CHAPTER

1

UNDERSTANDING THE BASICS OF RESEARCH

LEARNING OBJECTIVES

- To be able to understand the many ways research affects our everyday lives
- To be able to identify the research process using the scientific method
- To be able to formulate a testable research hypothesis
- To be able to define variables and differentiate between independent and dependent variables
- To be able to recognize some of the research methods that can help answer your research questions
- To be able to define scales of measurement and understand their importance in research

Each day, we learn things from the news on the television, the Internet, the radio, and in the newspaper. Research is conducted on everything from a new diet suggesting different weight-loss methods, to ways to improve your love life, to new drugs that cure diseases, to how your personality attracts different types of people, among so many others. Gallup polls might show that the president is losing popularity or that people don't support the president's economic policies. Research findings change over time, though, and what was good for you yesterday may not be good for you today. How do we evaluate this information? Do we blindly accept these reports or do we question them? Learning about research methods will help you evaluate the validity of these claims.

Almost every occupation uses research in some way. For example, clinicians depend on research findings to diagnose a patient or prescribe drugs. Educators use research methods to create new and better curricula and teaching strategies. Business professionals use research to examine product and marketing strategies to increase customer satisfaction and sales. Legislators rely on research findings to create new laws. Seat belt laws were enacted based on findings that the use of seat belts significantly reduces the number of people injured or killed in car crashes. Research on eyewitness testimony has helped change federal legislation so that law enforcement officials use a uniform approach when questioning eyewitnesses. Research can also examine issues pertaining to media, aggression, and pornography, just to name a few.

Some question whether the Internet and other forms of media should be censored. How do we reconcile our First Amendment right of freedom of speech with allowing hate groups to publicize and entice others to join them? In essence, research can change the world. It can change the way we behave and how we perceive the world. If it weren't for social scientific research we might still live in a segregated world (*Brown v. Board of Education*, 1954). Research findings also lead to continuous amendments of existing laws and passage of new laws. Laws pertaining to law enforcement, business transactions, and new medical and social programs are continually changing as new research is done examining the effectiveness of the programs. Because research affects our lives in such fundamental ways, it is essential to understand the underlying aspects behind the findings.

When you think of research, what comes to mind? ***Basic research*** is conducted to address essential questions about human behavior. Questions might relate to thinking, learning, memory, biology, personality, and social behavior. The researcher gathers data on a variety of questions and tests theoretical assumptions. Researchers who conduct basic research publish results in scholarly journals after the research has been reviewed by fellow scholars. Research concerned with the practical application of research findings is called ***applied research***. For instance, an applied researcher might examine the effect of a new drug's effectiveness in treating AIDS or depression. A marketing researcher might look at the effectiveness of new product packaging. Clinicians might research a new theory of behavioral intervention and use the new behavioral treatment approach with a client.

One area of applied research is program evaluation. New federal and state programs are constantly being created or reformed within our educational, criminal justice, health care, and mental health systems. Program evaluators research the effectiveness of these programs. Basic and applied researchers work together to provide a systems approach (to bring together or combine) theory and research into real world settings. Basic research provides and perpetuates new research findings and theory. Applied researchers utilize these basic findings within their own research to discover whether the theory and research can be applied to the real world.

In our experience, students taking courses in social science research methods tend to have a natural inclination toward investigating human behavior. You might enjoy observing people in an attempt to explain their behavior. Perhaps people tend to come to you for information. Your observation skills are so acute that your friends might rely on you for insight to assess whether they are perceiving or reacting to an incident in an appropriate manner. Based on your experience and your own personal observations, you offer advice to your friend. How does the way you approach your friend's problem differ from scientific approaches toward solving problems?

An empirical approach would be more scientific. The word ***empirical*** means that we base our knowledge on observation. Non-scientific approaches—such as taking a wild guess, relying on intuition, basing decisions on vicarious experiences of others, or simply relying on an authority to tell you what to think—are not empirical. By itself, empiricism is not necessarily a systematic, scientific approach to research. We can describe behavior we observe, but these descriptions are not considered scientific because they are not conducted in a systematic way that limits error and bias.

MAKING DECISIONS: INTUITION VERSUS SCIENCE

When we add a systematic approach to observing behavior, our observations become more scientific. Using the scientific approach often leads us to conclusions that are not always what we expected them to be (that is, intuitive). One example of false intuition is that, when the home computer was first invented, many believed it would be a short-lived fad.

Some researchers conduct studies that conclude with what many would believe to be obvious findings. In some situations, scientific research does find what we believe to be the obvious answer, but often research findings are surprising and generally not intuitive. For example, a famous psychologist, Leon Festinger, examined how people rationalize their behaviors, particularly when their behaviors are not consistent with their own values or personality. Festinger set up a research study where students were offered either $1.00 or $20.00 to participate in a study. Once participants came to the laboratory, they were told to sit in the lab and simply turn a wooden peg in a peg board for one hour. Upon completion of the task, Festinger asked the participants how satisfied they were with the task and how happy they were to participate in the study. Which group do you think reported they were more satisfied and happy to participate? Think about it.

Most students believe the group receiving $20.00 would be more satisfied with the task. Surprisingly, Festinger found that participants who were given one dollar reported being happier and more satisfied with their experience. How do you think Festinger explained this? This study actually became a major theory called cognitive dissonance theory. Festinger believed that participants who received the dollar had to justify their behavior. They had practically wasted one hour of their lives, therefore they had to rationalize why they participated. When our behaviors are not consistent with our values and morals, we feel uncomfortable, experiencing disharmony or cognitive dissonance. In order to reduce this dissonance, we justify the behavior to ourselves. We tell ourselves what a great experience it was. By doing this, we reduce the dissonance we are experiencing. Perhaps you have done this. Have you purchased something one day and then found something better and cheaper the next day? If so, you may have justified your behavior by telling yourself how much better your original purchase was.

Festinger and his colleagues took this idea a little further (Festinger, Riecken, & Schacter, 1956). Festinger had a colleague infiltrate a cult that believed the world would end at the start of the new year. The cult was formed by a woman who began hearing voices that she believed were from aliens. Eventually others were attracted to the cult. Most of the individuals in the cult gave up all of their material belongings because they believed they would not need them when the spaceship came to pick them up before the total annihilation of the world. When the time for the world to end came and went, the group then rationalized their behavior by saying the world did not end because their group was so cohesive and had such a connection to the aliens that they themselves were the reason that the world did not end. When we do things that are contrary to our usual behavior, our human nature will provide justifications for our behavior so we don't feel so bad. The point here is that things are not always what they seem. In fact, more often than not, when we scientifically investigate things, researchers are likely to be surprised by something they have found in their data. Results are not always intuitive and science has helped us realize this.

USING THE SCIENTIFIC METHOD IN RESEARCH

Using empiricism in conjunction with the scientific method, you can be more confident that the outcome is based on a behavior you are measuring and not something else. The scientific method allows scientists to get rid of alternative explanations (confounds) and bias that lead to errors and erroneous judgments. With the scientific method you not only can describe behavior, but you can ultimately predict and explain it.

The scientific method has four goals: describing behavior, predicting behavior, explaining behavior, and understanding behavior.

Describing Behavior

Researchers conduct scientific observations of individuals, behaviors, and events. Dodd, Russell, and Jenkins (1999) examined the simple aspect of smiling. Previous research had found that boys and men smile significantly less than girls and women

(Hall, 1984). The study of gender differences in smiling can contribute to theory and research on the development of gender roles. According to both social learning theory (see Lott & Maluso, 1993) and gender schema theory (Bem, 1985), the socialization of gender occurs during childhood, but gender schemas change and evolve after childhood (Jacklin & Reynolds, 1993). Dodd et al. (1999) studied the onset of these gender differences. For instance, did females always smile more than males? Or was smiling a function of societal norms and expectations? After observing over sixteen thousand school yearbook pictures of individuals in kindergarten through adulthood, the researchers found that though females do tend to smile more than males overall, there were no differences in smiling between females and males until approximately age ten. Gender differences were found in fourth grade and reached a peak by ninth grade, at which point, there were significant differences between males and females in smiling.

It is amazing to note that simply by observing and describing behavior, researchers are able to find relationships between variables such as gender differences and smiling—ultimately leading us to make a prediction that if you are a female between the ages of nine and thirteen, you will most likely be smiling in your school picture, but males between the same ages will be less likely to be smiling. Researchers can also make inferences from these results that imply social smiling may be a function of societal expectations.

Predicting Behavior

Once a behavior has been observed and described, a researcher can make a prediction based on previous behavior. For example, if you look outside your window each morning at approximately 7:45 AM and see your little six-year-old neighbor Joey waiting for the bus, you would likely conclude that your neighbor will be waiting for the bus on the next day. You also notice that Joey is not there waiting for the bus on weekends (when there is no school). Hence, you conclude that little Joey will be outside waiting for the bus Mondays through Fridays. If today is Monday, you can make a pretty safe prediction that Joey will be at the bus stop at 7:45 AM. Similarly, researchers can predict that a female in a yearbook picture will be smiling before they see her picture. However, they cannot explain *why* females smile more than males.

Explaining Behavior

Descriptions and predictions of behavior can imply relationships between variables; however, they cannot imply explanations for the observed behavior. For instance, many people wonder whether the use of iPods and cell phones leads to more car accidents. Researchers can explore the relationship between the use of cell phones and iPods and their role in accidents to determine whether a relationship exists. However, researchers cannot say that using your cell phone or iPod in the car will lead to a car accident. Wouldn't it also have to be true that younger people tend to have more iPods and cell phones and are less experienced drivers, and this too might lead to car accidents? Another example might be that playing violent video games causes one to

become aggressive and violent. We must also consider whether individuals who are already violent or aggressive might also be more attracted to violent video games.

In order to infer causation, researchers conduct experiments using the scientific method. In order to make causal inferences, three elements are required. The first element is ***temporal precedence***. This means that the cause must precede the event or outcome. For instance, according to this element, researchers must demonstrate that playing violent video games actually comes before violent and aggressive behaviors, or that using a cell phone comes before a car accident. Next, researchers must find a relationship between aggression and video games. The second element is that cause and event must *covary.* This means that when the cause is present the event must occur, and when the cause is not present the event does not occur. The third element needed to explain behavior is using experimental control to eliminate alternative explanations. ***Experimental control*** is a necessary element of the scientific method that uses manipulation, holding conditions constant, and balancing to isolate effects of various variables. For example, research has found a relationship between the use of hands-free cell phones and poor driving performance (Beede & Kass, 2006). We can take this a bit further and suggest that cell phone use is related to car accidents. However, research demonstrating relationships between variables can never conclude that one thing causes another or, in this case, that cell phones *alone* cause accidents. Similarly, if we cannot determine that playing violent video games and *only* violent video games causes aggressive and violent behavior, then we cannot say with certainty that playing violent video games causes violent and aggressive behavior. One would be hard-pressed to find that the use of iPods and cell phones alone are the cause of car accidents. Researchers would have to take into consideration other issues that might affect the outcome. In the case of cell phones, we would have to control for factors such as weather, number of people in the car, the age and experience level of drivers, road conditions, and the possibility of drug or alcohol use.

Understanding Behavior

The last goal of the scientific method is to understand how and why behaviors occur. When relationships are found, researchers need to explain why they exist. In our example of female students smiling in yearbook photos, we find a relationship between age and social smiling. Why would the gender differences in smiling—at least in school photographs—emerge during the ages of nine to thirteen years? In a general sense, it seems likely that younger children are not fully attuned to social expectations related to gender roles (Salkind, 1990) and have thus not yet incorporated the way they smile as part of their gender identities. According to gender schema theory (Bem, 1985), ideas about gender develop throughout childhood, but these schemas change and evolve to organize new information and influences (Jacklin & Reynolds, 1993). Preadolescent children (between the ages of nine and twelve) are particularly susceptible to gender roles as we see in the increased interest of opposite-sex relationships and interest in sexual information. They are also influenced by how men and women are

portrayed in the media. There may be many explanations for such a finding. It is the job of researchers to find what might be the best explanation for their findings.

All of the four goals of the scientific method mentioned are related to one another. In order to make predictions one must first find, observe, and describe behavior. To find an explanation for behaviors, researchers must also observe, describe, and find relationships between variables. Researchers conduct experiments that demonstrate temporal precedence, that find covariation among cause and effect, and, finally, that address possible alternative explanations. Finally, when trying to understand the "how" and "why," researchers provide theories that provide explanations for the research findings.

Researchers attempt to describe, predict, explain, and understand behavior.

FORMULATING A RESEARCH QUESTION

Great research theorists develop theories and research based on their interests and passions. You probably have some ideas or questions on topics about which you are particularly passionate. Ideas for research can come from a professor's lecture, something you heard in the media, or from personal experience. Let's say you are interested in psychology as it relates to law. You might study jurors or legislators and how they make their daily decisions that affect many lives. One important research question you might ask is, Does the way in which eyewitnesses are questioned affect the accuracy of their testimony? Scheck and Neufeld's pivotal work (1992) led to the Innocence Project, which has found that over the last ten years more than one hundred individuals on death row have been released following revelations of inaccurate eyewitness testimony. Or you might investigate the effectiveness of a new measure designed to assess competence to stand trial. From these ideas you create research questions and a corresponding design that will help you measure what you want to measure.

When you create a research question or idea, you are creating a hypothesis. A ***hypothesis*** is a tentative question that can be tested. Evidence may support or refute the hypothesis. As you formulate your own hypothesis, ask yourself a question about the topic and make a specific prediction as to the outcome of your research. Hypotheses are usually stated in a way that suggests the direction of relationships or cause and effect between variables. For example, one might investigate whether spending habits differ according to a person's gender. Before you can make a good testable hypothesis about this, there are two things you must do. First, as a researcher, your job is to examine the literature regarding your topic to see what has already been found. Perhaps someone already conducted a study examining the same question. As you read the research on the topic, you come across evidence that men are less likely to make purchases on a regular basis then women. However, men tend to spend more money on large ticket items than women do. Based on this finding, you can make a hypothesis that predicts men make fewer purchases than women, yet the amount of

money spent for both men and women is approximately the same. Second, after reviewing the extant literature on the topic you will want to pay close attention to research theories that can provide an explanation for your research findings.

As you read the literature and formulate your hypothesis, you will also want to consider finding a research theory that can be used to explain why you think purchasing trends differ for men and women. A ***theory*** helps us organize and explain information. According to Myers (2008), a theory is "an integrated set of principles that explain and predict observed events" (p. 17). Theories are used to summarize explanations for research findings as well as to infer testable predictions. For instance, you would need to find a theory that explains why you believe females evaluate defendants differently than males. This new theory must be tested and evaluated, and, as this is done, new knowledge is gained.

As you create a hypothesis, you must also remember to try to identify potential relationships that can exist between variables. A ***variable*** is defined as "any event, situation, behavior, or individual characteristic that varies" (Cozby, 2004, p. 62). The weather is a variable, as it changes from day to day. Some examples of variables in the study about using hands-free cell phones and driving ability include the type of hands-free phone, average speed, changes in speed, reaction time, attention, and traffic violations.

Researchers must clearly identify which variables they will study. In the study examining the effect of hands-free cell phones on driving performance, driving ability would be considered the outcome (measured by speed, reaction time, traffic violations, and so on). In investigating gender differences in spending habits, spending habits would be considered the outcome variable. As you create your hypothesis, you can discuss variables within the context of a relationship—typically one of cause and effect. Researchers call these variables independent and dependent variables. An ***independent variable*** is the variable that is considered to be the cause of the results. A ***dependent variable*** is considered to be the effect (or outcome variable). For instance, you want to determine whether socioeconomic status (SES) of an individual (lower SES or higher SES) affects perceptions of academic achievement. In this situation, socioeconomic status is the independent variable and perception of academic achievement (as measured on a scale where 1 = "extremely low academic achievement" and 7 = "extremely high academic achievement") is the dependent variable. In experiments, the independent variable is the variable that is typically manipulated to "cause" the effect. For instance, if you wanted to determine whether socioeconomic status made a difference in ratings of academic achievement, you could manipulate the socioeconomic status of the individuals in the study. Half of the participants would receive a scenario depicting an individual with high SES and half of the participants would receive a scenario portraying the individual with low SES. You would then examine ratings of perceived academic achievement to determine whether these ratings change as a function of socioeconomic status.

Based on previous research and theory, your hypothesis might be that individuals with low socioeconomic status are perceived to have lower academic achievement.

In order to assess your hypothesis, you could then measure whether ratings of perceived academic achievement differed among individuals with low or high SES to determine whether your hypothesis is supported or refuted. If the research findings show that those with lower SES are perceived to have less academic achievement, then your hypothesis is supported. If the research does not find any differences among the ratings, then the hypothesis is refuted.

UNDERSTANDING RESEARCH TERMINOLOGY

Keep in mind that all research questions and hypotheses must be testable. Most research questions and hypotheses aim to explain why something happens. If a hypothesis cannot be tested, it is not useful to anyone. Terms must be clearly defined in a way that can be tested. For instance, Freud's theory of id, ego, and superego continues to be one of the most famous psychological theories but lacks the ability to be tested. One cannot test the existence of an id, ego, or superego. Therefore, most researchers do not consider this a "testable" theory. When developing a testable theory, questions must be clearly written and not circular in meaning. Therefore, as you create a research question, you cannot say a child has Attention Deficit Disorder (ADD) and therefore has more behavioral problems in the classroom. This rationale is circular as more behavioral problems in the classroom may be a result of the child's ADD. Furthermore, the topics you decide to study cannot be abstract—they must be measurable. For example, researchers cannot investigate topics such as "hell" or "the devil," because these topics are abstract concepts that cannot be measured. You must be able to test your hypothesis using a research methodology. Let's say you hypothesized that a new after-school program would lead to student success in the classroom. This is a great start. However, you must be very specific as to what you mean by "student success." How will student success be measured? Each variable in your study needs to be clearly defined.

Researchers use ***operational definitions*** to define the variables they decide to measure. An operational definition is the way we define our hypothetical construct so that the construct is now measurable. In the example above, you could define student success in many ways. If you considered academic achievement to be success, you might measure changes in student grades from year one to year two. Or student success might be measured by the number of social interactions with peers. However you decide to define student success, definitions must be very clear so you and your readers know exactly how the variables in your study will be measured before any research is conducted. This would also include the variable "after-school program." Because the after-school program is a variable of interest that is expected to lead to success, you would also need to define the after-school program in detail. What will the program include? How long will it be? Where will it take place? How do students participate? Are there eligibility criteria?

Defining your variables clearly is necessary for several reasons. Let's say that you created an after-school program. You or someone else conducted a study that found student success (as measured by better grades) increased once the after-school program

was implemented. The results of the study were published and you and your after-school program became famous. Other schools around the country now want to implement your after-school program into their schools. How do they do this? Without a clear definition of what your program entailed, they cannot implement it properly. If you do not provide a clear definition to assess student success, others cannot replicate your research. If something such as your after-school program was successful, you might want to re-create similar programs around the world. Once these other programs were implemented, they could be evaluated to determine whether the program works with students in different areas. Researchers call this *reliability*. Research is reliable when it is replicated with other populations and samples. Researchers look for consistency among research findings. When findings are replicated across different groups and situations, this increases our ability to generalize to the greater population.

An important goal is to ensure your measures are valid and reliable. If you are studying student success, do student grade changes actually capture "student success"? Perhaps they do in one way or another, but certainly if we limit our definition of success to grade change, we neglect to look at other aspects that can be defined as success. Measures are ***valid*** when they measure what they are supposed to measure. Validity tries to capture the "truth and accurate representation of information" (Cozby, 2004, p. 79). Measures are ***reliable*** when they are consistent across time and populations. It is certainly not wrong to define student success as change in grades, but be sure to realize whether the method you are using to define your terms actually captures the definition of what you intend to measure. Later in the text, we will address many other types of reliability and validity that researchers consider when conducting research.

RESEARCH METHODS THAT CAN HELP ANSWER YOUR QUESTION

Always remember the phrase "Correlation is NOT causation."

Choosing a research method will depend upon your research question. In order to describe, predict, explain, and understand behavior, researchers collect data. They have many options for collecting data using qualitative and quantitative measurements. Some data collection methods include describing behavior in naturalistic observations, systematic or repeated observations, case studies, archival research based on previously obtained statistical records from the mass media or other communication records, interviews, or surveys. Keep in mind that when your goal is to describe or predict relationships between variables, you can establish only that the variables are related.

You cannot infer that one thing causes another thing. In order to explain or understand behavior, a researcher must conduct an experiment. This book will help you establish which of these methods will help you answer your research question.

Describing and Predicting Behavior	*Explaining and Understanding Behavior*
Naturalistic observations	Conduct experiment
Systematic observations	
Case studies	
Archival research	
Interviews	
Surveys	

Why Scales of Measurement Are Important in Survey Construction

Before researchers can conduct their studies, they have to consider how each of the variables in the study will be measured. They must operationalize all of the variables in their study. This clear definition of variables will help readers and other researchers understand exactly how the study was conducted. When discussing how a variable is measured, researchers must explain the exact way in which they measured. For example, as a researcher studying depression, you might be collecting data to determine whether depressed individuals differ from non-depressed individuals. One way to study the effects of depression would be to simply ask individuals whether they are depressed. This would be a categorical way of obtaining information. When you offer a participant categorical options such as "yes," "no," or "other," these are ***discrete categories*** (variables that are not continuous, but categorical). If a participant says "yes," he or she cannot be placed in any other category. An example can be seen in Figure 1.1.

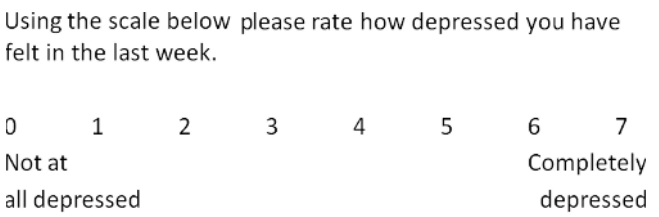
Another option in investigating the construct of depression might be to use a scale that already exists and has been proven valid and reliable, such as the Beck Depression Scale (Beck & Steer, 1987). This scale measures depression on a Likert-type scale or a continuous scale. ***Likert-type*** or ***continuous scales*** are rating scales that provide greater options for your participants and more variability for your study. In a continuous rating scale, participants choose a numeric value, giving you quantitative information about the amount of depression that each of them experiences. For instance, you could ask participants to rate how depressed they felt in the last week on an 8-point scale where 0 = "not at all depressed" and 7 = "completely depressed." For example, see Figure 1.2.

FIGURE 1.1 *Question with Discrete Categories for Answers*

Please rate whether you have experienced depression in the last week (check one box)

❑ Yes ❑ No ❑ Not Sure

FIGURE 1.2 *Question with Likert-type or Continuous Scale for Answers*



It is important to be aware of how you are measuring the variables you have chosen to study. The decision of whether to measure depression as a categorical variable or a continuous variable will affect how variables will be defined and ultimately determine which statistics you can use to analyze your data. Understanding the scales of measurement will help you understand your options in measuring variables.

The Scales of Measurement

A ***nominal variable*** has no numeric or quantitative properties. Researchers refer to these measurements as categorical data. In this situation, participants' responses are placed into categories. Their response to the question will render them in one category or another. For instance, you might wonder what percentage of students in your class passed the last exam. If an individual passed the exam, he or she cannot be in the "did not pass" category. Hence, categories in nominal scales are always ***mutually exclusive*** (meaning that if you are in one category, you cannot be in another). Gender is considered a nominal variable. A person is male or female, pregnant or not pregnant, dead or not dead; and so forth.

Ordinal variables are those variables that are measured by ordering or ranking. With ordinal values, the categories can be ordered from first to last, from long to short, or from top to bottom. Examples include college football standings, pop music charts, or rating your favorite ice creams. Some questionnaires ask us to rate something from least important to most important. This is evident with regard to measures of our general concern for environmental issues. For instance, you might be asked to rank the order of importance of the environmental factors you believe to be the most significant in affecting our air quality today.

Figure 1.3 depicts a nominal scale used in a situation where someone might favor one thing much more than they do another thing; the amount of difference between rankings 1 and 2, or between 2 and 3, may be very different from each other.

Interval and Ratio Scales

The difference between the numbers on an ***interval scale*** is assumed to be equal and meaningful. In other words, the difference (or distance) between 2 and 3 and between

FIGURE 1.3 *Question with Ordinal Ranking Scale for Answers*

Please rank the following problems by writing the number in the blank:
1 = most important to 3 = least important. Use each rank only once.

_____ Car emissions

_____ The diminishing rain forest

_____ Industrial waste pollution

3 and 4 are equal. You have probably seen interval scales when you have completed a short survey where a Likert-type scale or continuous scale was used to assess your thoughts on a given topic. An example of an interval scale was noted earlier, where 0 = "not at all depressed" and 7 = "completely depressed." An interval scale is differentiated from a ratio scale wherein an interval scale has no true zero value. For example, if you checked your own temperature (in degrees Fahrenheit), it would most likely be 98.6˚. The difference in the temperature of 78.6˚ and 88.6˚ is equal to the difference between 98.6˚ and 108.6˚, yet there is no true absolute zero on the scale that suggests temperature does not exist. In this case, the number 0 is only a random reference point. When there is no absolute zero reference point, you cannot form ratios with numbers. For example, you cannot say the person who scored 100 on the depression scale is twice as likely to be depressed than someone scoring 50 on the depression scale. You will find interval scales are particularly useful when measuring attitudes toward virtually any topic.

Ratio scales have an absolute zero point and are separated by equal intervals. The best examples of ratio scales are scales measuring physical attributes of objects (such as weight, width, or length). In this situation, ratios can be assumed. For instance, a table weighing one hundred pounds weighs twice as much as a table weighing fifty pounds. Ratio scales are most often used to study things such as time and duration. You will find that analysis of data using interval or ratio scales is virtually identical—both are considered continuous in nature.

Scales of measurement (nominal, ordinal, interval, and ratio) are important to consider when designing a research study.

Researchers need to choose carefully which scale of measurement is appropriate to obtain the most useful data. Computers techies coined the phrase "garbage in, garbage out" to describe the dangers of inputting bad data when creating a program. The same goes for doing research. Quantitative research is data-driven and the data you collect are an essential part of conducting a good study. Scales of measurement ultimately limit your ability to analyze data in the manner you choose. That is why it is important to carefully

consider two key things when designing your study. First, will the measurement you choose enable you to answer your research question or hypothesis in a valid manner? Second, because the measurement you choose will dictate which statistics you can use, will the scale of measurement you choose enable you to statistically examine the outcome of your study as you intended?

SUMMARY

In this chapter, we addressed the importance of research in everyday life and explained the scientific method that researchers use to conduct research. This chapter introduced many key terms to which we will refer in greater detail in later chapters. After reading this chapter, you should have a fundamental understanding of the difference between basic and applied research. You should also remember that researchers do not rely on intuition or anecdotal information to draw conclusions. Instead they establish testable research hypotheses using the scientific method. This empirical approach has four goals: to describe behavior, predict behavior, explain behavior, and understand behavior.

A careful review of the extant literature on your topic will help you formulate your research question and create a testable hypothesis. Be sure to include research theory to support your hypothesis. Your research question should also have clear independent and dependent variables; how you define these variables will be based on the definitions you choose. When deciding how to define your variables of interest, you must also consider how reliable and valid your study will be based on the operational definitions of your independent and dependent variables and your target sample. Clear definitions with an explanation of how each variable is measured are necessary to help you, your readers, and other researchers understand exactly how the research is conducted.

We discussed the importance of understanding the scales of measurement (nominal, ordinal, interval, and ratio) and their role in formulating an operational definition of your variables and ultimately in dictating the type of statistics you can use to evaluate your research results. Then the research method you choose (correlational or experimental) will be based on your research question and the operational definitions you choose.

By now, you should have an understanding of some basic concepts in research. At first the thought of conducting your own research can be quite overwhelming. Our text will walk you through the necessary steps needed to conduct a high-quality research project.

KEY TERMS

basic research
applied research
empirical
temporal precedence
experimental control
hypothesis
theory
independent variable

dependent variable
operational definition
valid
reliable
discrete categories
Likert-type or continuous scales
nominal variable
mutually exclusive
ordinal variable
interval scale
ratio scale

DISCUSSION QUESTIONS

1. Think of at least three examples of how research has affected your personal life.
2. What are some of the key differences between empirical and nonscientific approaches to research and what are the primary reasons researchers use the scientific method?
3. Name and distinguish between the four research designs that describe and predict behavior and experiments that explain behavior.
4. What is the importance of using an operational definition?
5. What are the four scales of measurement and why are they so important to conducting research?