are appropriate for your particular investigation and so you can arrive at the appropriate conclusions.

Understanding research methods can also help you as a consumer. For example, I was recently in the market for a new car. I wondered how I should choose a new car? I could just talk with my friend who has the type of car I want and see what she thinks of her car. However, someone who is familiar with research methods would know that, under typical circumstances, getting the view of just one person is not likely to provide you with the information you need. You might want to know, for example, how reliable the car is. What if your friend is particularly hard on her car, careening around corners and jumping curbs? She might need more service on her car than those who treat their cars more gently. What likely is more helpful is to know how reliable this vehicle *typically* is. To know this, you need to go to a source (such as *Consumer Reports*) that has collected data from a larger sample, ideally a representative sample. A **representative sample** is one that has the same characteristics as the population of interest. A **population** consists of the members of an identifiable group—in this case the *population* is defined as all the people who drive the car you are interested in. You'll learn more about **sampling**, or choosing a portion of the population as study participants for research, in Chapter 7.

Finally, understanding research methods can help you in your future career. Many careers require using research methods or evaluating research findings in some way. For example, you could be a market researcher, determining what people think of a particular toothpaste, politician, or radio station. You could be a teacher, evaluating which teaching techniques to use and assessing how well your students are doing. You could work in the mental health industry, selecting the best treatment method given your client's particular needs. You could be a human resources executive, evaluating and implementing ways to enhance employee performance and morale as well as increase employees' participation in healthy activities. There are so many ways a knowledge of research methodology can become a part of your life.

Teachers use research too!

TEST YOURSELF! 1.1

1. A _____ sample is one that has the same characteristics as the population of interest.
   - **a.** descriptive
   - **b.** fluid
   - **c.** empirical
   - **d.** representative
2. The members of an identifiable group is called a
   - **a.** representative sample.
   - **b.** research sample.
   - **c.** population.
   - **d.** designated grouping.
3. Sampling refers to
   - **a.** relying on a source for information.
   - **b.** choosing a portion of the population.
   - **c.** evaluating research reports in the media.
   - **d.** understanding research methods as a consumer.

THE GOALS OF SCIENCE

Scientific research has four general goals: (1) to *describe* the phenomenon of interest, (2) to *explain* the phenomenon of interest, (3) to *predict* when the observed phenomenon will occur again, and (4) to *control* the phenomenon of interest. I'll talk about each of these goals below. (See Figure 1.1).

FIGURE 1.1 ■ The Four Goals of Science

Describe

Explain

Predict

Control

Description

One of the main goals of scientists is to describe phenomena. For scientists who study psychology, this often means describing observable behavior. **Observable behaviors** are behaviors that can be seen, such as the amount of time students spend texting while walking between two buildings on campus, the number of alcoholic beverages people drink on the day they turn 21, or the number of M&Ms eaten while watching a movie with friends. We can observe activities like these in a systematic manner and document the results of our observations. To be systematic means to develop a plan for exactly what we are going to look for, striving to make these observations as objectively as possible so we can generate accurate descriptions of the phenomena of interest.

For example, McCormick and Jones (1989) conducted an observation study to investigate differences in nonverbal flirtation in men and women. They were interested in the following behaviors: "gaze, movement, posture, facial expression, grooming, and touch" (p. 273). According to McCormick and Jones, each of these behaviors could be used to bring about two possible outcomes when you are interacting with someone—you could be trying to increase closeness ("escalation") or reduce it ("deescalation") (p. 272). Thus the researchers used a checklist with 12 options (see Table 1.1), and they checked these options off as they saw them while observing couples in a bar. At the end of their observation study, McCormick and Jones were able to describe the frequency of the nonverbal flirtation behaviors they observed.

What did McCormick and Jones (1989) find? I'll concentrate on their observations of the initial minutes of the interactions. As they expected, women showed both more escalation behaviors (e.g., more likely to briefly touch their partner while interacting) and more

TABLE 1.1 ■ McCormick and Jones' (1989) Twelve Categories of Nonverbal Flirtation Behavior

Behavior	Purpose*	Definition
Gaze toward	Escalation	Establishing or holding eye contact; mutual gaze
Gaze away	Deescalation	Looking away; avoiding partner's eyes
Move closer	Escalation	Positioning body closer to partner
Move away	Deescalation	Increasing distance between self and partner
Open posture	Escalation	Relaxed stance, e.g., open legs, open arms, trunk easily visible; pivoting toward or facing partner
Closed posture	Deescalation	Arms and/or legs crossed and held tightly against body, closing off body; pivoting away from partner; shifting to shoulder-to-shoulder position
Positive facial expression	Escalation	Smiling, laughing, and grinning
Negative facial expression	Deescalation	Frowning, yawning, and grimacing
Grooming	Escalation	Enhancing appearance: smoothing hair, tightening abdomen, most self-touching; arched back, chest thrusting, stretching; lip licking
Brief touching	Escalation	Placing fingertips on or making fleeting physical contact with partner's shoulder, hair, arm, leg, face, or hand for a few seconds
Continuous touching	Escalation	Ongoing touching; holding hands, placing arm around partner, leaning against partner, touching legs; one partner rests against the other's head or shoulder
Intimate touching	Escalation	Touching two or more parts of partner's body or sexual areas; kissing, hugging, placing hand on partner's buttocks, breast, or genitals; rubbing against partner

Source: McCormick & Jones (1989)

*Escalation behaviors attempt to increase intimacy or attract another person; deescalation behaviors attempt to decrease intimacy or reject another person.

deescalation behaviors (e.g., using a closed body stance) than men. Men were only more active than women in the use of intimate touching (e.g., hugging). These data led McCormick and Jones to the conclusion that women were not just "passive recipients of male sexual advances," but were very active delivering a message that they were interested (p. 279). Thus, McCormick and Jones were able to observe these couples and gather data that provided information on how men and women differ in nonverbal flirtation.

Psychologists also can describe factors that are less readily observable, such as how many times a week people remember their dreams, how anxious people feel when speaking in front of an audience, or how people feel after working out. We typically can't get the answers to these questions by observing people, but we *can* get them by asking.

For example, Yantcheva and Bindal (2013) found that those who preferred a low-fat meal to a high-fat meal were seen as more "socially attractive" by female college students in Australia (p. 286). How did Yantcheva and Bindal know this? *They asked.* (By the way, I'm not happy about this finding [guess which type of food I prefer?], but it doesn't matter whether I am happy or even whether Yantcheva and Bindal are happy. These are the results that were obtained; the way researchers feel about them does not matter.) You'll learn more about how to observe behavior in Chapter 5 and how to describe thoughts and attitudes in Chapter 7.

In order to learn how people feel after working out, we can ask them.

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Explanation

Scientists also want to explain the phenomena of interest. Often this means that we wish to determine *why* something happens. In other words, we want to find out what causes the phenomena of interest.

Scientists will often look at the pattern of data from research on a particular topic and propose a theory to account for why the data appear as they do. More formally, a **theory** is a statement that organizes, summarizes, and explains available information about a phenomenon and serves as a basis for formulating testable predictions about the phenomenon. Let's look at an example.

Have you ever looked through a magazine, decided you wanted to buy it, but you put it back and then chose one that looked like it had not been touched? This is the question that Argo et al. (2006) asked in an introduction to their investigation of how consumers react

to products they think were touched by others. In Argo et al.'s research, the products of interest were T-shirts, and they tested what people thought about three possible contamination cues: how close the item was to the location where it was presumably touched by someone (proximity to contact), how long it has been since someone presumably touched the item, and how many people were believed to have touched the item. With regard to proximity, they found that evaluations of the T-shirts were less favorable when, for example, the T-shirt was reported as discarded in a dressing room as opposed to hanging on a rack; however, this lowered evaluation occurred only when participants thought others had more recently touched the item. Contamination effects seemed to wear off with time. Participants also rated the T-shirt less favorably when they believed many people had touched it as opposed to only one.

Thus Argo et al. (2006) found that if consumers thought a product had recently come into contact with one or more other customers, they saw it as less appealing. When Argo et al. asked their study participants a series of questions to determine why they felt the way they did about the T-shirt, they found that the responses were driven by disgust. Argo et al. then proposed a *theory of consumer contamination* motivated by disgust to explain why people feel as they do about products that have been touched. Consumers are believed to contaminate products simply by having contact with them. Think about this the next time you're in a fitting room.

Once a scientific phenomenon has been described and a theory has been put forth to explain the phenomenon, we can attempt the next goal of science: prediction.

Prediction

Forming hypotheses is the third purpose of scientific research. **Hypotheses** are predictions, our expectations for our results and they are often developed from theories. To illustrate, let's follow a previous train of thought and look again at Argo's et al.'s (2006) theory of consumer contamination. Recall that Argo et al. found if people thought a product had recently come into contact with one or more other customers, they saw it as less appealing, and that this feeling was motivated by disgust. So Yan et al. (2015) wondered how people would feel about shopping for secondhand clothes, clothing that one could assume had been touched by others, perhaps many others. Specifically, they wondered how college students would feel about this shopping experience since young people are reportedly a large part of this rapidly growing market (Boston Consulting Group, 2022).

Yan et al. (2015) used Argo et al.'s (2006) theory of consumer contamination to develop the following hypothesis; they expected a "negative relationship between perception of contamination and secondhand clothing shopping frequency" (p. 90). (As you'll see later, a negative relationship, i.e., a negative correlation, means that the two variables of interest tend to move in opposite directions; in other words, Yan et al. expected that those who are *more* likely to perceive secondhand clothing as contaminated would be *less* likely to shop at secondhand clothing stores.) Yan et al. then tested their hypothesis by asking college students to answer a survey regarding their thoughts on shopping for secondhand clothing. They found that their

hypothesis was supported. Those who shopped at secondhand clothing stores saw used clothing as less "gross/disgusting/unclean/revolting" than those who did not shop at such stores. So as you can see, Yan et al. developed their hypothesis from Argo et al.'s theory; Yan et al. then tested their hypothesis and found support for it.

Let's look at another specific theory and a specific hypothesis derived from that theory. Duval and Wicklund's (1972) theory of objective self-awareness claims that when people are self-aware, they tend to focus on what behavior is expected in a particular setting (i.e., "standards of correctness") and evaluate how well their behavior matches that standard (p. 4). Now let's look at how a team of researchers used this theory to generate a hypothesis.

Lewis et al. (2021) gave their study participants a decoding task that they were supposed to work on with another participant. Five minutes into the task, the participants were told that the other participant would be late due to a minor car accident (this was not true—it was only said to provide a reason why the other participant was not there), thus the participant would be alone when solving the secret codes. They were also told that any of the decoding they did not do would be left for the other participant who would show up later. During the decoding task, some participants were made self-aware by the experience of seeing themselves in a mirror (the decipher key was written on the mirror so they had to look at the mirror repeatedly), while others were not made self-aware (the decipher key was written on a non-mirrored surface). Based on Duval and Wickland's (1972) theory of objective self-awareness, Lewis et al. hypothesized that if being self-aware leads us to think about what would be ideal behavior in this setting, then those who are self-aware will be more helpful and decipher more codes (helping out the poor accident victim). Their hypothesis was supported; those who had been made more self-aware deciphered significantly more codes than those who had been less self-aware.

A mirror is often used in research to make someone self-aware.

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As demonstrated by the above two examples, once we have formed our hypotheses, we can test them to find out how accurately they predict events. If the results are as we predicted, we need to relay that information to our audience. There are specific ways to say this. Each of the following is appropriate:

- The data support the hypothesis, or
- The data are consistent with the hypothesis.

If the results are not as we predicted, we say

- The data did not support the hypothesis, or
- The data are not consistent with the hypothesis.

If the data were not consistent with the hypotheses, and the hypotheses were derived from a theory, then the theory likely needs to be modified. We could then modify the theory, generate new hypotheses, and test again. That's how science works. Each time our hypotheses are supported (the results come out as we expected), we gain confidence in the theory. We'll talk more about hypotheses in Chapter 2.

Notice however, that we never use any version of the word *prove* when talking about theories or hypotheses (Do not say "my hypothesis was proven!"). The reason for this is that as scientists continue to explore a particular topic, they may find disconfirming evidence, a case in which the theory does not fully account for the observed pattern of results or a case in which a hypothesis is not supported. It is always possible that new information may require researchers to modify current ideas.

Control

After we have described and explained a scientific phenomenon and made predictions about what we expect to occur, it's time to talk about control, the fourth purpose of scientific research. For many psychologists, learning how to influence or even control attitudes and behavior is a goal. For example, many researchers are trying to determine how to curb racism, discrimination, and aggression, to name a few. Let's look at a more specific example.

Emile Bruneau was a cognitive neuroscientist who had spent years investigating groups around the world that have historically been in conflict (such as Democrats and Republicans, Israelis and Palestinians). How can we stop or at least lessen the likelihood of these conflicts? Many have suggested solutions, each designed to increase people's positive attitudes toward those who oppose them. Bruneau's approach (see e.g., Bruneau & Saxe, 2010) was to use brain scans in an effort to see how our brains react when we empathize or fail to empathize with someone outside our group (empathy is thought to play a role in conflict resolution). The hope is that we'll be able to identify the parts of the brain responsible for empathy and then learn how to increase empathy for those outside the group (see Interlandi, 2015). Again, learning how to minimize conflict is an example of the kind of influence or control a psychological researcher might have as an overall goal.

The Goals of Science in Action

Let's take a look at a research example to illustrate the goals of description, explanation, prediction, and control. First, picture the following. You're a star of the track team preparing for a big meet. Under which conditions are you likely to run your fastest: alone or with other runners? Those with experience running on a track team are likely to say, "I run faster when other runners are present." Now picture another situation. You are about to perform your first monologue in acting class. You practice in front of the mirror repeatedly until you feel you are pretty good. Then it's finally time to perform in front of the class. You slowly walk up to the front of the class and prepare to speak. But you start to shake and stutter. And you realize you are not giving nearly the same level of performance you gave in the mirror.

Members of a track team tend to run faster when they are running with others as opposed to alone.

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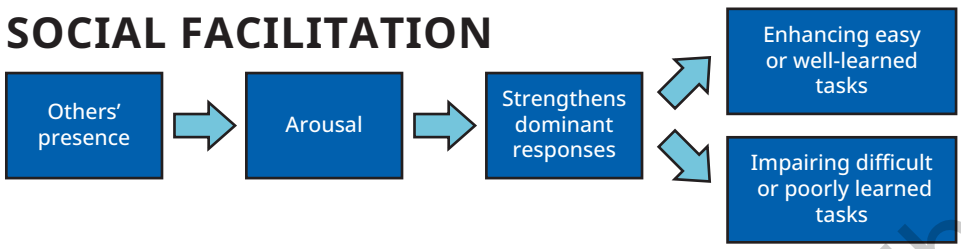
These two scenarios both describe a performance in front of others. In one case the performer is better in front of others, while in the other the performer is worse. Early researchers were often perplexed by similar outcomes, sometimes seeing better performance with an audience (e.g., Weston & English, 1926) and sometimes worse (e.g., Pessin, 1933). Why the difference? Researchers wanted to create a theory that accounted for both outcomes, and Robert Zajonc (rhymes with science) did just that. In 1965, Zajonc used the theory of social facilitation to explain why the presence of others sometimes improves performance and sometimes inhibits it. He explained that when someone is just learning a task, that person's responses are likely the wrong responses (wrong responses are dominant). However, when the task is well learned, the dominant responses are likely correct responses. Zajonc postulated that the presence of others increases physiological arousal, and that arousal enhances the presence of dominant responses. In other words, according Zajonc's depiction of social facilitation, when others are present, people will tend to do better on simple or well-learned tasks and worse on complex or poorly learned tasks. (See Figure 1.2)

FIGURE 1.2 ■ Flow Chart of Zajonc's (1965) Hypothesis



So Zajonc's theory of social facilitation did a good job of explaining the data. This theory was then used to generate hypotheses. For example, Kotzer (2007) used Zajonc's theory to predict what will happen when expert and novice basketball players attempt free throws in front of an audience and alone. As hypothesized, Kotzer found that those who were relatively experienced playing basketball made more free throws when being watched by an audience than when alone. On the other hand, those who were relatively inexperienced made more free throws when alone than with an audience. This is consistent with what Zajonc's theory of social facilitation would predict.

Now that the phenomenon of performance differences has been described and explained through theory and predictions have been made, let's take a look at how researchers could use social facilitation research to influence or control attitudes or behavior. Yu and Wu (2015) considered how the presence of observers would affect those performing baggage x-ray screening tasks. Would the presence of an audience enhance simple x-ray screening tasks and impair difficult x-ray screening tasks, as the theory of social facilitation predicts? The researchers brought the screening task into the laboratory and trained college students to look for knives in x-ray images of baggage. After the training, these students were tested on an additional 400 images, 200 of which had a knife. For half the images an observer watched the student complete the screening; for the other half, the students performed the screening task while alone. What happened? The presence of an observer did have an influence; when the screening task was relatively easy, those being watched performed it faster. When it was relatively difficult, those being watched slowed down. The presence of an audience did not affect response accuracy, however.

How did Yu and Wu (2015) use this research to influence or control the phenomenon of interest? After seeing their results, they made recommendations for the security industry. They suggested that if the task is simple, such as detecting threats in small bags (what you likely would find people carrying on the subway), the security screeners should be performing their tasks while being watched. On the other hand, if the task is complex, such as detecting threats in large bags (what you likely would find people carrying in the airport), they should be performing their tasks while alone. The researchers also suggested that small bags and large bags be screened separately, with an observer present only for those screening small bags. According to Yu and Wu, these policies would optimize the performance of those detecting threats to security. With these recommendations, Yu and Wu are seeking to influence the way x-rays of baggage are screened.

Note that even though the theory of social facilitation could explain many research findings by focusing on the complexity of the task, science didn't stop there. Researchers have continued to conduct research to determine *why* people have such reactions to the presence of others and whether Zajonc's (1965) social facilitation theory can account for all kinds of tasks (see van Meurs et al., 2022). So as you can see, while Zajonc's theory of social facilitation was an important development in explaining why performance sometimes improves and sometimes falters when people are watched, researchers have continued to refine the theory with additional research.

TEST YOURSELF! 1.2

1. Which of the following is an observable behavior?
   a. The number of ice cream scoops one wishes to eat
   b. The amount of rage one feels after being cut off in traffic
   c. The amount of happiness one feels after getting tickets to a desired concert
   d. The number of minutes one spends waiting in line at the bookstore
2. Which of the following terms refers to a statement that organizes, summarizes, and explains available information about a phenomenon and serves as a basis for formulating testable predictions about the phenomenon?
   a. basic research
   b. principle
   c. theory
   d. value statement
3. Lewis et al. (2021) expected that those who were made self-aware would be more helpful than those who were less self-aware. What is this expectation typically called?
   a. assumption
   b. belief
   c. hypothesis
   d. premise

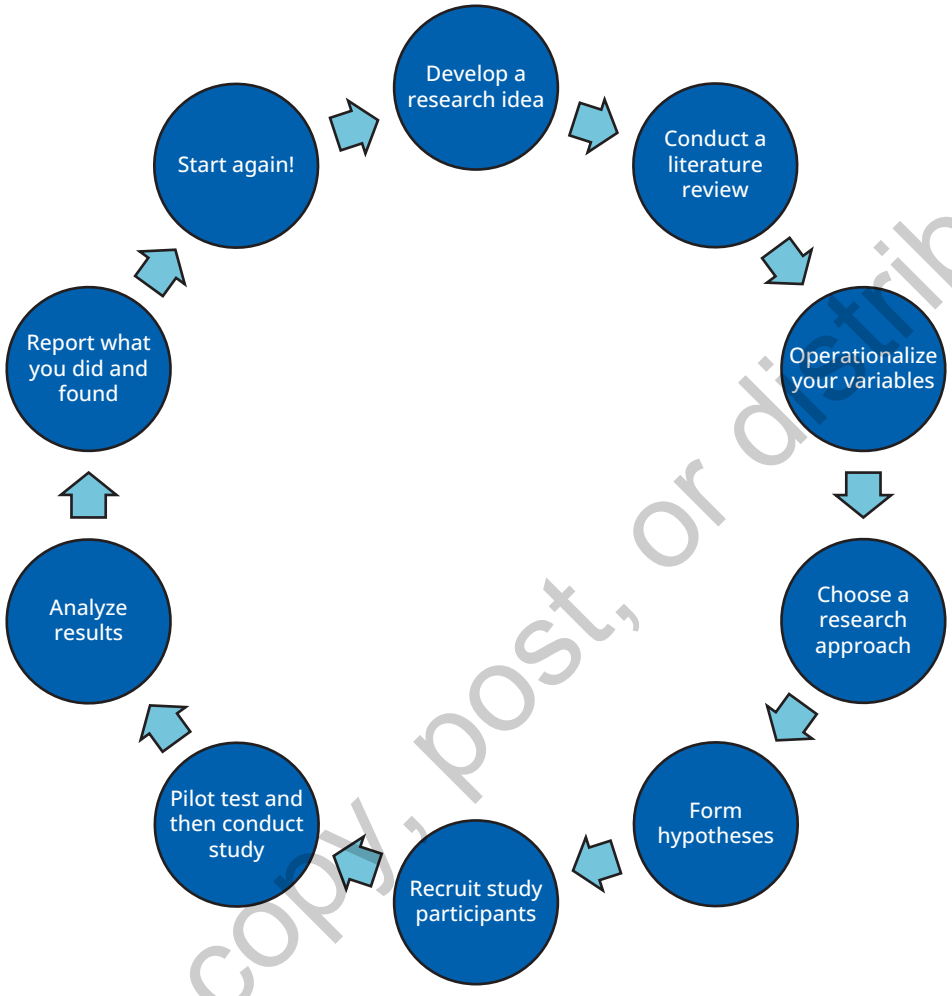
THE STEPS IN THE RESEARCH PROCESS

How do scientists accomplish their four goals of description, explanation, prediction, and control? In this section we'll go over the general steps you take when you conduct research (Figure 1.3). We'll discuss all these steps in more detail later in the textbook.

Step 1: Develop a Research Idea

The first thing you need to do is come up with a research idea. There are lots of ways to do this. For example, consider the research in this textbook. This textbook was designed to provide you with research examples that are generally pertinent to students' lives; you may wish to use these ideas or look at the experiences in your own life to come up with more ideas.

FIGURE 1.3 ■ Steps in the Research Process



Let's take an example. Let's say you find yourself completely obsessed with texting on your cell phone, even in very odd places like the shower and at very odd times such as during intimate moments. You wonder, "Am I the only one doing this?" You now have an idea for research. You can develop a survey and ask your respondents to indicate under what conditions they text.

As you'll see in Chapter 7, Harrison and Gilmore (2012) did this. They were interested in why and when college students text. So they created an online survey presenting 29 social situations and asked a sample of students at their university to indicate whether they texted in such situations. They found that almost 30% of the respondents had texted while in the shower and 13% while having sex! In Chapter 7, you will learn how to create a survey to address your own research questions.

Where do you do your texting?

Thinking about your own life is just one of many ways to come up with an idea for your research. You can also get ideas from the need to solve practical problems, from previous research, and from theories. Chapter 2 will elaborate on each of these ways to generate research ideas.

There is another way to think about research ideas. Psychological research can generally be considered either basic or applied. **Basic research** attempts to answer fundamental questions about a phenomenon, without much focus on how the information could be applied in the real world.

Let's look at a memory task as an example. Many researchers have demonstrated that it is more difficult to recognize a face when it is presented upside down than right side up (see Valentine, 1988 for a review of this "face-inversion effect") (Figure 1.4). For example, Rakover (2012) considered how removal of the eyebrows affects memory for upright versus inverted faces. Why is it important to study how well people remember inverted faces, with or without their eyebrows? As you'll find with many basic research studies, the potential application of this work is not necessarily obvious, perhaps even to the researchers themselves. These researchers and, if the work is published, the research community will learn something about facial recognition that adds to our general body of knowledge about memory for faces. Perhaps one day, this kind of knowledge of how facial stimuli are processed by the brain will have an application in the real world, such as aiding those who have difficulty processing such stimuli.

FIGURE 1.4 ■ Which Face Would You Find Easier to Recognize?

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Applied research, on the other hand, is conducted with a practical, real-world issue in mind. Let's say a research team is interested in investigating better ways of learning and retaining information (this is something that, for example, students might be interested in). Mazza et al. (2016) had this as their goal. To investigate this, they compared three groups who were tasked with translating 16 Swahili words into French (this experiment took place in France). One group learned the words over two sessions without sleeping in between ("learning without sleep"); one group learned the words over two sessions and they slept in between ("learning with sleep"); there was also a control group that did not have a second opportunity for learning.

All three groups were then tested for their memory of the word pairs one week later and then again, six months later. So what happened? The main finding is that those that had slept in between two learning sessions showed better performance (and they needed less practice) than those who had not slept. This was true at both 1-week and 6-month retention intervals. This work suggests that pulling an all-nighter before an exam (i.e., not sleeping) is likely not the best approach to exam taking. This work suggests that "sleeping between two learning sessions is a better strategy" (Mazza et al., p. 1321). As you can see, while both the face recognition work and the French–Swahili translation procedure both involve memory issues, the translation task research is more applied, because it seeks to address an identified real-world issue (how to improve retention).

Basic research often provides a foundation for later applied research. For example, basic information about the way people process faces can certainly be helpful when investigating a related memory issue in the real world, such as the facial recognition capabilities of an eyewitness to a crime. Ultimately both types of research, basic and applied, are necessary to advance knowledge and aid society.

Step 2: Conduct a Literature Review

No matter how you came up with your research idea, it is important to conduct a literature review so you know how others have investigated your general topic and what they found. Having up-to-date information about what others have done helps you to decide on what

would be a good addition to the literature. A literature review can also aid you with many of the research decisions you will have. For example, knowing what others have found on your topic can provide you with ideas regarding what to expect from your own research (i.e., your hypotheses). We'll talk about how to search the literature in Chapter 2.

Step 3: Operationalize Your Variables

Once you have your research idea and you have a knowledge of how others have investigated your general topic, you are ready to specify the variables you are going to study. A **variable** is any characteristic that can take on different values. One way to think about this is to remember they are called variables because they can vary. For example, IQ is a variable, a measure of intelligence that for most people yields a test score somewhere between 70 and 130 (Neisser et al., 1996). Quantifying other variables is perhaps less intuitive, but we can still measure them. For example, shyness can be a variable; someone can be more shy or less shy, and we can use a shyness test to measure this (e.g., Li et al., 2020). Anything that can vary, such as gender, socioeconomic status, or food type, can be a variable in a research study.

When you are planning your research, you should always ***operationalize*** *your variables*. This means you specify the precise meaning of a variable in terms of the specific procedures to be performed. You'll learn more about operationalizing your variables in Chapter 4, but for now let's go over a brief example.

To operationalize your variables it's not enough to say, "I'm studying aggression." I would ask you, "What do you mean by that? How will you measure aggression? This is again where a literature review can come in handy. How have others measured aggression? Will you ask your study participants how aggressive they feel on a scale of 1 to 10? Will you count the number of times someone throws a punch in a bar?" Scientists are precise. Take the work of Reifman et al. (1991) as an example. These researchers looked at a random sample of major league games in an effort to investigate the relationship between temperature and aggression in professional baseball. How did they operationalize aggression? They identified it as the act of hitting batters while they are on home plate, and they counted the number of batters hit by the ball per game. This operational definition of aggression is appropriate given Reifman et al.'s research question. They found that as the temperature increased, there tended to be more players hit by pitches.

Let's consider another example from the world of sports. Craig et al. (2016) also wanted to investigate the relationship between temperature and aggression, but they chose football as their sport of interest. How did they operationalize aggression? They counted the number of aggressive-type penalties. Specifically, they considered the following as aggressive penalties: "taunting, face masks, unnecessary roughness, and unsportsmanlike conduct" (p. 207). So to explore the relationship between temperature and aggression in football, they counted the number of aggressive penalties that occurred in the 2000–2001 NFL seasons. They found that when the temperature was higher, there were more aggressive penalties, but this relationship was only found for home games. So you see, aggression in baseball was operationalized as the number of pitchers hitting batters and aggression in football was operationalized as the number of aggressive penalties. How you define aggression can change depending on your research question and the context in which your investigation takes place.

Step 4: Choose a Research Approach

There are lots of different ways to conduct research and you need to decide which approach you are going to take. One of your most fundamental decisions is whether you will use experimental or descriptive research methods. We'll start by looking at what it means to conduct an experiment.

The Experimental Research Approach

The **experiment** is our most influential research approach because it is the only one that allows us to establish cause and effect. In the simplest kind of experiment, researchers manipulate (vary) one variable, called the **independent variable**, and observe the effects of that manipulation on a response measure called the **dependent variable**. The independent variable is considered the "cause," and the dependent variable is considered the "effect." Let's look at an example.

Have you ever wondered whether music can affect people's mood? Campbell and White (2015) wondered whether music would affect undergraduates' mood if they were exposed to music during exercise. In their experiment, Campbell and White tested two groups of undergraduates; one group exercised while listening to music and the other group exercised without listening to music. Music was Campbell and White's independent variable; it was varied in that for one group music was present and in the other group music was absent. They wanted to see whether music would cause a change in their participants' mood. Mood was what they were measuring; this was one of their dependent variables. Another way to think of this is that mood was expected to *depend* on the presence or absence of music.

Does listening to music while exercising affect your mood?

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When you are conducting an experiment, the goal is to keep everything the same between your groups except for your independent variable(s). So Campbell and White (2015) had everyone do the same kind of exercise (moderately intense walking) for the same amount of time (20 minutes). You might think, "Well, how about fitness level? Maybe everyone wasn't equally fit and that affected their mood?" That's a reasonable question. To ensure that all things besides the independent variable were held constant across groups, Campbell and White randomly determined which participants heard the music and which did not. When we use **random assignment** to place people into groups, all characteristics of the participants are theoretically distributed across groups in approximately equal proportions. So the two groups were theoretically equivalent in fitness level and in all other ways too.

What did Campbell and White (2015) find? Those who listened to music while exercising reported a more pleasant mood than those who did not. We know it was music that caused the difference because its presence was the only thing that differed between the two groups. When you can conclude that your independent variable caused the change in your dependent variable, your experiment is said to have high internal validity. In other words, **internal validity** is the degree to which the results of an experiment can be attributed to the manipulation of the independent variable.

This example described a relatively simple experiment, with just one independent variable. You will learn more about experiments with one independent variable in Chapter 8, and we'll consider experiments with more than one independent variable in Chapter 9.

The Small-N Design Approach

The experimental approach described above involved testing groups of people, summarizing the responses for each group, and then comparing one group's responses to the other group's responses. Testing just a single individual could have yielded a response that was unusual. Testing larger groups tends to provide a fuller range of responses and allows us to see what the typical response is for the group overall. Thus much experimental research involves testing large groups.

One experimental research approach, however, typically involves testing just one or a few participants. We call this the **small-*N* design** approach. "*N*" refers to the number of people in your study, so small-*N* design means you are conducting research with a small number of study participants. When you use a small-*N* design, you consider the results for each individual separately and do not combine them with the results for other individuals. Small-*N* designs are often used in applied settings to examine whether a particular treatment works to alter a behavior you want to change in a *particular* person. To achieve this, the researcher needs to assess the behavior of interest before and after the treatment. Let's take a look at an example.

Wack et al. (2014) were interested in finding out whether the act of setting goals and getting individualized feedback would help five female runners on a college campus increase their weekly running distances. First the researchers measured how far each student was running without setting any goals. This is called determining the **baseline** level of performance; it took 2 to 4 weeks to determine the baseline for each runner, how far each generally ran.

The researchers then met with each runner to decide on a long-term goal (for example, "When this study is over in 20 weeks, how far do you want to be running each time you run?"). In

addition, a researcher met with each runner once a week to set a short-term goal for the upcoming week (such as, "Each time you run next week, how far do you want to run?"). Participants were expected to run at least three times a week and were allowed to increase their distance goals as the weeks progressed if they were meeting earlier goals as scheduled. At their weekly meetings, each runner got feedback from a researcher on whether the weekly goal had been accomplished.

What happened? Although the five women had varying levels of achievement, all increased their running distance over their baseline levels of performance. Thus, with a small-*N* design, Wack et al. (2014) demonstrated that goal setting and performance feedback worked to increase the running distance for each of the five participants. You can read more about small-*N* designs in Chapter 11.

Although goal setting and feedback improved the running distances in these five individuals, we cannot jump to the conclusion that the same treatment will work for all who want to increase their running distance. The question here—"Do these results hold for others?"—is one of external validity. **External validity** refers to the generalizability of the results to other persons, places, or times. Replicating these results with additional respondents from a different type of sample can help us know just how generalizable these findings are. You can read more about external validity in Chapter 12.

The Quasi-Experimental Approach

Another experimental research approach is **quasi-experimental research**. *Quasi* means "resembling," and quasi-experimental research is research that resembles experimentation but is missing one of the key components of experimentation: random assignment. In a quasi-experiment, the participants are already in preformed groups, so the groups are not considered equivalent. This means, of course, that we cannot definitively establish cause and effect with a quasi-experiment. Let's look at an example.

Livingston et al. (2010) wondered whether there was a relationship between parents allowing their high school students to drink at home and the likelihood that those individuals would abuse alcohol when they got to college. To investigate this, they divided a sample of female high school seniors into three groups: (1) girls who were not allowed to drink alcohol, (2) girls who were allowed to drink alcohol during family meals, and (3) girls who were allowed to drink alcohol at home with friends. Livingston et al. then assessed how much drinking these girls did in high school and during their first semester of college. When they compared the three groups, they found that those who were not allowed to drink in high school drank the least in college, significantly less than those who had been allowed to drink during family meals. Those who had been permitted to drink at home with friends while in high school reported the most drinking in high school and in college.

What can we say about Livingston et al.'s (2010) data? We can say that a greater level of parental permissiveness was associated with more drinking. What can't we say? We cannot say that this greater permissiveness *caused* the increase in drinking. We cannot state cause and effect in this case because parental permissiveness was not randomly assigned to groups. In other words, the researchers didn't determine who would not allow their daughters to drink, who would allow them to drink with meals, or who would allow them to drink at home with

friends. The parents determined that for themselves. Because the groups were not randomly determined, there could have also been other differences between them besides permissiveness, such as parents who are problem drinkers or an older sibling who drinks, and these could be the reasons for these individuals' drinking habits in college.

When researchers use quasi-experimental designs, they often strive to increase the internal validity of their research by ruling out known threats to it. For example, Livingston et al. (2010) could attempt to assess the percentage of drinking siblings in each group. If they found, for example, that these percentages did not differ across groups, they could rule out the influence of older siblings' drinking as a possible reason for their results. In this way, they could make a stronger argument for the internal validity of their research findings. When a threat to internal validity cannot be ruled out in a quasi-experimental design, the researchers have to acknowledge that an alternative explanation for their findings exists. Thus, again, due to the lack of random assignment (in other words, a lack of equivalent groups) we cannot use quasi-experimental research to definitively state cause and effect. We'll talk more about quasi-experimental research in Chapter 10.

The Descriptive Research Approach

All descriptive research methods have one thing in common; they are *nonexperimental* methods. That means we cannot use descriptive methods to establish cause and effect. We are only observing and describing what we see; we do not have an independent variable to manipulate. Since we are only observing and not controlling what our participants experience, we cannot determine what is causing their behavior. There are a variety of types of descriptive research methods, as you'll see in Chapters 5, 6 and 7. I'll give a couple of brief examples here.

You've already read an example of a descriptive research study, the work by McCormick and Jones (1989) on gender differences in nonverbal flirtation. McCormick and Jones observed people in a variety of bars. I referred to this study earlier as an observational study; to be more specific, the type of research McCormick and Jones did is called a **naturalistic observation** study. In naturalistic observation, we observe people (or animals) in their natural settings (such as a school, park, mall, bar) and systematically record their behavior.

Before I give you another example, let me ask you a question: Are you careful when you cross the street? The reason I ask is because there are a number of risks that people take while crossing; in fact, pedestrian deaths are at an all-time high (Cogan, 2023). Some researchers have sought to document the risks that people take when crossing the street with the thought that once we know what people have a tendency to do, public health agencies can work to attempt to change behaviors.

Here's an example of a research team that sought to document the risks that people take while crossing the street. Reish et al. (2021) conducted a naturalistic observation study at seven crosswalks at three different Washington, D.C., sites next to social drinking venues. They recorded a number of risky behaviors. For example, 32% of the 1,045 pedestrians observed crossed against the pedestrian crossing signal. Seventeen percent of the pedestrians were distracted in some way while crossing (distraction was defined as any behavior that redirected a pedestrian's visual gaze such as texting). In addition, 15% of the pedestrians observed were outside of the crosswalk while crossing. Note that these researchers merely observed and documented what was

happening at these intersections. Reish et al. cannot conclude why these people took these risks. Since Reish et al. was only observing and not controlling what their observed pedestrians did; they cannot determine what was causing the observed behavior.

Do not try this at home.

Another type of descriptive research technique you'll encounter is correlational research. **Correlational research** is a descriptive research technique in which we measure two or more variables to see whether there is a relationship between or among them. Again, because it is a descriptive technique, we cannot use correlational research to determine whether one thing causes another. We are merely observing our study participants, without influencing them at all. Merriam-Webster's online dictionary definition of correlation sums this up well: It is "the relationship between things that happen or occur together."

Let's look at a brief example, and again I'll start with a question. Are you one of the millions of people who watch cat videos on the internet? Myrick (2015) wondered about the characteristics of people who watch internet cats. Remember that in correlational research there is no independent variable. Nothing gets manipulated. Researchers only measure variables in correlational research, and that's what Myrick did. She asked an online sample of those who acknowledged viewing online cat videos or photos to answer questions about themselves. For example, she asked how often they viewed online cat videos or photos as well as how many hours a day they spent online overall. She also asked them a series of questions to assess factors such as their level of shyness and emotional well-being. What did she find? Many of these variables were correlated; in other words, there was a relationship between them. For example, those who spent more time online overall were more likely to view cat videos and photos, were more likely to own a cat, and were also more likely to be classified as shy.

Remember that correlation does not imply causation. For example, viewing cat videos and photos likely didn't cause people to be shy, and being shy likely didn't cause people to view cats doing funny things on the internet. Just because variables are correlated does not mean that one causes another. We'll talk about this more when we discuss correlational research in Chapter 6.

I would now like to discuss surveys. When you conduct a **survey**, you are attempting to estimate the opinions, characteristics, and/or behaviors of a particular population by asking some of the people in that population to respond to questions. Again, this is nonexperimental research; there is no independent variable manipulation, so you cannot state cause and effect. However, you can find out what people think and how they feel about your topic of interest. Let's take a look at what a team of researchers interested in the topic of tobacco use on college campuses found out.

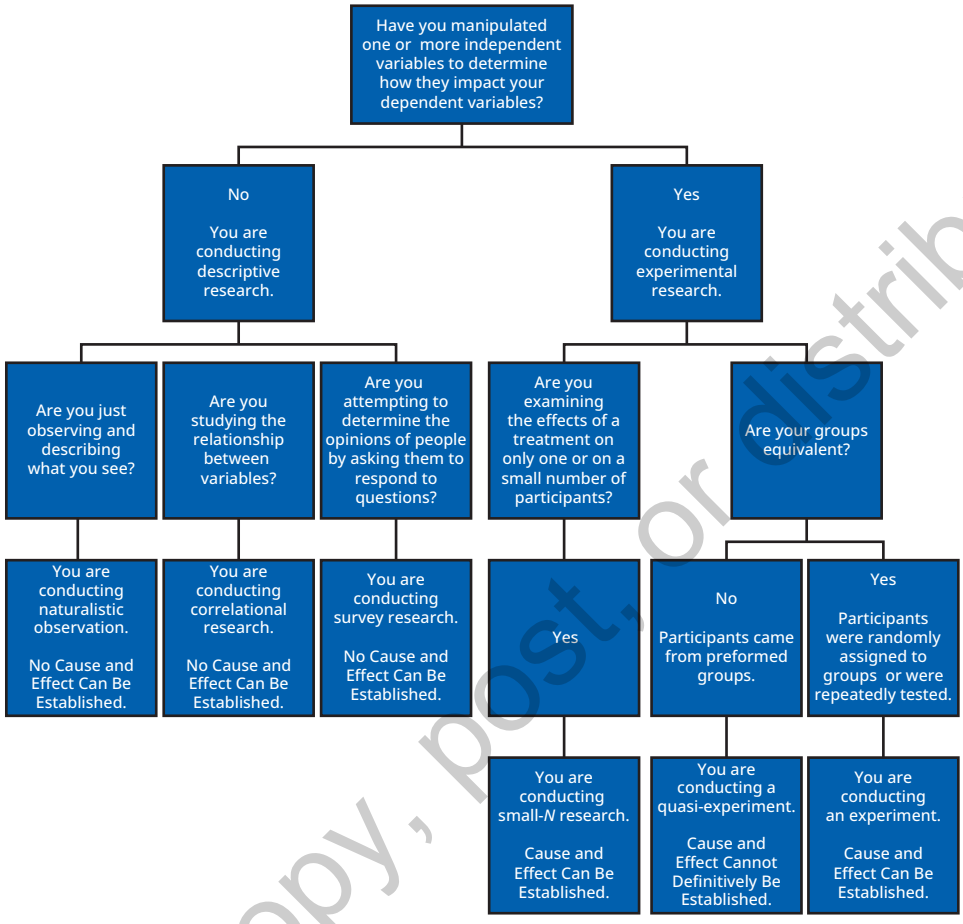
Cigarette smoking has long been recognized as a health problem (National Center for Chronic Disease Prevention and Health Promotion, 2014), and while there is evidence that the incidence of cigarette smoking has decreased in recent years, the use of new tobacco and nicotine products such as vaping pens have increased (Creamer et al., 2019). Did you know that there has been a recent push to make college campuses tobacco-free? How do you feel about that? Nyman et al. (2022) wondered how much students were using tobacco products on campuses before and after their campus converted to tobacco-free status. So Nyman et al. surveyed students on five of these campuses both before and after the conversion. Students did report that they smoked fewer cigarettes after their campus converted to tobacco-free status, but the use of "electronic nicotine delivery systems (ENDS)" increased after the change (p. 1)! (Note that these new campus policies prohibited students from using ENDS.) Students did, however, indicate that they were subjected to less secondhand smoke after their campus converted to tobacco-free status. In addition, a majority of the students agreed with statements such as "colleges have a responsibility to reduce the risk of tobacco addiction by adopting policies to discourage tobacco use" (p. 3), although support for these statements was higher among those who did not use tobacco.

Nyman et al. (2022) suggested that the increase in using ENDS would need to be addressed explicitly on campuses that adopt a tobacco-free policy, perhaps with education regarding the health outcomes associated with ENDS and perhaps instituting a form of punishment for those who do not abstain.

As you can see, survey research can be informative, although it does have limitations. For example, the study participants in Nyman et al.'s (2022) study were asked to remember if they had used any form of tobacco in the last 30 days. It is certainly possible that participants were not accurately reporting what happened, perhaps because they did not want to or perhaps because they couldn't remember. Another limitation to consider is what is known as nonresponse bias. If some of your sample fails to answer your survey, you run the risk of having a nonresponse bias. Nonresponse bias occurs if those who fail to answer the survey differ in some significant way from those who do answer it. More specifically, Nyman et al. reported that over 12,000 students had been invited to answer the first survey but only about 20% of them did. For the second survey, over 10,000 students were invited, but only 16% responded. Perhaps those that did not return the survey were using tobacco more frequently (or less frequently) than those who answered the survey. Thus, if you have a large nonresponse bias, you need to be cautious about assuming that your results are representative of your entire target population.

You will read more about creating surveys as well as the advantages and potential limitations of this kind of research in Chapter 7. (See Figure 1.5 for a summary of all the research methods discussed in this chapter.)

FIGURE 1.5 ■ Use This Flowchart to Help You Identify Your Research Method.



Step 5: Form Hypotheses

Once you have selected your research idea, conducted a literature review, operationalized your variables, and selected your research approach, you are ready to form your hypotheses. As we noted earlier, hypotheses are your predictions for the outcome(s) of your research. Recall Reifman et al.'s (1991) investigation of the potential relationship between temperature and aggression on the baseball field. Prior to conducting their research study, Reifman et al. expected that aggression would increase as temperature increased initially and then decrease as players weakened. This hypothesis was only partially supported, because they found that aggression did increase as the temperature increased, but the expected decrease did not occur. You will read more about forming hypotheses in Chapter 2.

Step 6: Recruit Study Participants.

After you have decided what kind of study you are going to conduct, you need to decide who to recruit as research participants. Think about who your ideal participants would be. Community

citizens? Children? Shoppers at the mall? It all depends on your research question. You might decide, as many in psychology do, to test undergraduates at your college or university. This type of sample is known as a **convenience sample** because it's so convenient. That's one advantage of testing a sample like this.

There is, however, a disadvantage to testing a convenience sample; your results may not generalize to a different type of population. Undergraduate students are generally different in some ways from the general population. They tend to be relatively young and also have a relatively advanced educational background (Sears, 1986). Ultimately, the differences between your ideal population of interest and undergraduates means you should indicate to those presented with your research findings that the results may not generalize to the population of interest. As I mentioned earlier, you can read more about the issue of generalizability (also known as external validity) in Chapter 12.

How are these college students likely different from the general population, and how would those differences limit our ability to generalize our results if we chose them to be our research participants?

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These days researchers often recruit online participants for their research. Although the practice is still relatively new, researchers generally find that data collected online do not differ significantly from data collected from more traditional sources (e.g., Lutz, 2016). Of course, no matter who your study participants are, you have a responsibility to treat them ethically. You'll learn more about these responsibilities in Chapter 3.

Step 7: Pilot Test and Then Conduct Your Study

Before you actually conduct your study, you need to conduct a pilot test. A **pilot test** is a series of practice sessions run during the initial stages of research that allow us to determine whether the procedure is running as intended. At the end of these practice sessions, you will ask your participants for their feedback: Were the task instructions and the questions you asked clearly

understood? Your pilot test will also allow you to determine how long the actual testing session will take. And practicing gives you experience running the study so you get comfortable with the procedure. Note that you should not include the data you generate from the pilot study in your final dataset.

Once your pilot test has been completed, you will conduct your study as planned and record your data for later analysis. That brings us to the next step.

Step 8: Analyze the Results of Your Study

After you have collected your data, it's time to analyze your results. One of the first steps researchers typically take after collecting their data is to calculate **descriptive statistics** to summarize the data they collected. In many cases, they then use **inferential statistics** to determine whether the mean responses for the groups were significantly different from each other. Inferential statistics theoretically enable researchers to make conclusions about a population after studying just a sample of that population. After analyzing the results, we interpret the findings and draw conclusions from what we see. We will talk more about what statistics enable us to do in Chapters 8 and 9.

Step 9: Report What You Did and Found

As suggested above, researchers share what they did by presenting and/or publishing their research. You will read more about preparing your work for presentation and publication in Chapter 13. In addition, a sample manuscript is provided in Appendix A so you can see how to prepare a research paper for publication.

"WRITING IS FUNDAMENTAL!": EXPLAINING A FOCUS OF THIS TEXTBOOK

Writing about research is often the way researchers share information. Thus, throughout this book (after this introductory chapter), you'll be encouraged to write about research. For example, you may be asked to conduct a simple study and write up a report of your results. As you proceed through the text, you'll see that each chapter will include tips on how to write about the many components of research (Research Writing Fundamentals). These tips and the end-of-chapter activities (Let's Write About Research) are designed to guide you as you learn to write about research.

Step 10: Starting the Whole Process All Over Again

I've included Step 10 just to indicate that the scientific process is cyclical. Every study we run will likely answer some questions but also will likely lead us to ask additional ones. And

researchers tend not to stop after just conducting one study. We continue to investigate the topics that interest us, and with each study we gain more knowledge.

TEST YOURSELF! 1.3

1. When you specify the precise meaning of a variable in terms of the specific procedures to be performed, you are _____ your variables.
   - **a.** classifying
   - **b.** delineating
   - **c.** outlining
   - **d.** operationalizing
2. Campbell and White (2015) had one group of undergraduates exercise while listening to music and another group of undergraduates exercise without listening to music. Afterward, Campbell and White measured the study participants' mood. Which of the following was Campbell and White's independent variable and which was their dependent variable?
   - **a.** Exercise; mood
   - **b.** Mood; exercise
   - **c.** Music; mood
   - **d.** Undergraduates; exercise
3. When you are conducting an experiment, the goal is to keep everything the same between your groups with the exception of the variable you are manipulating. How do we keep our groups equivalent when there are different people in the different groups?
   - **a.** Ensure that the groups come from people of similar backgrounds.
   - **b.** Keep the groups large.
   - **c.** Randomly assign participants to groups.
   - **d.** Test only undergraduates.
4. Livingston and colleagues (2010) wondered whether there was a relationship between parents allowing their high school children to drink at home and the likelihood that those children would abuse alcohol when they got to college. To investigate this, they divided a sample of female high school seniors into three groups: (1) those who were not allowed to drink alcohol, (2) those who were allowed to drink alcohol during family meals, and (3) those who were allowed to drink alcohol at home with friends. Livingston et al. then assessed how much drinking these females did during their first semester of college. When they compared the three groups, they found that those who were not allowed to drink in high school drank the least in college, while those who had been permitted to drink at home with friends while in high school reported the most drinking in college. What can we conclude from Livingston et al.'s data?
   - **a.** A greater level of parental permissiveness was associated with more drinking.
   - **b.** A greater level of parental permissiveness caused an increase in drinking.
   - **c.** A lower level of parental permissiveness was associated with more drinking.
   - **d.** A lower level of parental permissiveness caused an increase in drinking.
5. What do all descriptive research approaches have in common?
   - **a.** One cannot establish cause and effect with any of the approaches.
   - **b.** One cannot use any of the approaches to describe behavior.
   - **c.** One cannot do statistical analyses with any of the approaches.
   - **d.** One cannot obtain an estimation of opinions with any of the approaches.

CHARACTERISTICS OF SCIENCE

All kinds of scientists, including psychologists, biologists, chemists, physicists, and sociologists, learn about science by collecting data in systematic ways and drawing conclusions about those data. A main goal of this textbook is to provide you with information about the systematic ways in which data are collected. Scientists use the **scientific method** when conducting research; it is a basic set of rules and procedures that govern the way research is to be conducted.

Note that although it sounds like the scientific method is just *one* method, that's not the case. In fact, as you saw above, there are many different strategies a scientist can use to answer research questions. But in any case, use of the scientific method means that scientists typically follow this general pattern: They formulate a hypothesis, test that hypothesis, revise the hypothesis as needed, and test again until they ultimately form a conclusion. Both individual scientists and the scientific community as a whole use this pattern of hypothesis formulation and testing. On an individual level, scientists can formulate a hypothesis, test that hypothesis, and form a conclusion. They may then choose to test a revised hypothesis or just make recommendations for future researchers regarding how the hypothesis should be revised. They will often publish their findings so others can use this information when creating their own hypotheses. In this way, the scientific community works together to come closer to the truth.

Regardless of the strategy you use to investigate your research question, science has certain common characteristics: It is empirical, objective, replicable, and public. We'll now discuss these important characteristics.

Science Is Empirical

Scientists rely on **empirical data**, evidence collected from the systematic observation or measurement of relevant information. We do not accept that something is true just because we've always known it to be true, or just because it is intuitive, or just because it is told to us by an authority, or just because it makes sense. We need evidence.

Let's start with a question. Have you heard of "phubbing?" Phubbing refers to using your cell phone while you are interacting with someone in person (it's snubbing with a phone!). Do you do this? Do others do this when they are with you? Do they ever give you a reason for why they are paying attention to their phone and not you? Suppose you were wondering whether the reason people gave for phubbing would affect how their interaction partners would feel about the interaction. This is an empirical question. An **empirical question** can be answered using systematic observations and techniques. Let's take a look at how one set of researchers chose to answer this question.

McDaniel and Wesselmann (2021) decided to use an experiment to investigate whether a reason given for phubbing would affect how people feel about an interaction. Here's what they did in the main part of their experiment. They had college students come to the lab individually. Once there, the participant met a researcher and another participant. This other participant was actually a **confederate**, an accomplice of the experimenter who was operating according to a prearranged script. After the "participants" filled out a survey regarding what emotions they were currently experiencing, the participants and the confederate were seated together at a table.

They were told that they would have a 5-minute conversation; they would alternate asking questions that the researcher provided.

Now recall that I told you that McDaniel and Wesselmann (2021) conducted an experiment. If they conducted an experiment, they manipulated an independent variable. So what did they vary? They randomly assigned each participant to one of three groups: (1) the confederate gave an *important reason* for using their phone, (2) the confederate gave a *trivial reason* for using their phone, or (3) there were *no phone interruptions* (control condition). So 2 minutes into the interaction, the confederate either used their phone for an important reason ("mother was in the hospital"), a trivial reason ("making plans with their friends"), or did not use their phone at all (p. 417). At the end of the 5 minutes, the interaction ended. Then each participant completed a questionnaire assessing how they felt about the interaction (the confederate also completed a questionnaire; they were continuing to play the role of "participant").

So what happened? Those who had been phubbed (for either reason) indicated that they felt more excluded, less close and more distracted than those in the control condition. Furthermore, the reason that the confederate gave for using their phone mattered. Those who had been phubbed for a trivial reason felt more excluded and distracted than those who were phubbed for an important reason.

McDaniel and Wesselmann (2021) used an experiment to answer the question of whether the reason someone gave for using a phone while in the middle of a conversation would affect perceptions of that interaction. Their approach is considered empirical because they used systematic observations (the interaction was standardized with the exception of the phone use and reason for that use) and a measurement of relevant information (questions regarding perceptions of the interaction). They collected evidence; they didn't just rely on their intuition or ask a few friends what they thought. So perhaps the next time you want to reach for a phone while you are having an in-person conversation, at least state that you have a good reason to do so.

Science Is Objective

Science is objective; it is free of our personal biases. Let me give you an example of what *not* to do when you need to be objective.

A student of mine wanted to do a research study that would enable her to test what people thought of a prospective employee with tattoos as opposed to one without tattoos. She did a good job of reviewing the research in this area; researchers have consistently found that those with tattoos are viewed more negatively than those without (see e.g., Timming, 2015). The student then hypothesized that the prospective employee who was tattooed would receive more favorable ratings than the prospective employee who was not tattooed.

Can you see the problem here? While none of the previous researchers had done the exact same study my student was planning, their results should have led her to hypothesize that the tattooed individual would be seen *less* favorably, not more. Why didn't she come to this conclusion? Would you be surprised to learn that my student was tattooed and felt pretty positive about her tattoos? She had injected her personal values into the work rather than considering what the previous data indicated. As I mentioned earlier, the results from previous research typically help us form the expectations for our own work.

Science Can Be Replicated

Sometimes researchers will repeat a study to try to replicate the research findings. To **replicate** the findings means to discover a pattern of results similar to that obtained before. Each time we replicate our findings, we gain confidence in them. If our findings are not replicated, we have reason to question their validity.

In recent years, some psychologists have instituted a "mass replication effort" with the goal of determining whether prominent research findings can be replicated (see Bohannon, 2015, p. 910). While many findings have not been replicated, researchers acknowledge that attempting replication is an important part of the scientific process; it allows us to ultimately get at the truth (Open Science Collaboration, 2015).

Science Is Public

After conducting a research study, a scientist typically tells the scientific world about it by presenting the results at a scientific conference and/or publishing them in a scientific journal. However, in most cases, before a study is presented or published, other scientists familiar with the topic will first carefully evaluate the research. This process is called ***peer review***. Those conducting the review decide whether the work should be accepted for presentation or publication. This process helps to ensure that research studies with major flaws do not become part of the scientific literature.

Evaluation of researchers' work can continue even after a study has been published. For example, in the journal *American Psychologist*, those who view the evidence differently or otherwise dispute something that has been recently published in that journal can send in a comment for publication. If an editor accepts a comment for publication, they will likely invite the original authors of the published piece to respond to the comment and then the editor will publish both pieces. This open discourse is another way in which science progresses.

In addition, in the literature review researchers conduct for their own work, they will refer to earlier studies and may, for example, point out a flaw or omission. Fixing this flaw or considering the missing information can be the motivation for the current work. In this way, researchers can build upon previous work in order to make further research advances.

Let's take a look at a few examples that all concern what has come to be known as the "pet effect," the idea that individuals benefit from having a pet (Allen, 2003, p. 237). Early researchers in this area found that just interacting with a dog had beneficial effects. For example, Grossberg and Alf (1985) found that undergraduates had lower blood pressure readings when they petted an unfamiliar dog as opposed to reading a book or talking with others. Researchers also wondered what would happen if the dog belonged to the participant. Would you see a similar response? For example, Allen et al. (1991) had White female participants complete a stressful task (counting backward quickly) while interacting with their own dog, a close friend or no one. They found that those who performed the stressful task with their pet present showed less of a physiological response (e.g., less of a rise in blood pressure) than those with a friend or alone (interestingly, no one touched their dogs while performing the stressful task so Allen et al. suggested that touch was not essential to the pet effect). Allen et al. proposed that the friend might have been perceived as more judgmental than the dog and that this judgment might have produced the difference in blood pressure.

Interacting with a dog has been shown to have beneficial effects.

Researchers have continued to investigate the pet effect. For example, Janssens et al. (2020) sought to investigate the experience of pet owners over the course of a 5-day period. Instead of just looking at a glimpse of the experience of pet owners and their dogs (as Allen et al., 1991 did), Janssens et al. tested both dog and cat owners from the general population in the Netherlands. They had them report, at 10 random times during each of 5 consecutive days, whether their pet was present, whether they were interacting with their pet, and how they (the participants) were feeling. Janssens et al. used what is known as the experience sampling method (ESM) to get this information; participants received a notification on their cell phones 10 times a day to report the information stated above. Janssens et al. noted that use of the ESM provided an advantage over previous work in which participants were asked to recall how much time they spent with their pet and recall how they felt about those interactions. The ESM allows researchers to get information from participants "in the moment" without worrying that participants might misremember or otherwise fail to provide accurate information (p. 581). So what did Janssens et al. find? They found that their participants experienced less negative affect when they were with their pets (versus not). In addition, participants experienced more positive affect when they interacted with their pets. That's the pet effect again!

I now want to look at one more recent study of the pet effect. Another set of researchers were interested in this phenomenon, but they noticed that most of the research in this area has focused on examining the relationship between those who are cisgender (someone whose personal identity and gender is the same as their birth sex) and their pets. Thus, Grey and colleagues (2023) extended this investigation to include those who are not cisgender. Specifically, Grey et al. surveyed those who varied in gender (e.g., men, women, nonbinary people, those of "another gender") and those who varied in sexuality (e.g., pansexual, bisexual, lesbian, gay, queer, heterosexual, asexual, questioning/undefined and those with "another sexuality"), for a study examining the "pet effect and trans people" (p. 1). Transgender people are those whose identity and

gender is not the same as their birth sex (note that the term *transgender* does not have a universally agreed-upon definition so your definition might differ from that described here).

As you can see from my brief literature review, there is evidence that having a pet is associated with well-being. Considering pet ownership in the trans population is clearly important; consider that those who are transgender are almost four times more likely than cisgender individuals to experience a mental health problem (National Alliance of Mental Health, n.d.). What do we know about pet ownership in the trans community? Grey et al. (2023) asked this question by surveying trans individuals in New Zealand, Australia, the United Kingdom and the United States. Specifically, Grey et al. found that those who lived with an animal (the type of animal was not specified) indicated that they experienced less psychological distress than those who did not reside with an animal. There was also an advantage to those who considered their animals part of the family; they too experienced less distress. Grey et al. suggested something akin to what Allen et al. (1991) had suggested; that the nonjudgmental companionship that animals give may be a key to the pet effect.

Recognize that most of the research conducted on the pet effect is correlational; we cannot state that pets are *causing* these beneficial effects. While this work suggests that pets can be beneficial, pets are clearly not for everyone. Future research can continue to explore who is likely to benefit, and what the advantages may be. Note that researchers typically suggest ideas for future research, and Grey et al. did this; they suggested that future researchers might wish to consider, for example, whether particular types of animals offer different advantages. And so research will continue . . .

I've only summarized a small part of the pet effect literature, but can you see how, generally speaking, these studies tended to build on those that came before it? In each case, the researchers noted something that had not been addressed previously and worked to fill that void. Understand that no one study can provide all of the answers to all of the questions. This is how we work together; it is another example of how science works.

TEST YOURSELF! 1.4

1. McDaniel and Wesselmann (2021) wondered whether the reason someone gave for using a phone while in the middle of a conversation would affect perceptions of that interaction. An accomplice of the experimenter gave either a trivial or an important reason for using their phone (or did not use their phone at all) during the conversation. What term is used to refer to the accomplice of the experimenter?
   a. agent
   b. ally
   c. collaborator
   d. confederate
2. McDaniel and Wesselmann (2021) wondered whether the reason someone gave for using a phone while in the middle of a conversation would affect perceptions of that interaction. Those who had been phubbed for a trivial reason felt more excluded and distracted than those who were phubbed for an important reason. Now let's pretend that you repeated this study and found a similar pattern of results. Since you obtained

a similar pattern of results to that of McDaniel and Wesselmann, we would say that you _____ their results.

a. hypothesized
b. objectified
c. theorized
d. replicated

3. Before a study is presented at a conference or published in a journal, other scientists familiar with the topic will first carefully evaluate the research. What is this process called?
   a. expert review
   b. peer review
   c. total review
   d. peer evaluation
4. Scientists generally formulate a hypothesis, test that hypothesis, revise the hypothesis as needed, and test again until they ultimately form a conclusion. What is this process called?
   a. the research method
   b. the hypothetical method
   c. the scientific method
   d. the association method

SUMMARY

An understanding of research methods can aid you whether you need to know how scholars obtained knowledge in your field or you choose to conduct your own research. It will also help you evaluate media reports of research findings.

The four general goals of science are description, explanation, prediction, and control. Scientists often develop a theory to explain what they observe and then hypothesize what will occur under similar conditions. Then they are often interested in learning how to influence or control the phenomenon of interest.

The research process contains a series of common steps that begin with the development of a research idea. After conducting a literature review, the researcher must operationalize the variables of interest by specifying precisely how they are to be manipulated or measured. A fundamental decision is whether to use experimental or descriptive research methods. Only a true experiment allows us to establish cause and effect. Once researchers have formed a hypothesis they will recruit study participants, pilot test, and then conduct the research. The final steps are analyzing the data and reporting the findings.

Researchers use the scientific method when investigating their phenomenon of interest. They formulate a hypothesis, test, revise as needed, and test again until they form a conclusion. Scientists must rely on empirical data and remain objective. Science can be replicated; each time we replicate our findings, we gain confidence in them. Science is also a public endeavor.

We share our results with the research community and with the public by presenting and/or publishing those results, typically after a peer-review process.

KEY TERMS

applied research
baseline
basic research
confederate
convenience sample
correlational research
dependent variable
descriptive statistics
empirical data
empirical question
experiment
external validity
hypotheses
independent variable
inferential statistics
internal validity
naturalistic observation
observable behavior
operationalization
peer review
pilot test
population
quasi-experimental research
random assignment
replicate
representative sample
sampling
scientific method
small-N design
theory
variable

REVIEW QUESTIONS

1. Identify five reasons why it is important for people to have an understanding of research methods.
2. Name and describe the four goals of science.
3. Describe the steps in the research process.
4. Differentiate between basic and applied research.
5. Define the term *variable* and explain what it means to operationalize your variable.
6. An experiment is considered the most influential research approach because it is the one approach that allows you to establish cause and effect. Explain why an experiment allows for this conclusion. Use the following terms in your explanation: *independent variable, dependent variable, random assignment*.
7. Explain what a small-*N* design is and when it is likely to be used.
8. Describe how a quasi-experimental design differs from an experimental design, and how this difference limits what you can conclude with a quasi-experimental design.

9. Compare experimental and descriptive research approaches.
10. Explain what a naturalistic observation study is.
11. Explain what correlation research is.
12. Describe why it is important to run a pilot test.
13. Define *internal* and *external validity*.
14. Identify and explain the characteristics of science.

ARTICLES AS ILLUSTRATION

Bohannon, J. (2015). Many psychology papers fail replication test. *Science, 349(6251),* 910–911. https://doi.org/10.1126/science.349.6251.910

Van Bavel, J. (2016, May 29). Why do so many studies fail to replicate? *The New York Times*. http://www.nytimes.com/2016/05/29/opinion/sunday/why-do-so-many-studies-fail-to-replicate.html?_r=0

Read the article by Bohannon to get a glimpse of the "mass replication effort" that has recently begun in psychology (p. 910). Then read the op-ed piece by Van Bavel. Answer the following questions:

1. Describe the replication effort that began in 2011. What percentage of the studies in this effort replicated?
2. Why, according to Van Bavel, did many of the research studies likely not replicate? What evidence does Van Bavel give to support his reasoning?

Read one or more of the following articles to see examples of research approaches presented in this chapter. Questions are presented after each of the readings.

Surveys:

Harrison, M. A., & Gilmore, A. L. (2012). U txt when? College students' social contexts of text messaging. *The Social Science Journal, 49*(4), 513–518. https://doi.org/10.1016/j.soscij.2012.05.003

1. Describe the sample.
2. How did the researchers assess the importance of texting to their sample?
3. What six categories did Harrison and Gilmore use as reasons for texting? Give an example of a result in each of these categories.

Blomquist, B. A., & Giuliano, T. A. (2012). Do you love me, too? Perceptions of responses to I Love You. *North American Journal of Psychology, 14*(2), 407–418.

Ever said "I love you" to someone who then doesn't say it back? Or ever been on the receiving end of those fateful words and not felt the same in return? What have you said? There are lots of

things that can be said in response to "I love you." Blomquist and Giuliano (2012) were interested in determining how women and men react when different responses to "I love you" occur. They conducted two studies. The first study tested an online sample, the second tested a college sample. Answer the following questions for the first study:

1. What was their hypothesis?
2. Describe the sample.
3. Describe the methodology.
4. Describe the results.

Answer the following questions for the second study.

1. Describe the sample. How does the sample of this second study differ from the sample of the first study?
2. Describe the methodology.
3. Describe the results. Could the type of sample affect the obtained results? If so, how?

A naturalistic observation study:

Basch, C. H., Ethan, D., Zybert, P., & Basch, C. E. (2015). Pedestrian behavior at five dangerous and busy Manhattan intersections. *Journal of Community Health, 40*, 789–792. https://doi.org/10.1007.s10900-015-0001-9

1. Why is this study considered a naturalistic observation study as opposed to an experiment?
2. Describe the procedure.
3. Describe the main results.

An experiment:

Farley, S. D., Kelly, J., Singh, S., Thornton, C. Jr., & Young, T. (2019). "Free to say no": Evoking freedom increased compliance in two field experiments. *The Journal of Social Psychology, 159*(4), 482–489. https://doi.org/10.1080/00224545.2018.1505707

Answer these questions for each of the two experiments presented in this article.

1. What did the researchers hypothesize and what were the two theories behind this hypothesis?
2. What was the independent variable?
3. What was the dependent variable?
4. Describe the procedure.
5. Describe the main results. Was the hypothesis supported or not?
6. Did this research replicate previous findings? Explain your answer.

A quasi-experiment:

Puryear, C., & Reysen, S. (2013). A preliminary examination of cell phone use and helping behavior. *Psychological Reports: Sociocultural Issues in Psychology, 113*(3), 1001–1003. https://doi.org/10.2466/17.21.PR0.113x31z4

1. Why is this study considered a quasi-experimental study as opposed to an experiment?
2. Describe the procedure.
3. Describe the main results.

SUGGESTED ACTIVITIES

1. This chapter lists a variety of ways in which people use research methods or evaluate research findings. Can you think of ways in which research methods and research findings are already a part of *your* life (e.g., Do you consult polls, product ratings, and/or car reliability statistics?). Provide a list of the ways you make use of research methods or the results that they provide.
2. Description is one of the main goals of scientists, and we differentiated between describing observable behavior (such as the average number of M&Ms eaten when watching a movie with a friend) and describing phenomena you must ask people about rather than observe (such as how many times a week people remember their dreams). Give three additional examples each of observable behaviors and behaviors that are not observable.
3. Find an article in the popular press (newspaper, magazine, online) that describes a psychological science research study. You can use the following "Psychological Science in the News" link from the Association for Psychological Science to help you find an article: http://www.psychologicalscience.org/index.php/news?type=items
   Once you've found an article you like, answer the following questions:
   a. What kind of study was described?
   b. Who were the study participants?
   c. What were the author's(s') conclusions?
4. Conduct a replication of Harrison and Gilmore's (2012) study on the "social contexts of text messaging" (p. 513). Harrison and Gilmore provide ample information regarding their study to enable you to easily create a similar survey. Think about how you would like to extend their work. Do you want to ask questions of students at a different kind of college (e.g., religious)? Do you want to test a noncollege sample to see if the results are comparable to what Harrison and Gilmore found? Note that Harrison and Gilmore provide great ideas for future research; perhaps one of those would be of interest:

   Harrison, M. A., & Gilmore, A. L. (2012). U txt when? College students' social contexts of text messaging. *The Social Science Journal, 49*, 513–518. https://doi.org/10.1016/j.soscij.2012.05.003

5. In the following research descriptions, identify the independent variable and the dependent variable. The first one is done for you.

   a. Azar et al. (2015) wondered how receiving too much change after paying their restaurant bill would affect the size of the tips restaurant patrons left. The patrons either received approximately $3 or $12 in extra change. The average tip was higher for those who received a larger amount of extra change.

      Independent variable: ***The amount of extra change ($3, $12)***

      Dependent variable: ***The average amount of tip***

   b. Ford et al. (2014) were interested in whether a towel dispenser set up to present a towel automatically would increase the percentage of people washing their hands after using a public restroom. The towel dispenser was set up to provide a towel either with or without activation by the user. When towels were presented automatically, use of both towel and soap increased.

      Independent variable:

      Dependent variables (there are two!):

   c. Peetz and Soliman (2016) examined whether varying the size of an image of money would vary the way people perceived that money. They presented study participants with an image of money that was either actual size or enlarged by 15%. Participants were asked to imagine the cash was their own. Those presented with the larger-size money reported feeling more wealthy than those presented with smaller, actual size money.

      Independent variable:

      Dependent variable: