2 FORMULATING A RESEARCH QUESTION

CHAPTER OUTLINE

LEARNING OBJECTIVES

1. Choose a research topic.
2. Explain how to operationalize research constructs.
3. Describe the different types of variables.
4. Formulate the various types of hypotheses.
5. Create a visualization of a research question.

SELECTING *YOUR* RESEARCH TOPIC

Here is a secret about researchers: They don't feel that conducting research is a job or a burden. They *love* the topic they are investigating. They love reading about the topic. They can easily spend hours analyzing data. Researchers are excited when they encounter something new, and they can talk passionately about it for hours. This reality check is important because typically no one mentions it. We often think of researchers as hermits, confined to their own worlds and invested in a boring pursuit. This image could not be further from the truth. Research is not a 9-to-5 job. It crawls under your skin and becomes an obsession. It is almost like a deeply engaging video game where you cannot rest until you reach the next level.

This discussion of love and passion in research may have gotten you thinking about what you *love* to read about. Ask yourself the following questions: What topic keeps my attention? What blogs or news feeds am I likely to read? What do I repeatedly search for online? What topics pique my curiosity and inspire endless discussion? Is it a new high-tech gadget? Is it fashion? Is it the most recent smartphone app and what your friends are posting? The answer can sometimes be found at your doorstep, but if you are still wondering what you are passionate about investigating, it may help if you take a day off and simply observe your behavior. Note what news headlines catch your eye and what keeps you alert and curious. By the end of the day, you will certainly have an idea about what topics interest you.

Fundamental vs. Applied Research

Now that you have an idea about what you want to research and explore on your own, it is time to categorize whether your research is fundamental or applied. **Fundamental research** looks at the world at large and tries to generate new ideas or explanations about how the world works and why. This type of research aims at collecting information about large groups of people and may not have an application in our everyday life, at least not in the immediate sense. We need fundamental research to gain insights into our world. (Both theories of knowledge from Chapter 1 are types of fundamental research.) They don't have an immediate application to our lives, but they show us how the knowledge is developed. We then use these broad explanations as a basis to develop practical guides that apply to various aspects of life.

For example, one area of fundamental research is theories of migration. Many researchers have tried to determine why people move from one place to another and what triggers a mass exodus. Sometimes the answer seems clear—economic or political reasons (Mahler, 1995). Other researchers claim that there are some additional reasons related to social status (Pajo, 2007) that put global migration into motion. These theories are fundamental because they are not applied directly to people who migrate. Researchers do not intervene in their subjects' daily lives or bring changes that concern them, but they aim to gain a deeper theoretical understanding of the human condition. These larger theories can build principles that help us understand a situation and are helpful in practical life, but that aspect of the research is not immediately clear when reading such studies.

On the other hand, **applied research** seeks to solve a specific societal problem or uncover more information about a particular issue. This type of research explores why people behave in a specific way. Understanding why allows us to find a solution to the problem. This has direct implications in practice and increases our understanding of how things work.

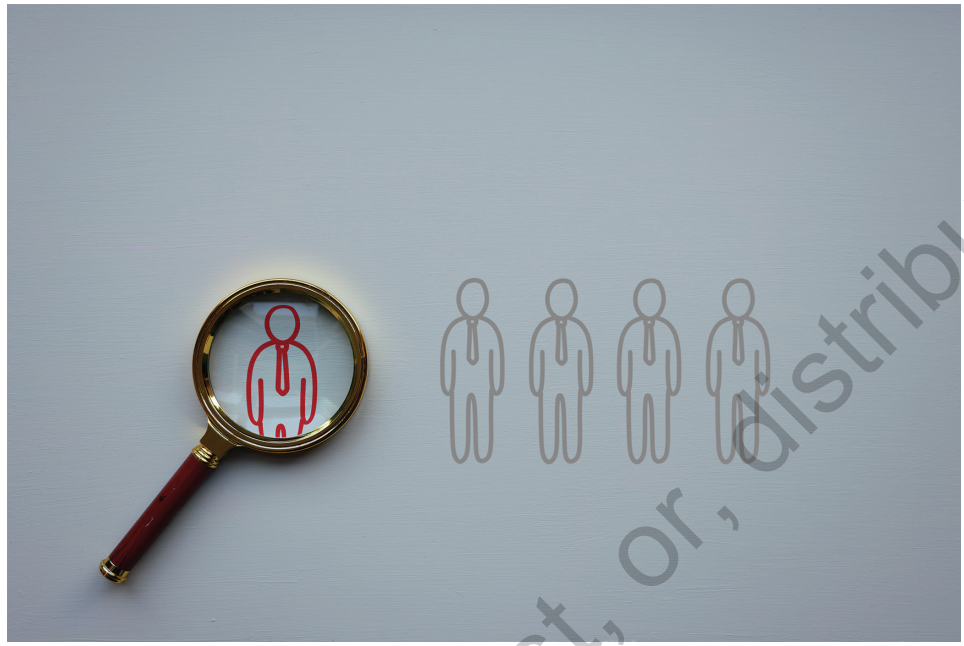
For example, a researcher was curious about the growing number of children diagnosed with attention deficit hyperactivity disorder (ADHD) in our society. Let's imagine for a moment that this researcher conducted an experimental study and compared children in a very active classroom (where they learn by doing and participating) with children in a traditional classroom (where they learn by passively absorbing information presented to them). Let's say the findings showed that traditional classrooms had an increasing number of children with ADHD-like symptoms, but there were almost no children with attention or behavioral problems in the active classroom.

If everything else was equal (age of the students, marital status of parents, socioeconomic status of parents, race and ethnicity, and parents' education), this researcher could state that perhaps by placing children with ADHD-like behaviors in an active environment, we could lessen the problem. Restructuring our entire education system may be the solution. The findings in this hypothetical case have a clear application in society and suggest a solution to a common childhood problem. Studies of this type are used to test forms of interventions or training to evaluate their effectiveness in practice.

Narrowing the Research Topic

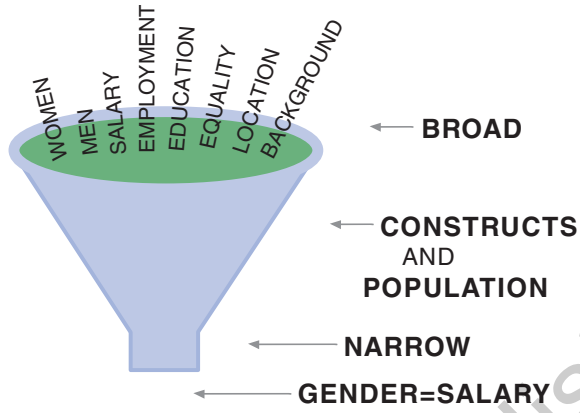
Now that you've decided on a fundamental or applied research approach, let's examine the steps needed to focus your topic of interest (see Figure2.1). Figure 2.2 shows how we start with broader interests or topics, and by asking questions, we can narrow our topic to something more specific. There are two features of your broader topic that can lead to your research question: (1) the constructs of interest (or the main concepts around your topic) and (2) the population of interest. A **construct** is a concept related to your topic (e.g., health or knowledge) that is possible to measure in one form or another. Narrowing down your topic by the constructs of interest is easily done if you start asking yourself a couple of questions. If you refer to your topic using a broader term (e.g., *society*, *health*, *well-being*, or *education*), try asking yourself what exactly the word means to different people. You will notice that general terms often have various meanings according to different people. So how do you narrow down your term so that when you mention it to people who are unfamiliar with your interest, they will understand exactly what you mean? If you say, "I am interested in the way society makes decisions," they may be unclear on what you mean—or, worse yet, interpret it completely differently from your intentions. Are you interested in how people decide what type of property to buy, what movie to watch, what type of food to buy, or what type of medical therapy to choose when they have a problem? Trying to be as specific as you can about what exactly you are going to study and the constructs of interest will help you narrow it down to just one sentence that will clearly convey what your study is about.

FIGURE 2.1 ■ So how do we narrow down our interest to something specific?



The second important feature that helps narrow down your topic is your population of interest. Let us assume for a moment that you have identified the constructs you are interested in. In this hypothetical example, you are interested in the *quality of education in the elementary schools in the United States*. However, as you may already notice, there are a few vague things in here, starting with the word *quality*. Does *quality of education* mean how well students perform in elementary schools? Does it mean the quality of teaching or students' skills? Does it refer to how parents feel about the quality of education or how students think about it? Here, the population of interest can clear out any inconsistencies. So you ask yourself whether you are interested in students, parents, teachers, or other authorities involved in the elementary schools, such as psychologists or social workers. You may decide that you are interested in how parents feel about the quality of education in elementary schools. Then, you will need to decide the type of elementary schools. Are you talking about public schools, private schools, charter schools, or Montessori programs? You decide you are interested in public schools. You can even go further and decide that by *parents* you actually mean fathers because their perspective seems to be missing from the current literature on the topic. Great. Now, you have narrowed down the constructs of what you want to study as well as the population of interest. Your topic now becomes *fathers' perspectives about the quality of public education in the elementary schools in the United States.* Now you can expect most people to have a very good understanding of the subject of your study.

FIGURE 2.2 ■ Moving From a Broad Topic to a Narrow Topic



RESEARCH WORKSHOP 2.1 AN EXAMPLE OF NARROWING DOWN A RESEARCH INTEREST

In this example, a student is trying to narrow down a topic by asking questions and answering them. This student's interest is in health.

Question A: What type of health?
Answer A: Children's health.
Question B: What type of children's health? Lungs, heart, brain?
Answer B: No, maybe mental issues like ADHD, oppositional defiant disorder (ODD), or autism spectrum disorder (ASD).
Question C: So these are emotional and behavioral problems of children. What aspect of these issues is interesting to you?
Answer C: I am not sure how to answer . . .
Question D: Let's browse some aspects of the problem. Is it about how these emotional and behavioral problems start? Is it about whether children are being medicated for these problems? Is it about how the problems are identified by parents and teachers? Is it about how parents experience these problems emotionally? Is it about how psychiatrists diagnose these problems? Is it about whether some medications work and others don't? Is it about how disability centers in schools handle these issues? Is it about whether these children are successful in the long run? Is it about children who are identified as having a problem, but are not taking medications? Is it about children who go to cognitive behavioral programs instead of taking medications?
Answer D: Hmmm . . . I think I want to look at how parents decide to go and check their child for emotional and behavioral problems . . . I mean, how do they know their child is even having a problem? What triggers the entire problem?
Question E: Now, when you say *children*, do you mean preschoolers or school-age children? Can you narrow down by age?
Answer E: I had school-age children in mind . . . maybe elementary school children.

This student managed to narrow down the topic to this research question: "How do parents of elementary school children, ages 6–10 years old, decide that their child is having emotional and behavioral problems and they need to ask for professional help?"

Try this type of exercise for your own topic by seeing if you can narrow it down to a very specific topic and by population. You will be delighted to see that you have a solid start for your research.

OPERATIONALIZATION OF CONSTRUCTS

Now that a specific research question or problem has emerged, you may attempt to put the idea in the form of a research question if it fits the study you are conducting. Formulating a research question means writing a well-thought-out question that includes the gist of your study as well as the population you are interested in studying. Depending on the specific topic of the study, you may also include the location where the study is conducted. The idea is to be as specific as possible so that most people will understand immediately what this study is about. Just as in the earlier example concerning fathers' perspectives on the quality of public education in elementary schools, you need to convey your entire meaning of the study in one research question.

The next step in finding out more about your topic of interest is finding good sources depicting studies of similar interest. The following short list will likely satisfy your search, but keep in mind that although these sources are a great beginning, they are not scientific sources for finding literature. Consider these more like friendly and easily accessible resources to get you started with new ideas on a specific topic.

a. Technology, Entertainment, and Design (TED) is an excellent source that includes videos of some of the finest and most elaborate research studies, unique ideas, and creative solutions. TED.com is free and friendly to navigate. Its focus is widespread and covers many fields, so it should be quite easy to find information on your topic of choice.

b. National Public Radio (NPR) is one of the best sources available. You can start by searching NPR.org for keywords on your topic to see if it has articles, short stories, audio stories, or any other information. Its programs are well researched, made simple for larger audiences, and likely to intrigue you into wanting to know more.

c. TED Radio Hour is a collaboration of these two sources in 1-hour weekly programs where a topic is investigated further by interviewing a few researchers who presented at TED conferences. There are many different topics available, and this collaboration gives you various perspectives on the same topic at once.

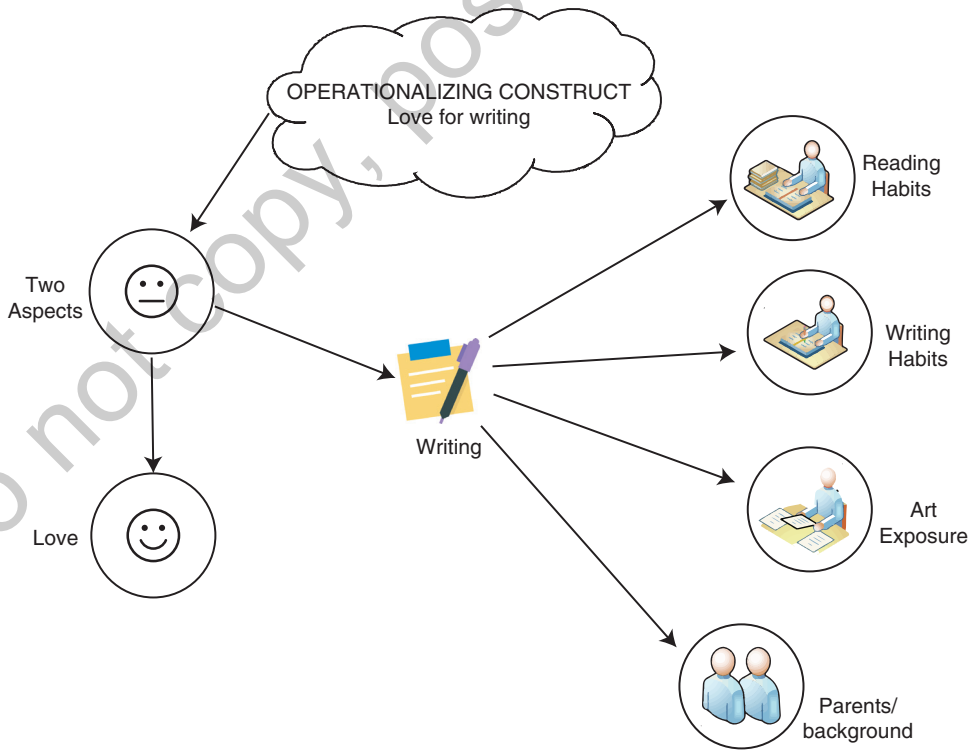
d. The Public Broadcasting Service (PBS) is another outstanding source for beginners in any topic of research. At PBS.org you can find videos, long-format programs, articles, and other sources of rich information that again are very well researched, show both sides of the problem, and can get you excited about the topic.

e. The *New York Times* is perhaps the one source that will certainly have something related to your topic. In most cases, your school library will have access to its online version where you can search articles on your topic. The articles at NYTimes.com are well researched, written in an engaging style, and critically thought out. You will be happy you started here.

The next step in going deeper into your own research study will require digging into the scientific literature and getting your hands on articles about research that has been conducted on your topic of interest. This step requires a trip to the library or familiarity with the library databases. Here you will look specifically for research articles on the exact same topic you are hoping to conduct your study on. Figuring out what your study will be about from the nonscientific sources recommended earlier is an excellent first step that will help you develop a more solid understanding of your own topic. When you have the idea quite clear in your mind, you can then look for scientific articles. The process will be much easier than delving into scientific studies without a clear research focus.

Once you have some ideas about your topic, it is time to talk about **operationalization**. Operationalization refers to turning our constructs into actual variables that we can measure (see Figure2.3). A **variable** measures a specific feature or aspect of a construct and can take different values for each participant in the study. First, we need to return to our topic of interest and see if we

FIGURE 2.3 ■ Operationalization is nothing more than our ability to transform constructs into measurement pieces. The best researcher is able to measure all the characteristics of a construct.



can conceptualize our constructs into measurable variables. **Conceptualization** of constructs is the process of breaking down our constructs into smaller pieces and clarifying those pieces so we know the precise meaning of each. Conceptualization of constructs is the first step toward operationalizing them. Operationalization applies to the concrete measurable variables of one specific construct whereas conceptualization applies to the breakdown of constructs into smaller pieces. Once we have these smaller pieces, we can then operationalize them or turn them into specific variables.

Say your topic of interest, or construct, is self-esteem. As we've discussed, constructs are general or abstract terms that are not straightforward to measure and are often understood differently by different people. If you want to operationalize self-esteem, you must figure out a way to measure it other than asking people to rate their own self-esteem. You will need to ask yourself: "How do I measure self-esteem? What type of questions should I ask my participants to get a sense of their self-esteem?"

So what is self-esteem? Dictionary.com states that self-esteem is a "favorable impression of oneself or self-respect." Great! This means that by asking people what they think of themselves, you should get a pretty good idea about their self-esteem. But would you? Or would you be measuring their *perception* of their self-esteem? Would this be an objective measure of their self-esteem or simply the participants' subjective perspectives on their self-esteem? So how do you find an objective measure of self-esteem?

The definition of *self-esteem* provided earlier indicates that a favorable impression of oneself is what self-esteem is all about. A favorable impression may be expressed in terms of how much one likes oneself—likability. A favorable impression may also mean how important a person feels—worthiness. We can also turn the question around and think about the negative feelings one might have about oneself—the opposite of self-esteem, feeling like a failure.

Let's say you plan to read people three statements and ask them to choose an answer from the following: Do they (1) strongly agree, (2) agree, (3) disagree, or (4) strongly disagree?

Their answers to these three statements should give you a good idea about people's self-esteem, measuring both positive feelings and negative ones.

Something to keep in mind especially for popular constructs such as self-esteem, is that many researchers have conducted myriad studies on the topic. What that implies, for us as novice researchers, is that researchers have already designed many measures for these constructs. These measures have been widely tested in various studies and are therefore likely quite accurate. More often than not, we are not required to reinvent the wheel but can utilize available measures for constructs that are widely researched.

This is a simple example of operationalizing your construct of self-esteem into three variables. The answers that you would get for each question are your variables. Continuing with this example, let's say that we are trying to figure out whether self-esteem varies by gender. That means we also need to operationalize gender by adding it to our questionnaire:

A. I think I am bright and have a number of valuable skills and qualities.

B. Most days, I like myself very much.

C. Most days, I feel like a failure and want to hide from people.

D. Select your gender: (1) female, (2) male, (3) other.

For the sake of illustration, let's say we gathered data from 40 students—half were women, and half were men. Table 2.1 shows the results.

Although you may feel that now we are ready to analyze the information, there are some additional aspects we need to consider and define first. We need to consider ethics of data collection as well as be clear on what type of variables we are using to measure our constructs.

TABLE 2.1 ■ Self-Esteem Data

ID	A. Worth	B. Likability	C. Failure	D. Gender
001	1	1	4	1
002	2	1	4	1
003	2	1	4	1
004	2	2	4	1
005	1	1	3	1
006	3	3	2	1
007	1	2	3	1
008	3	1	4	1
009	1	1	3	1
010	2	1	3	1
011	2	1	4	1
012	2	1	3	1
013	1	2	4	1
014	1	2	4	1
015	3	2	2	1
016	1	1	4	1
017	1	1	4	1
018	2	1	4	1
019	2	1	3	1
020	1	2	3	1
021	3	2	2	2
022	4	3	2	2
023	4	3	2	2
024	4	3	1	2
025	3	2	1	2

(*Continued*)

TABLE 2.1 ■ Self-Esteem Data (*Continued*)

ID	A. Worth	B. Likability	C. Failure	D. Gender
026	3	3	1	2
027	2	2	2	2
028	2	2	2	2
029	3	3	2	2
030	2	1	2	2
031	1	1	2	2
032	3	3	2	2
033	4	3	1	2
034	4	4	1	2
035	4	4	2	2
036	3	4	2	2
037	2	2	1	2
038	3	3	2	2
039	4	3	2	2
040	1	1	1	2

ETHICAL CONSIDERATION 2.1 OPERATIONALIZING CONSTRUCTS

The ethical rules of research must be considered when operationalizing constructs into variables. Questions need to be formulated in a way that will not cause harm to participants. We need to be sensitive and consider how the participant will feel about our questions. For example, if we are asking trauma survivors to relive their pasts and tell us how they felt, we may cause them emotional and psychological distress. This may be an obvious example, but some are more subtly discriminatory. For example, asking someone "Is language a barrier for you when you see a doctor?" holds the assumption not only that the participant speaks a different language, but also that the language one speaks can be a barrier. Imagine if you were to ask that question of someone who had never even considered that speaking a different language is a form of barrier. Maybe a better way to understand the role of a second language in interactions with a doctor is to simply ask participants to talk about their interactions with doctors and probe with additional questions if you see fit.

Sometimes, we may not be able to avoid negative feelings among participants because of the study's focus. In such cases, we need to inform participants at the beginning of the study that the questions may trigger psychological and emotional distress and remind them that taking part in the study is voluntary and they can stop at any time.

TYPES OF VARIABLES

A variable a piece of information that is collected from most if not all participants in your study. Take a look at Table 2.1 where we collected data on self-esteem. Each column represents one variable. You can see that the likability variable collects information from all the participants about how much they seem to like themselves. Gender is another variable in this small data set, recording information about the gender of all participants. Now that we have a broad definition of what a variable is, let us consider some categories of variables.

Independent and Dependent Variables

Our research inquiry was to find out if gender influences a person's self-esteem. Using this research question, we can identify two important types of variables: independent and dependent variables. The **independent variable** is the explanatory or predicting variable that explains the variation in self-esteem—in this case, gender. It predicts the variation in the dependent variable and is often a constant, meaning it doesn't change for the participant. The **dependent variable** is the outcome, or the surprise variable—what we want to find out from a specific study—the one we hope is influenced by the independent variable. In our study, all three variables that measure self-esteem (worth, likability, and failure) are our dependent variables.

Note that the independent and dependent variables are unique for each study, so the same variable can be a dependent variable in one study and an independent variable in another study—it depends on the formulation of the research question. For example, if we were to ask a research question to determine whether the amount of makeup people wear relates to their self-esteem, our independent variable would be the amount of makeup worn, and our dependent variable would be the measure of self-esteem. But if our research question was trying to determine whether self-esteem relates to the amount of makeup people wear, our independent variable would be the measure of self-esteem, and our dependent variable would be the amount of makeup worn.

Control Variables

Going back to Table 2.1, notice that each variable has different values, because some people answered *agree*, some *disagree*, and so on. However, we have little additional information about these participants. It would be helpful to know each participant's age, family income level, parents' marital status, or anything else that may influence their self-esteem. For example, a participant with a higher income level may also feel a higher level of worth compared to people with a lower level of income. If we did not measure the variable of income and looked only at the data as they are, we may have concluded that gender is related to self-esteem when, in fact, if we had considered the variable of income—if we had *controlled* for income—we might have had a different outcome. When we control for something in research, we are simply saying that we have taken into consideration the possibility that a specific variable had an influence on the outcome. To put this in the context of the earlier example, if we say that even after controlling for income, gender still had an association with levels of self-esteem, we are saying that for people with the same level of income, gender was associated with self-esteem. Any variables that we use to

control our results are called **control variables**. Control variables are not directly related to the focus of the study, but are crucial for understanding the relationship between the variables of our focus.

Control variables help to minimize biases and provide more accurate findings. For example, say that all the boys but few of the girls in the study came from single-parent families or families with low socioeconomic status and you neglected to control for either of these by asking about parents' marital status and family income. Based on your data, the girls have higher self-esteem than the boys. This statement, however, would be far from accurate because you did not control for the variables of socioeconomic status and parents' marital status. The participants' self-esteem may be related not to being male or female, but instead to their family background and the way they were raised. Therefore, controlling for other variables can become quite important.

Control variables are as important as the independent and dependent variables. If you were to collect data only on gender and self-esteem, anyone could dispute your findings by raising valid questions: (a) What if all the girls in your study were very good students whereas all the boys were poor students? Maybe that is the reason their self-esteem is so different. (b) Sometimes children who are raised by single parents have low self-esteem. What if most of the boys in your study were coming from single-parent families? (c) Did you control for their socioeconomic status? Maybe most girls came from a higher socioeconomic status, which could boost their self-esteem compared to boys. You get the idea, right? Therefore, in addition to collecting information on your independent and dependent variables, you will need to collect information on the control variables for other characteristics that could potentially complicate your findings and devalue them.

RESEARCH WORKSHOP 2.2 HOW TO IDENTIFY CONTROL VARIABLES

Control variables are just about any variable out there that can manipulate your variables of interest and as a result manipulate your findings in undesirable ways. Although there are some common control variables that may influence just about any study of society, there are some other control variables that may require a little bit more thinking. Widely used control variables include income, gender, education level, nativity, and race and ethnicity. The less common control variables are specific to your study and harder to identify. For one study religiosity may be of importance, but for another study marital status may be crucial to control for. Here are some sample questions to ask about your own study that may help you identify possible control variables:

1. What could possibly influence your independent or dependent variables?
2. What could possibly influence the relationship between the independent and dependent variables? It may be helpful to think of cases that are contrary to what you believe—how are these cases different? Are there some characteristics that these cases have in common? That may be a control variable for you to consider.
3. Ask friends and family about your study without telling them everything about your study; just ask for their understanding of what you are trying to do. Most people will share what they know about the topic and will also provide hints about control variables you may not have considered.

4. Look at the research articles in scientific journals on the same topic. Most studies will make it clear in their methodology section how many variables they controlled for and list these variables. This is undeniably the best source for you to start with in preparing a good list of control variables.

Confounding and Disturbance Variables

There are other variables that you may not be able to control for that could potentially ruin your findings, which fall into one of two categories: confounding (or intervening) variables and disturbance (or extraneous) variables. **Confounding variables** influence the independent variable in such a way that the results from the dependent variable become untrustworthy.

We can try to protect our study from confounding variables, but it may not always be as clear. These variables could not have been controlled for or predicted during the study's design. They only become apparent during data collection or later during analysis. Controlling variables are the ones we are able to predict before we collect data. Confounding variables are the ones that we did not think would possibly interfere with our study.

Let's say you want to study the influence of Facebook participation on socialization. You collect data from 40 people on how often they log into their Facebook account and how often they post a status update or a picture. You also ask these people about how often they meet a friend or acquaintance for coffee or lunch. Your results seem to show that there is little, if any, effect on socialization from people who seem to be active on their Facebook accounts. Then it dawns on you that everyone who participated in your survey was single. They were probably going on coffee or lunch dates. The information on their marital status—the confounding variable—has influenced your independent variable and, ultimately, your results for the dependent variable.

The other problematic type of variable is the **disturbance variable**, which lurks in the background and disturbs the findings of our dependent variable. Disturbance variables are certain common characteristics of our participants that are misleading the findings of our study without our awareness. Although we call them variables because they include common features of participants, most often we have not collected the information on these variables and are not even aware of their existence. Sometimes, disturbance variables become apparent to the researcher, but at other times they may never be identified. Disturbance variables are not directly related to the independent variable. Unfortunately, these variables may be out of our control when we conduct a study. We could simply be unaware of them entirely.

Recall the researcher from Chapter 1 who was trying to find out whether people who frequented a specific bakery were also likely to have gained weight during the last year. The study saw some relationship between eating cheesecake and gaining weight, but the relationship was weak. It almost looked like it didn't matter much how cake a participant ate per day. The researcher had not anticipated the fact that the bakery was next to a breastfeeding center, and the majority of women frequenting the bakery were mothers who had just delivered a baby. Breastfeeding is related to weight loss in women. The fact that these women just gave birth is the extraneous variable that could have potentially changed the results of the study.

Moderators and Mediators

There are two additional important types of variables you will likely encounter in your research: moderators and mediators. **Moderators** are variables that can strengthen or weaken an already established relationship between the independent and dependent variables. They are powerful enough to make a relationship seem weaker or stronger than the relationship is on its own. But the relationship between the two main variables still exists.

Let's assume that we want to investigate the relationship between alcohol consumption and liver damage. The amount of alcohol consumed daily would be our independent variable, and liver deterioration would be our dependent variable. The value of our dependent variable in this example would be determined by tests that measure the levels of specific enzymes and proteins in the liver.

After conducting this study, we find out that there is a direct relationship between the amount of alcohol consumed daily and liver damage. But we also see that this relationship is much stronger for women than men. Furthermore, the relationship is weaker for people who have less body fat and exercise regularly. Although the relationship between alcohol consumption and liver damage is always clear, it seems to be stronger or weaker depending on these two other variables. Therefore, gender and weight are our moderating variables, because they moderate the strength of the main relationship in our study. So if you are male, you are in very good shape, and you exercise regularly, you can binge drink and not have liver problems—is that what we are saying? Well . . . not really. The relationship between alcohol and liver problems is still present, just weaker in this case.

Mediators are intervening variables that interfere with the relationship between the main variables. When a mediator is present, the relationship between the independent and dependent variables may not even exist anymore. Mediators are strong enough to completely destroy a relationship between the main variables. Therefore, they are extremely important to consider when we design our study.

Confounding variables often act as mediators because they are powerful enough to radically change the relationship between the independent and dependent variables. For example, there is a well-known relationship between the amount of time students study and their grades; the more hours students read and prepare for classes, the better their grades. Imagine that we surveyed 100 students about the amount of work they put in and their grades and found that the amount of work they reported had no relationship to their grades. What could have happened?

What if, prior to conducting the study, we had met with the school director and explained our student survey? The director misunderstood our study and thought that the amount of time students spent working was a reflection of the teaching at this school. Therefore, this director was active in prepping students over an entire week so they would report a much higher number of hours as their study time. The instructions and prepping given from the director is our mediating variable that ruined the relationship we were measuring. Although this is a hypothetical example, similar cases happen all the time, so we need to make sure that there are no extraneous variables interfering with our work.

TYPES OF HYPOTHESES

Now that you have identified a research question, you have operationalized it, and you have a clear understanding of independent, dependent, control, confounding, and disturbance variables, it is time to take a deep breath before moving ahead. The time has come to think about whether you have a hypothesis that answers your research question or if you have a vague idea of what your answers could be.

Say that you would like to study eating disorders in young women. If you believe that eating disorders are related to or influenced by the media's portrayal of female bodies, you may guess that women who watch more television are more likely to have some form of eating disorder. If this is the case, then you are hinting toward a hypothesis. A **hypothesis** is a statement that predicts a specific phenomenon or behavior. In other words, a hypothesis makes a prediction about how people will respond to your research question. A hypothesis is usually present in a quantitative study, but never present in a qualitative one. It can even go further in determining exactly how you expect the variables to behave after you have collected your data. Using a hypothesis, we offer an answer to our research question. For example, if we were to assert that television watching is associated with women's self-esteem, we would be stating a hypothesis. But we can go further and predict how the variables will behave by speculating that more hours of television watching are associated with lower self-esteem in women.

Alternative Hypothesis and Null Hypothesis

A hypothesis may seem like a guess as to what our results will be once we have measured all the variables, but it is more of a prediction that we need to test through statistical analysis. Rather than calling it just a hypothesis, we refer to it as an **alternative hypothesis**. An alternative hypothesis is therefore our prediction—based on the literature and theory—about what our testing results will be. In more specific terms, the alternative hypothesis states exactly how we expect the variables will look once we have collected the data. This hypothesis predicts the type of relationship between variables and even what may happen to one variable if another variable increases or decreases in value. A study can have more than one alternative hypothesis, and for each one, we will have one null hypothesis. The **null hypothesis** claims that there is no relationship between the variables of interest in our study. So how does that work? Let's say that you are interested in finding out whether listening to music is related to sport performance for college-age student athletes. (*Note:* H_n is the notation for any alternative hypothesis and can take different numbers, like H_1, H_2, H_3, and so on. The null hypothesis is always expressed by H_0.) Your hypotheses are the following:

H_1: Athletes who listen to music for 4 hours or more per day perform better than athletes who listen to music for 4 hours or less per day.

H_2: Athletes who listen to jazz for 4 hours or more per day perform worse than athletes who listen to classical music for 4 hours or more per day.

H_0: Music listening and sport performance are not related to each other for college-age student athletes.

Now, if the alternative hypotheses are meant to predict a relationship between variables you are exploring, the null hypothesis always states that there is no relationship between variables under investigation. The null hypothesis is crucial to any research study because *this is the hypothesis we are actually testing with our findings.* By collecting and analyzing data, we attempt to reject the null hypothesis. (We attempt to falsify, remember?) Therefore, since we are attempting to falsify the null hypothesis, we have only two options: (1) reject the null hypothesis in favor of our alternative hypothesis, or (2) fail to reject the null hypothesis.

RESEARCH IN ACTION 2.1 ILLUSTRATION OF OPERATIONALIZATION OF CONCEPTS

The following article provides an illustration on how concepts are operationalized, as well as how we create and formulate research questions and null hypotheses. The study is focused on how self-concepts and academic achievements are influenced by gender stereotypes of young students in secondary schools.

Source: Igbo, J. N., Onu, V. C., & Obiyo, N. O. (2015). Impact of gender stereotype on secondary school students' self-concept and academic achievement. *SAGE Open*, *5*(1), 1–10. http://journals.sagepub.com/doi/abs/10.1177/2158244015573934. CC BY 3.0 https://creativecommons.org/licenses/by/3.0/.

Study Excerpt

The major purpose of the study is to investigate the influence of gender stereotype on students' self-concept and academic achievement in senior secondary schools.

COMMENT:

From the purpose, we can identify the major constructs: (1) gender stereotypes, (2) self-concept, and (3) academic achievements. These concepts are further operationalized into variables. Note that the study is looking for a specific group of students (seniors in secondary schools), and it will also consider the location of the school.

The following research questions guided the study:

- **Research Question 1:** What is the influence of gender stereotype on senior secondary school students' self-concept?

COMMENT:

First, the study will look at the effects of gender stereotypes on students' self-concept.

- **Research Question 2:** What is the influence of gender stereotype on senior secondary school students' academic achievement?

COMMENT:

Second, it will investigate the association between gender stereotypes and academic achievement.

- **Research Question 3:** What is the influence of school location on senior secondary school students' self-concept?

  COMMENT:

  Third, it will consider the effect of the school's location on students' self-concept.

- **Research Question 4:** What is the influence of school location on senior secondary school students' academic achievement?

  COMMENT:

  Fourth, it will also investigate the effect of the school's location on students' academic achievement.

The following null hypotheses were tested at the .05 level of significance:

- **Null Hypothesis** 1 **(H_1):** Gender stereotype has no significant influence on self-concept of senior secondary school students.
- **Null Hypothesis** 2 **(H_2):** Gender stereotype has no significant influence on academic achievement of senior secondary school students.
- **Null Hypothesis** 3 **(H_3):** Location has no significant influence on self-concept of senior secondary school students.
- **Null Hypothesis** 4 **(H_4):** Location has no significant influence on academic achievement of senior secondary school students.

COMMENT:

The null hypotheses all state that there is no relationship between variables.

Note that for every research question, there is a null hypothesis to be tested. In this study, we see research questions, but these could have been formulated as alternative hypotheses as well. The researchers have kept them as research questions because they are nondirectional hypotheses. They are not making assumptions on how the variables will behave after the data are collected.

You are probably asking why we have two negatives in one sentence. Can't we just accept the null hypothesis? Wouldn't that be easier for everyone? We can *never* accept the null hypothesis, because our goal is to refute it. We are trying to build new knowledge, and to do so, we need to test the null hypothesis with the aim of rejecting it. If we fail to do so, we are simply failing to reject the null hypothesis—we are *not* accepting it as valid. To accept the null hypothesis, we would need to test its veracity, and that is a different research project.

Directional Hypothesis and Nondirectional Hypothesis

In other words, in a study, we are trying to determine if there is a relationship between two or more variables. To do so, we attempt to test and reject the null hypothesis, which basically states that no such relationship exists. When we prepare our alternative or competing hypothesis, we

can choose a directional or nondirectional hypothesis. A **directional hypothesis** will predict a specific course for your variables. For example, if your hypothesis states that younger people are more empathic toward endangered animals, you are stating a directional hypothesis because you are predicting your results will show that the younger someone's age, the more empathy the person will show toward endangered animals. There is more to this hypothesis than claims about the existence of a relationship between age and empathy toward endangered animals—you are giving this hypothesis a direction (i.e., the younger a person is, the more empathic one will be).

A **nondirectional hypothesis**, on the other hand, has no direction, but simply predicts a relationship between two or more variables. Often, nondirectional hypotheses are expressed in the form of a research question because researchers are not making any assumption on how the variables will behave, but are investigating the possible relationship between variables. For example, if you say that perceptions of rape are different between girls and boys, you are not specifying how this difference is happening. You are simply saying that boys perceive rape differently than girls do; there is no clear direction about this difference, which makes it a nondirectional hypothesis.

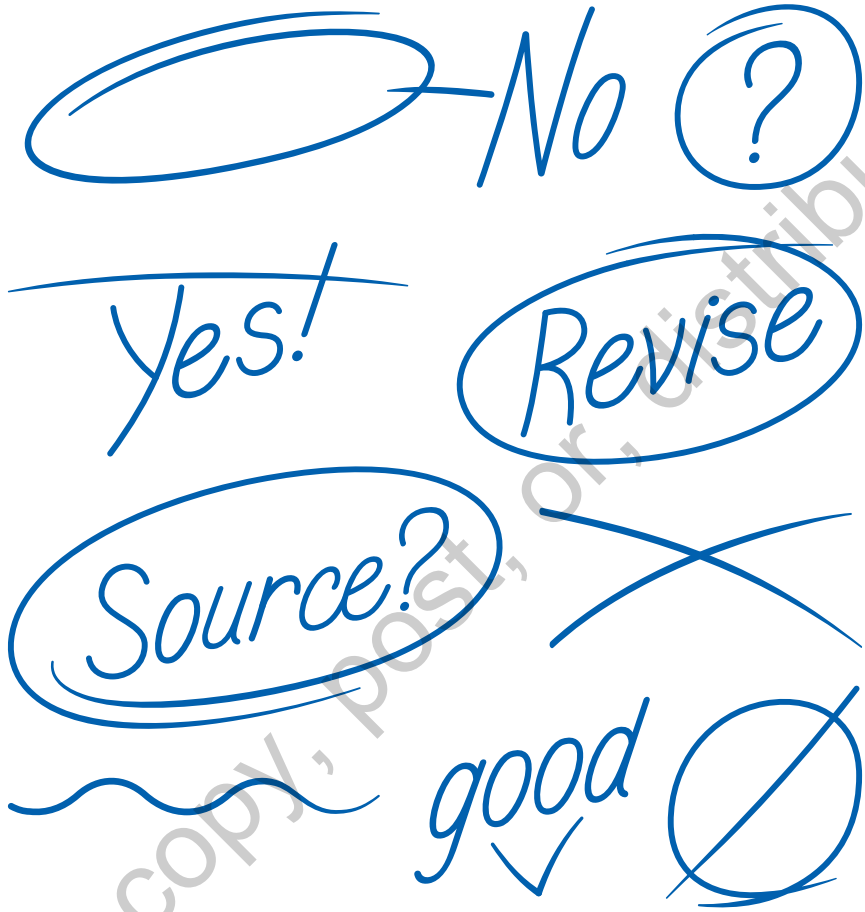
Open-Ended Question

Last, but not least, you may not have any prediction about how the variables will behave and whether they are related or not. In fact, maybe you don't even have variables, but rather you have a few constructs and a lot of curiosity about your topic. Then you may be heading toward a qualitative study rather than a quantitative one. It is important to bring the difference between these two types of designs forward. In a qualitative design, we have constructs, but we are not attempting to measure them. In fact, we do not have any variables or hypothesis. We are trying to capture information through words and definitions. A qualitative study asks different types of research questions and demands a different methodology to collect data. Open-ended questions in a survey are exploratory in nature. If you are asking "How do people react to a chaotic situation?" that is an open-ended question that will only reveal its answers by collecting more information from the people you are studying. In a quantitative study, we often see these open-ended questions throughout the survey. That does not mean that the study is qualitative. That simply means that the researcher will look at those qualitative open-ended answers separately from the quantitative answers. Those will be grouped together based on certain characteristics identified by the researcher (e.g., one may want to look at answers of women separately from those of men) and then be explored by qualitative means. More on the topic of qualitative design and analysis can be found in Chapters 11 and 12. For now, it is important to emphasize that variables and hypotheses are all housed under the quantitative design umbrella.

VISUALIZING A RESEARCH QUESTION

Once everything connected to your planned study has started to make a little sense, the best thing to do is to put everything on paper. And I mean visually (see Figure 2.4). Get a piece of paper and visualize your research question in a simple drawing. Your constructs could be circles,

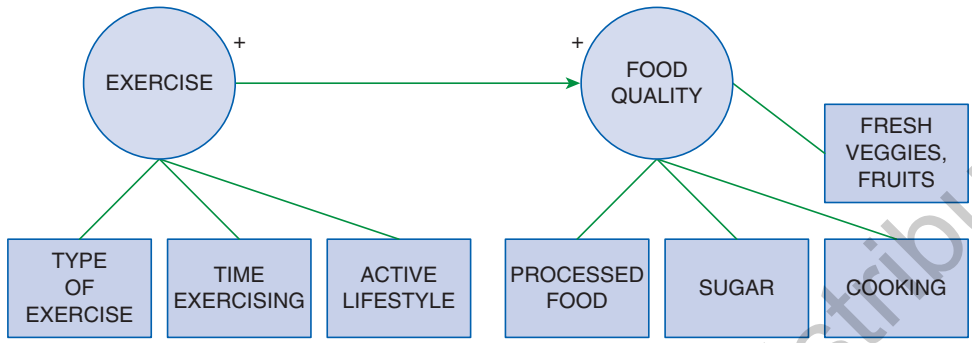
FIGURE 2.4 ■ Never underestimate the power of writing thoughts and ideas down on paper, even when you are certain that they will change again. Once written down, they become alive and explore further possibilities.



and your variable could be rectangles. Make sure you think about controlling variables. If you are assuming or expecting a specific change to occur for your dependent variable as a result of changes to the independent variable, show this relationship with an arrow that goes from the independent variable to the dependent one. If you have a directional hypothesis in mind, use + for increasing and – for decreasing to show how you expect the change to happen.

Let's go through an example, visualized in Figure 2.5. A researcher is thinking that when people exercise a lot, they are also likely to be eating healthy food. In other words, the more one exercises, the healthier food choices this person makes. This is a directional hypothesis because it predicts a specific course. Now, how does one express this visually? There are two big constructs here: (1) exercise and (2) quality of food. First, we draw two circles, one for exercise and one for healthy food. In terms of variables, we are saying that the more we have from the first circle (exercise), the more we will have from the second circle (food quality). Let's connect the

FIGURE 2.5 ■ The Relationship Between Constructs and the Breakdown of Constructs



circles with an arrow that goes from exercise to food quality and put a + in the corner of each circle, indicating the direction of our hypothesis.

Let's take the first construct, exercise. How do we define exercise? Maybe you would classify exercise as a type of physical activity. Does the specific type of activity matter? Are we thinking of cardio or muscle building? It is better to have more variables, so let's keep this question in mind to ask our participants: What type of physical activity do you engage in? Then we need to find out the amount of exercise, because we are hypothesizing that the more physical activity one does, the more likely one is to eat healthy foods. The amount of time one spends running, rowing, doing yoga, or walking is crucial. Therefore, we should ask: How many hours do you exercise per day? But wait a minute—shouldn't we ask if they exercise daily first? Yes! Our question is: How often do you exercise? Our multiple choices will have all the options (i.e., *daily*, *biweekly*, *weekly*, *rarely*, *never*). We could have the option that if people answer *daily*, they are asked how many hours per day.

Exercise is often determined by going to a gym and performing some form of activity. What about people who live in cities and walk or bike to work every day, walk up the stairs many times per day, or have jobs that involve carrying things, standing, or walking for hours? We may need to include another question that asks people whether they do physical activity as part of their daily routine.

Moving to the second construct, that of quality of food, we encounter a common problem in this type of research. What is considered good-quality food? This is a difficult question that is likely answered differently by different people. This is where investigating the literature comes in handy. If you haven't read the literature yet, you can still modify your model after you explore the research in this area. It usually helps to start from a tangible point and then modify it. You may be thinking that frozen dinners are not a healthy choice, along with sugar, chips, and soda. Returning to our model, how can we find out about our participants' eating habits? Perhaps you could make two lists of food that you identify as healthy and unhealthy and ask people to report how often they eat each product. Asking if they cook or not could be an additional good question.

Now, we have created some idea of what our model looks like and how we may operationalize our constructs. We will modify this model, but we needed a starting point. Finally, we need to add our controlling variables. What could influence the relationship we have stated between amount of exercise and eating healthy food? Generally speaking, what could make someone eat healthily or unhealthily regardless of exercise? Could gender make a difference? Could girls be more health-oriented than boys or vice versa? Let's control for gender. What else? People who work may have less time on their hands and opt for ready-made dinners or fast food. So we need to ask them if they are working or studying full-time or part-time. We also need to have an idea of their income. People with higher incomes may be able to afford better-quality food compared to people who may not have access to organic or fresh food options. Our little graph of the constructs and variables is now ready and looks cool! Save this piece of paper (or file) because we will return to it once we have explored the literature and theories on the topic in which we are interested.

SUMMARY

This chapter introduced the concepts of fundamental and applied research. We consider fundamental research those broad theories that attempt to explain how life works and can be applied to many different things rather than one specific problem. Applied research refers to studies that investigate one particular issue or problem. Once we have a topic of interest and have expressed this topic in the form of a question or a simple sentence, we are ready to operationalize our research. Operationalization means identifying the constructs of the study and expressing them in variables. Constructs are broad or general terms that cannot be measured straightforwardly but need to be broken down to simpler measurements. Variables are simple, specific measures of one characteristic. A construct can have one variable or many variables.

There are a few types of variables. Some basic variables are independent and dependent variables. An independent variable attempts to predict the changes in the dependent variable. A dependent variable changes, or we expect it to change, as a result of the presence of the independent variable. Besides the main types of variables in our study, we include other variables to make sure that our results are appropriate. Control variables, for example, are often not related to the main focus of the study, but they can influence the independent and dependent variables. To avoid biases and aim for higher accuracy in our work, we measure additional control variables.

Confounding variables may influence the independent variable and question the findings of our study. In our attempt to protect the study from confounding variables, we look out for possible variables that may influence our results. Disturbance variables are more difficult to distinguish and control for during the design stage. These are variables that are not related to the independent variable, but they can potentially create a problem for the dependent variable, leading us to false results.

Moderators and mediators can also influence the independent and dependent variables. Moderators are variables that can strengthen or weaken a relationship between the independent and dependent variables. These are powerful variables that can make results stronger or weaker, but the relationship between the main variables is still present. Mediators are even stronger. Mediators can cause the relationship between the independent and dependent variables to completely disappear.

This chapter also discussed the concept of hypothesis and its types. A hypothesis is a statement that predicts the relationship between variables. Some hypotheses have a direction and make specific predictions about how the variables will change. These are called directional hypotheses. Other types of hypotheses do not make specific assumptions about how the change in variables will be reflected—they just state the possibility of an association between variables. These are called nondirectional hypotheses or simply research questions, if stated in the form of a question.

Another categorization of hypotheses divides them into alternative and null. Alternative hypotheses are statements that predict some form of relationship between variables, either directional or nondirectional. Null hypotheses are the statements that claim no relationship between variables. Null hypotheses are the hypotheses we test in the study. Even though it seems like we are trying to prove the alternative hypotheses, we are in fact simply testing the null hypotheses or the possibility that there is no relationship between variables.

KEY TERMS

Alternative hypothesis (p. 37)
Applied research (p. 25)
Conceptualization (p. 30)
Confounding (intervening) variable (p. 35)
Construct (p. 25)
Control variable (p. 34)
Dependent variable (p. 33)
Directional hypothesis (p. 40)
Disturbance (extraneous) variable (p. 35)
Fundamental research (p. 24)
Hypothesis (p. 37)
Independent variable (p. 33)
Mediator (p. 36)
Moderator (p. 36)
Nondirectional hypothesis (p. 40)
Null hypothesis (p. 37)
Operationalization (p. 29)
Variable (p. 29)

TAKING A STEP FURTHER

1. Find the dependent and independent variables in these examples:
   - **a.** A researcher is focused on how sleep (measured in hours) influences academic performance (measured in grade point average).
   - **b.** A researcher wants to find whether academic performance (measured in grade point average) influences self-esteem (measured on a scale from 1 to 10).

c. A researcher is studying the influence of television watching (measured in hours) on speech onset of toddlers (measured in number of words spoken by age 2 years).

d. A researcher is attempting to see whether self-esteem (measured on a scale from 1 to 10) relates to and/or influences substance abuse (measured in frequency of substance use and abuse) among adolescents.

e. A researcher is interested in understanding whether exposure to a large variety of food (measured in the number of different food textures and food types) influences the level of pickiness among children younger than 6 years old (measured on a scale from 1 to 10).

2. What is the difference between the null and alternative hypotheses?

3. What is the purpose of the null hypothesis?

4. How can we distinguish between disturbance and confounding variables? Illustrate with an example.

5. What are some ways to operationalize constructs such as *sleep*, *time*, and *anxiety*?

6. What is the purpose of having a direction when we design an alternative hypothesis? What do directional and nondirectional hypotheses tell us?