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Quantitative, Qualitative, and Mixed Research

LEARNING OBJECTIVES

To be able to

- Describe the characteristics of quantitative research.
- List and explain the different types of variables used in quantitative research.
- Explain the difference between experimental and nonexperimental quantitative research.
- Explain the idea of a correlation coefficient.
- Describe the characteristics of qualitative research.
- List and explain the differences among the different types of qualitative research introduced in this chapter.
- Describe the characteristics of mixed research.
- List and explain the differences among the different types of mixed research introduced in this chapter.

This chapter is about the three major research paradigms in educational research. Each of these paradigms tends to bring a slightly different view or perspective on what we study. It seems appropriate to start this chapter with an age-old poem (written by the Persian poet/philosopher Rumi) that tells us that different perspectives can all have truth value and that when we put those perspectives together, we can come away with a fuller picture of what we are studying. We use the poem to support our view of the importance of using all three major research paradigms in educational research.

*Elephant in the Dark**

Some Hindus have an elephant to show.
No one here has ever seen an elephant.
They bring it at night to a dark room.
One by one, we go in the dark and come out
saying how we experience the animal.
One of us happens to touch the trunk.
“A water-pipe kind of creature.”
Another, the ear. “A very strong, always moving
back and forth, fan-animal.”
Another, the leg. “I find it still,
like a column on a temple.”
Another touches the curved back.
“A leathery throne.”
Another, the cleverest, feels the tusk.
“A rounded sword made of porcelain.”
He’s proud of his description.
Each of us touches one place
and understands the whole in that way.
The palm and the fingers feeling in the dark are
how the senses explore the reality of the elephant.
If each of us held a candle there,
and if we went in together,
we could see it.

*From: Jelaluddin Rumi, *The Essential Rumi*. Trans. & Ed. by Coleman Barks. San Francisco, Castle Books, 1995. p. 252.

A research paradigm is a perspective based on a set of assumptions, concepts, values, and practices that are held by a community of researchers. More simply, it is an approach to thinking about and doing research. In this chapter we introduce you to the three major educational research paradigms or approaches: *quantitative research*, *qualitative research*, and

- **Research paradigm**
A perspective based on a set of assumptions, concepts, and values that are held by a community of researchers

mixed research. Quantitative research was the generally accepted paradigm in educational research until the early 1980s, when the “paradigm wars” between advocates of quantitative and qualitative research reached a new peak (Guba, 1990; Tashakkori & Teddlie, 1998). During the 1980s, quantitative and qualitative research purists both argued that their approach was superior and that the other approach should not be used together because of differences in the worldviews or philosophies associated with the two approaches. This either-or position (i.e., one should use quantitative or qualitative research but not both) is called the **incompatibility thesis**.

Starting in the 1990s, many researchers rejected the incompatibility thesis and started advocating the pragmatic position that says that both quantitative and qualitative research are very important and often should be mixed in single research studies. According to **pragmatism**, what is important is not abstract philosophy but what works in practice. Although mixed research is still the “new kid on the block,” the list of researchers advocating this approach is increasing rapidly.

The three research approaches can be viewed as falling on a research continuum with qualitative research on the left side, quantitative research on the right side, and mixed research in the center of the continuum. In other words, research may be relatively quantitative, relatively qualitative, or mixed. We start our discussion by comparing the characteristics and tenets of the three major research paradigms in their pure forms. Later in the chapter, we will introduce you to some ideas and terminology associated with each of the three research paradigms.

Incompatibility thesis

The proposition that one cannot mix quantitative and qualitative research

Pragmatism

Philosophical position that what works is what is important



pragmatism

Quantitative research

Research that relies primarily on the collection of quantitative data

Qualitative research

Research that relies primarily on the collection of qualitative data

Mixed research

Research that involves the mixing of quantitative and qualitative methods or paradigm characteristics

CHARACTERISTICS OF THE THREE RESEARCH PARADIGMS

Pure **quantitative research** relies on the collection of quantitative data (i.e., numerical data) and follows the other characteristics of the quantitative research paradigm shown in Table 2.1. Pure **qualitative research** relies on the collection of qualitative data (i.e., nonnumerical data such as words and pictures) and follows the other characteristics of the qualitative research paradigm shown in Table 2.1. **Mixed research** involves the mixing of quantitative and qualitative research methods, approaches, or paradigm characteristics. The exact mixture that is considered appropriate will depend on the research questions and the situational and practical issues facing a researcher. All three research approaches can provide insights as we attempt to solve the problems facing us in the field of education. Take a moment now to examine Table 2.1, and then read the following discussion of the key differences between the three research approaches.

First, the quantitative research approach focuses on the deductive component of the scientific method (discussed in Chapter 1) because the focus is generally on hypothesis testing and theory testing. Quantitative research is also sometimes said to be *confirmatory* because researchers test or attempt to confirm their hypotheses. On the other hand, qualitative research relies more on the inductive component of the scientific method and is used to come up with or generate new hypotheses and theories. Qualitative research is often exploratory; that is, it is often used when little is known about a certain topic or when an inductive approach is deemed more appropriate to learn more about a topic.

Most researchers probably take a mixed approach to the inductive-deductive distinction because at some point in the research process, most researchers will use both induction

■ **TABLE 2.1** Emphases of Quantitative, Mixed, and Qualitative Research

	Quantitative Research	Mixed Research	Qualitative Research
Scientific method	Deductive or “top-down” The researcher tests hypotheses and theory with data	Deductive and inductive	Inductive or “bottom-up” The researcher generates new hypotheses and grounded theory from data collected during fieldwork
View of human behavior	Behavior is regular and predictable	Behavior is somewhat predictable	Behavior is fluid, dynamic, situational, social, contextual, and personal
Most common research objectives	Description, explanation, and prediction	Multiple objectives	Description, exploration, and discovery
Focus	Narrow-angle lens, testing specific hypotheses	Multilens focus	Wide-angle and “deep-angle” lens, examining the breadth and depth of phenomena to learn more about them
Nature of observation	Attempt to study behavior under controlled conditions	Study behavior in more than one context or condition	Study behavior in natural environments Study the context in which behavior occurs
Nature of reality	Objective (different observers agree on what is observed)	Commonsense realism and pragmatic view of world (i.e., what works is what is “real” or true)	Subjective, personal, and socially constructed
Form of data collected	Collect quantitative data based on precise measurement using structured and validated data collection instruments (e.g., closed-ended items, rating scales, behavioral responses)	Multiple forms	Collect qualitative data (e.g., in-depth interviews, participant observation, field notes, and open-ended questions) The researcher is the primary data collection instrument
Nature of data	Variables	Mixture of variables, words, and images	Words, images, categories
Data analysis	Identify statistical relationships	Quantitative and qualitative	Search for patterns, themes, and holistic features
Results	Generalizable findings	Corroborated findings may generalize	Particularistic findings Representation of insider (i.e., “emic”) viewpoint Present multiple perspectives
Form of final report	Statistical report (e.g., with correlations, comparisons of means, and reporting of statistical significance of findings)	Eclectic and pragmatic	Narrative report with contextual description and direct quotations from research participants

and deduction. As the research wheel in Chapter 1 showed (see Figure 1.1), scientific reasoning is a cyclical process of induction and deduction. In quantitative research, hypotheses are typically deduced from a theory or currently available explanations, and the predicted observable outcomes are deduced from the hypotheses. Data are then collected to determine whether the hypotheses, and as a result the theory or explanation, are supported. However, it is common for unanticipated outcomes to appear in quantitative research findings. When this happens, quantitative researchers commonly enter the inductive mode of generating new or revised hypotheses and explanations, which will be put to the test during a future research study. Likewise, in qualitative research, after inductive hypotheses and a tentative theory have been generated from initial observations, the observable consequences of these are often deduced and then tested through additional observations. In short, stating that quantitative researchers follow the deductive method and qualitative researchers follow the inductive method is really a matter of emphasis, not exclusion. Mixed researchers explicitly state that they use both induction and deduction.

Quantitative and qualitative research are also distinguished by different views of human behavior. It is generally assumed in quantitative research that behavior is highly predictable. The assumption of **determinism** was traditionally made, which means that all events have a cause (Salmon, 1984). For example, the process by which children learn to read is determined by one or more causes. Likewise, there are causes for adolescents dropping out of school. Because quantitative research has not identified any unerring laws of human behavior, most contemporary quantitative researchers search for **probabilistic causes** (Humphreys, 1989). A probabilistic statement might go like this: "Adolescents who become involved with drugs and alcohol are more likely to drop out of high school than are adolescents who do not become involved with drugs and alcohol." The point is that most quantitative researchers try to identify cause-and-effect relationships that enable them to make probabilistic predictions and generalizations. On the other hand, qualitative researchers often focus on the fluid and dynamic dimensions of behavior. Behavior is seen to be more situational and context bound than generalizable. Different groups are said to construct different realities or perspectives, and the focus is on how patterns of behavior vary from group to group and from situation to situation.

These views about human behavior are not set in stone, however. For example, when taking a mixed mode approach, quantitative researchers might study the influence of context and the dynamic processes of behavior (e.g., social psychologists examine individuals as they interact and change their behaviors in social situations). Quantitative research also focuses on how results vary according to the characteristics of the participants (e.g., see the discussion of *moderator variables* later in this chapter). Similarly, when taking a mixed mode approach, qualitative researchers often try to develop explanations of behavior (theories) that sometimes include causal language, and they attempt to make generalizations. In short, many researchers, including researchers who predominantly operate in either the quantitative or the qualitative mode, cross over into the mixed research mode.

Quantitative research often uses a narrow-angle lens in the sense that only one or a few factors are studied at the same time. Often, through experimental control, researchers attempt to hold constant the factors that are not being studied. This is often accomplished under laboratory conditions, in which an experimenter randomly assigns participants to groups, manipulates only one factor, and then examines the outcome. For example, a re-

Determinism

All events have causes

Probabilistic causes

Causes that usually produce an outcome

searcher might first randomly assign research volunteers to two groups. Random assignment helps to achieve experimental control because it makes the two groups similar. Then the researcher might expose one group to a new teaching method and use the traditional lecture method on the other group. The researcher examines which teaching approach results in the most learning and attributes the difference to the teaching method received. The researcher is able to make a causal attribution because the two groups were similar at the start of the experiment and the only factor they differed on was which teaching method they received.

On the other hand, qualitative research uses a wide- and deep-angle lens, examining behavior as it occurs naturalistically in all of its detail. Qualitative researchers do not want to intervene in the natural flow of behavior because they believe that this intervention would change the behavior. Qualitative researchers study behavior holistically. They try to look at many dimensions and layers of behavior, such as the types of people in a group, how they interact, what kinds of agreements or norms they have, and how these dimensions come together to describe the group. For example, perhaps a qualitative researcher wants to study the social climate and culture of a highly successful school. The researcher would probably spend a great deal of time studying the many aspects and dimensions of the school to come up with an analysis of how the school operates and why it is successful. Depending on the research questions, a researcher who was using the mixed approach might spend part of his or her time in each of the different focus modes (including wide-, narrow-, and deep-angle focus).

Quantitative researchers attempt to operate under the assumption of objectivity. They assume that there is an external reality “out there” to be observed and that rational observers who look at the same phenomenon in the world will basically agree on its existence and its characteristics. They also try to remain as value-free as they can, and they attempt to avoid human bias whenever possible. In a sense, quantitative researchers attempt to study the phenomena that are of interest to them “from a distance.” For example, standardized questionnaires and other quantitative measuring tools are often used to measure carefully what is observed. In experiments, researchers frequently use a random process to assign participants to different groups to eliminate the possibility of human bias while constructing different groups for comparison. In judging results, statistical criteria are often used to form conclusions.

Qualitative researchers often contend that “reality is socially constructed” (e.g., Guba & Lincoln, 1989). An example of this viewpoint is the common belief that Eskimos see many types of snow, whereas the average American or European will probably only see a few types. The Eskimos’ experiences might allow them to see distinctions that you do not see. In terms of the importance of remaining objective during the collection of data, many qualitative researchers would agree with the quantitative researchers, but at the same time they also want to “get close” to their objects of study through participant observation so that they can experience for themselves the subjective dimensions of the phenomena they study. In qualitative research, the researcher is the instrument of data collection. Rather than using a standardized instrument or measuring device, the qualitative researcher must collect the data, ask the questions, and make the interpretations about what is observed. In addition, the researcher must try to understand the people he or she is observing from their viewpoint. This is the concept of “empathetic understanding” (what the famous sociologist Max Weber, writing in the early twentieth century, called *verstehen*): understanding something

from that person's viewpoint (Weber, 1968). This is similar to the familiar idea of putting yourself into someone else's shoes.

According to mixed method research, it is important to understand both the subjective and objective realities in the world. Although it is important not to influence or bias what you are observing, it is also important to get the insider's viewpoint. For example, if you were studying the culture of the snake-handling churches in the area where Alabama, Tennessee, and Georgia come together, it might be helpful to collect quantitative data by having the people fill out standardized instruments measuring their personality and demographic characteristics. It would also be helpful to collect qualitative data through in-depth personal interviews and observations of the members to gain a better understanding (from the insiders' perspectives) of the snake-handling culture. In short, the mixing of methods would add very useful and complementary information.

Quantitative research generally reduces measurement to numbers. In survey research, for example, attitudes are usually measured by using rating scales. The following five-point agreement scale is an example: (1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree, (5) Strongly Agree. The interviewer makes a statement, and the respondents reply with one of the five allowable response categories. After all respondents have been asked a question, the researcher typically calculates and reports an average for the group of respondents. Let us say, for example, that a researcher asks a group of teachers for their degree of agreement with the following statement: "Teachers need more training in the area of child psychopathology." The researcher might then calculate the average response for the whole group, which might be 4.15 based on a five-point scale. The researcher might also determine whether the ratings vary by years of teaching experience. Perhaps the average agreement for new teachers is 4.5 and the average for teachers with five or more years of experience is 3.9. As you might guess, quantitative data are usually analyzed by using statistical analysis programs on a computer.

On the other hand, qualitative researchers do not usually collect data in the form of numbers. Rather, they frequently conduct observations and in-depth interviews, and the data are usually in the form of words. For example, a qualitative researcher might conduct a focus group discussion with six or seven new teachers to discuss the adequacy of their undergraduate educational programs in preparing them to deal with real-world problems that they face in schools. The facilitator of the focus group would probably videotape the group and tape-record what was said. Later, the recording would be transcribed into words, which would then be analyzed by using the techniques of qualitative data analysis (see Chapter 17). Also, when a qualitative researcher enters the field and makes observations, the researcher will write down what he or she sees as well as relevant insights and thoughts. The data are again in the form of words. During qualitative data analysis, the researcher will try to identify categories that describe what happened as well as general themes appearing again and again in the data. The mixed research approach would use a variety of data collection and analysis approaches.

Finally, qualitative, mixed, and quantitative research reports tend to differ. Quantitative reports are commonly reported in journal articles ranging from five to fifteen pages. The reports will include many numbers and results of statistical significance testing (to be explained later). In contrast, qualitative research reports are generally longer, and they are written in narrative form, describing what was found and including interpretations to make

sense out of it. Qualitative journal articles are frequently twenty to thirty pages long, and the results of qualitative research are often published in the form of books or monographs rather than journal articles. Mixed research might follow the quantitative style or the qualitative style or, more frequently, might use a mixture of the styles.

2.1 Describe the key features of quantitative and qualitative research.

2.2 Describe the key features of mixed method research.

REVIEW
QUESTIONS

QUANTITATIVE RESEARCH METHODS: EXPERIMENTAL AND NONEXPERIMENTAL RESEARCH

You now know some of the characteristics of quantitative and qualitative research. Now we introduce some of the different methods of quantitative research. Before we do so, however, you need to know about variables because quantitative researchers usually describe the world by using variables, and they attempt to explain and predict aspects of the world by demonstrating the relationships among variables. You can see a summary of the types of variables in Table 2.2.

Variables

A **variable** is a condition or characteristic that can take on different values or categories. A much-studied educational variable is intelligence, which varies from low to high for different people. Age is another variable that varies from low to high (e.g., from 1 minute old to 130 years old or so). Another variable is gender, which is either male or female. To better understand the concept of a variable, it is helpful to compare it with a constant, its opposite. A **constant** is a single value or category of a variable. Here's the idea: The variable *gender* is a marker for two constants: male and female. The category (i.e., constant) *male* is a marker for only one thing; it is one of the two constants forming the variable called gender. Gender varies, but *male* does not vary. Therefore, *gender* is a variable, and *male* is a constant. In the case of the variable *age*, all of the ages make up the values (i.e., constants) of the variable, and each value (e.g., twelve years old or thirteen years old) is a constant. If you are still having a hard time with the distinction between a variable and a constant, think of it like this: A variable is like a set of things, and a constant is *one* of those things.

The variables that we just used, age and gender, are actually different types of variables. Age is an example of a quantitative variable, and gender is an example of a categorical variable. A **quantitative variable** is a variable that varies in degree or amount. It usually involves numbers. A **categorical variable** is a variable that varies in type or kind. It usually involves different groups. As described in the previous paragraph, age takes on numbers (e.g., number of years old), and gender takes on two types or kinds (male and female). Now consider the variable *annual income*. How does it vary? It varies in amount, ranging from no



quantitative
research

- **Variable**
A condition or characteristic that can take on different values or categories
- **Constant**
A single value or category of a variable
- **Quantitative variable**
A variable that varies in degree or amount
- **Categorical variable**
A variable that varies in type or kind

■ TABLE 2.2 Common Types of Variables Classified by Level of Measurement and by Role of Variable

Variable Type	Key Characteristic	Example
Level of Measurement		
Categorical variable	A variable that is made up of different types or categories of a phenomenon	The variable <i>gender</i> is made up of the categories of male and female.
Quantitative variable	A variable that varies in degree or amount of a phenomenon	The variable <i>annual income</i> varies from zero income to a very high income level.
Role Taken by the Variable		
Independent variable (symbolized as IV)	A variable that is presumed to cause changes to occur in another variable, a causal variable	Amount of studying (IV) affects test grades (DV).
Dependent variable (symbolized as DV)	A variable that changes because of another variable, the effect or outcome variable	Amount of studying (IV) affects test grades (DV).
Mediating variable (It is also called an intervening variable)	A variable that comes in between other variables, helps to delineate the process through which variables affect one another	Amount of studying (IV) leads to input and organization of knowledge in long-term memory (mediating variable), which affects test grades (DV).
Moderator variable	A variable that delineates how a relationship of interest changes under different conditions or circumstances	Perhaps the relationship between studying (IV) and test grades (DV) changes according to the different levels of use of a drug such as Ritalin (moderator).

income at all to some very large amount of income. Therefore, income is a quantitative variable. If you think about how much money you made last year, you can determine your value on the variable *annual income*. Now think about the variable *religion*. How does this variable vary? It varies in kind or type. It can take on any of the categories standing for the different world religions (e.g., Christianity, Judaism, Islam). If you need a little more practice identifying quantitative and categorical variables, take a look at the examples in Table 2.3.

Yet another categorization scheme for variables is to speak of independent and dependent variables. An **independent variable** is a variable that is presumed to cause a change in another variable. Sometimes the independent variable is manipulated by the researcher (i.e., the researcher determines the value of the independent variable); at other times, the inde-

Independent variable
A variable that is presumed to cause a change in another variable

■ TABLE 2.3 Examples of Quantitative and Categorical Variables

Quantitative Variables	Categorical Variables
Height	Gender
Weight	Religion
Temperature	Ethnicity
Annual income	Method of therapy
Most aptitude tests	College major
Most achievement tests	Political party identification
School size	Type of school
Class size	Marital status of parents
Self-esteem level	Student retention (retained or not)
Grade point average	Type of teacher expectation
Teacher-pupil ratio	Native language
Time spent on homework	Teaching method
Age	Personality type
Anxiety level	Learning style
Job satisfaction score	Type of feedback
Number of behavioral outbursts	Computer use (or not)
Reading performance	Type of reading instruction
Spelling accuracy	Inclusion (or not)
Number of performance errors	Problem solving strategy used
Rate of cognitive processing	Memory strategy used
Dropout rate	Social class

pendent variable is studied by the researcher but is not directly manipulated (i.e., the researcher studies what happens when an independent variable changes naturally). The independent variable is an antecedent variable because it must come before another variable if it is to produce a change in it. A **dependent variable** is the variable that is presumed to be influenced by one or more independent variables. The dependent variable is the variable that is “dependent on” the independent (i.e., antecedent) variable(s). A **cause-and-effect relationship** between an independent variable and a dependent variable is present when changes in the independent variable tend to cause changes in the dependent variable. Sometimes researchers call the dependent variable an *outcome variable* or a *response variable* because it is used to measure the effect of one or more independent variables.

Here is a simple example of a cause-and-effect relationship. Think about the U.S. Surgeon General’s warning printed on cigarette packages: “Smoking Causes Lung Cancer, Heart Disease, Emphysema, and May Complicate Pregnancy.” Can you identify the independent and dependent variables in this relationship? It is smoking that is presumed to cause



causality

- **Dependent variable**
A variable that is presumed to be influenced by one or more independent variables
- **Cause-and-effect relationship**
Relationship in which one variable affects another variable

lung cancer and several other diseases. (You should be aware that extensive research beyond simply observing that smoking and lung cancer were associated was conducted to establish that the link between smoking and cancer was causal.) In this example, *smoking* is the independent variable (the values corresponding to the number of cigarettes smoked a day) and *presence of lung cancer* is the dependent variable (the values being *lung cancer present* and *lung cancer not present*).

For shorthand, we could use *IV* to stand for independent variable and *DV* to stand for dependent variable. We also sometimes use an arrow: $IV \rightarrow DV$. The arrow (\rightarrow) means “tends to cause changes in” or “affects.” In words, this says that the researcher believes “changes in the independent variable tend to cause changes in the dependent variable.” In the smoking example, we write Smoking \rightarrow Onset of Lung Cancer.

Another type of variable is an **intervening variable** (also commonly called a *mediating* or *mediator variable*). An intervening or mediating variable occurs between two other variables in a causal chain (Kenny, Kashy, & Bolger, 1998). In the case $X \rightarrow Y$, we have only an independent variable and a dependent variable. In the case $X \rightarrow I \rightarrow Y$, we have an intervening variable (I) occurring between the two other variables. In the case of smoking, perhaps an intervening variable is the development of damaged lung cells. In other words, smoking tends to lead to the development of damaged lung cells, which tends to lead to lung cancer. It is helpful to identify intervening variables because these variables may help explain the process by which an independent variable leads to changes in a dependent variable.

As another example, let X stand for teaching approach (perhaps the levels of this variable are lecture method and cooperative group method), and let Y stand for test score on class exam (varying from 0 to 100 percent correct). Research may show that $X \rightarrow Y$; that is, test scores depend on which teaching approach is used. In this case, an intervening variable might be student motivation (varying from low motivation to high motivation). Therefore, the full causal chain is $X \rightarrow I \rightarrow Y$, where X is teaching approach, I is student motivation, and Y is students' test scores; that is, teaching method \rightarrow student motivation \rightarrow student test scores.

The next type of variable is a moderator variable. A **moderator variable** is a variable that changes (i.e., moderates) the relationship between other variables. It's a variable that delineates how a relationship changes under different conditions or contexts or for different kinds of people. For example, you might analyze a set of research data and find that there is little or no difference between the performance scores of students who are taught by using the lecture approach and the students who are taught by using the cooperative learning approach. On further analysis, however, you might learn that cooperative learning works better for extraverted students and that lecture works better for introverted students. In this example, personality type is a moderator variable: The relationship between teaching approach and performance scores depends on the personality type of the student. One thing we commonly find in research on teaching is that what works well depends on the type of student. As you can see, it is helpful to know the important moderator variables so that you can adjust your teaching accordingly.

Experimental Research

The purpose of experimental research is to determine cause-and-effect relationships. The experimental research method enables us to identify causal relationships because it allows

Intervening variable
A variable that occurs between two other variables; it's a mediating variable



mediating variable
moderator variable

Moderator variable
A variable that changes the relationship between other variables

us to observe, under controlled conditions, the effects of systematically changing one or more variables. Specifically, in **experimental research**, the researcher manipulates the independent variable, actively intervening in the world, and then observes what happened. Thus, **manipulation**, an intervention studied by an experimenter, is the key defining characteristic of experimental research. The use of manipulation in studying cause-and-effect relationships is based on the activity theory of causation (Collingwood, 1940; Cook & Shadish, 1994). Active manipulation is not involved in any other type of research. Because of this (and because of experimental control), experimental research provides the strongest evidence of all the research methods about the existence of cause-and-effect relationships.

In a simple experiment, a researcher will systematically vary an independent variable and assess its effects on a dependent variable. For example, perhaps an educational researcher wants to determine the effect of a new teaching approach on reading achievement. The researcher could perform the new teaching approach with one group of participants and perform the traditional teaching approach with another group of participants. After the treatment, the experimenter would determine which group showed the greater amount of learning (reading achievement). If the group receiving the new teaching approach showed the greater gain, then the researcher would tentatively conclude that the new approach is better than the traditional approach.

Although the type of experiment just described is sometimes done, there is a potential problem with it. What if the two groups of students differed on variables such as vocabulary, reading ability, and/or age? More specifically, what if the students in the new teaching approach group happened to be older, had better vocabularies, and were better readers than the students in the traditional teaching approach group? Furthermore, suppose the students with better vocabularies, who were older, and who were better readers also tended to learn more quickly than other students. If this were the case, then it is likely that the students in the new teaching approach group would have learned faster regardless of the teaching approach. In this example, the variables *age*, *vocabulary*, and *reading ability* are called extraneous variables. **Extraneous variables** are variables other than the independent variable of interest (e.g., teaching approach) that may be related to the outcome. When extraneous variables are not controlled for or dealt with in some way, an outside reviewer of the research study may come up with competing explanations for the research findings. The reviewer might argue that the outcome is due to a particular extraneous variable rather than to the independent variable. These competing explanations for the relationship between an independent and a dependent variable are sometimes called *alternative explanations* or *rival hypotheses*. In our example, the researcher cannot know whether the students in the new teaching approach performed better because of the teaching approach or because they had better vocabularies, were older, or were better readers. All these factors are said to be *confounded*; that is, these factors are entangled with the independent variable, and the researcher can't state with any degree of confidence which is the most important factor. Sometimes we use the term **confounding variables** to refer to extraneous variables that were not controlled for by the researcher and could be the reason a particular result occurred.

Because the presence of extraneous variables makes the interpretation of research findings very difficult, the effective researcher attempts to control them whenever possible. The best way to control for extraneous variables in an experiment like the one above is to randomly assign research participants to the groups to be compared; that is, random assignment

- **Experimental research**
Research in which the researcher manipulates the independent variable
- **Manipulation**
An intervention studied by an experimenter

- **Extraneous variable**
A variable that may compete with the independent variable in explaining the outcome

- **Confounding variable**
A type of extraneous variable that was not controlled for and is the reason a particular "confounded" result is observed

is the most effective technique of experimental control. Random assignment helps to ensure that the people in the groups to be compared are similar before the intervention or manipulation. For example, if the researcher wants to randomly assign thirty people to two groups, then the researcher might put thirty slips of paper, each with one name on it, into a hat and randomly pull out fifteen pieces. The fifteen names that are pulled out will become one of the two groups, and the fifteen names remaining in the hat will become the other group. When this is done, the only differences between the groups will be due to chance. In other words, the people in the groups will be *similar* at the start of the experiment. After making the groups similar, the researcher administers the levels of the independent variable, making the groups different only on this variable. Perhaps teaching method is the independent variable, and the levels are cooperative learning and lecture. The administration of the independent variable, or manipulation, would involve exposing one group to cooperative learning and the other group to lecture. Then if the two groups become different after the manipulation, the researcher will know that the difference was due to the independent variable. In summary, (1) the experimenter uses random assignment to make the groups similar; (2) the experimenter does something different with the groups; and (3) if the groups then become different, the experimenter concludes that the difference was due to what the experimenter did (i.e., it was due to the independent variable). In later chapters, we will introduce you to additional methods that are used to control for extraneous variables when you are not able to use random assignment. For now, remember that random assignment to groups is the most effective way to make the groups similar and therefore control for extraneous variables.

Nonexperimental Research

Nonexperimental research

Research in which random assignment to groups is not possible and there is no manipulation of an independent variable by the researcher

In **nonexperimental research**, random assignment to groups is not possible, and there is no manipulation of an independent variable by the researcher. As a result, evidence gathered in support of cause-and-effect relationships is severely limited. Nonetheless, when important questions need to be answered, research must still be conducted, even if an experiment cannot be done. It is important to remember this cardinal rule: Your research question should determine what you study, not your preference for a particular research method. Tashakkori and Teddlie (1998) emphasize the dominant role of the research question with the phrase “the dictatorship of the research question.” For example, during the 1960s, extensive research linking cigarette smoking to lung cancer was conducted. Experimental research with humans was not possible because it would have been unethical. Therefore, in addition to experimental research with laboratory animals, medical researchers relied on nonexperimental research methods for their extensive research with humans.

Causal-comparative research

A form of nonexperimental research in which the primary independent variable of interest is a categorical variable

One type of nonexperimental research is sometimes called *causal-comparative research*. Typically, in **causal-comparative research**, the researcher studies the relationship between one or more categorical independent variables and one or more quantitative dependent variables. In the most basic case, there is a single categorical independent variable and a single quantitative dependent variable. Because the independent variable is categorical in causal-comparative research (e.g., males versus females, parents versus nonparents, or public school teachers versus private school teachers), the different groups’ average scores on a dependent variable are compared to determine whether a relationship is present between the independent and dependent variables. For example, if the independent variable is *student*

retention (and the categories of the variable are *retained in the first grade* and *not retained in the first grade*) and the dependent variable is *level of achievement*, then the retained students' average achievement would be compared to the nonretained students' average achievement. (Which group do you think would have higher achievements on average: the retained or the nonretained students?)

Despite the presence of the word *causal* included in the term *causal-comparative research*, keep in mind that causal-comparative research is a nonexperimental research method, which means that there is no manipulation of an independent variable by a researcher. Furthermore, techniques of controlling for extraneous variables are more limited than in experimental research (in which random assignment may be possible). Because of the lack of manipulation and weaker techniques of controlling for extraneous variables, it is difficult to make statements about cause and effect. In short, do not be misled by the word *causal* in the name of this type of research, and remember that well-designed experimental research is virtually always better for determining cause and effect than is causal-comparative research or any other type of nonexperimental research.

An example of causal-comparative research is a study entitled "Gender Differences in Mathematics Achievement and Other Variables among University Students" (Rech, 1996). Rech compared the average performance levels of males with the average performance levels of females in intermediate algebra and college algebra courses at a large urban commuter university. In the intermediate algebra course, Rech found that females did slightly better than males. The average percentage correct for females was 75 percent, and the average percentage correct for males was 73.8 percent. In the college algebra course, the difference in female and male performance was even smaller (74.3 percent versus 73.9 percent). The data were collected from more than 2,300 research participants over six semesters.

It was mentioned earlier that the basic case of causal-comparative research involves a single categorical independent variable and a single quantitative dependent variable. To design a basic causal-comparative study as an exercise, look at Table 2.3 and find a categorical variable that can serve as your independent variable (i.e., one that you would not manipulate) and a quantitative variable that can be your dependent variable. As an example, we can select *retention* as the independent variable and *self-esteem* as a dependent variable. We hypothesize that student retention (retained versus nonretained) has an influence on self-esteem. More specifically, we predict that, on average, retained students will have lower self-esteem than nonretained students. We would have to go to a school and collect data if we actually wanted to conduct a research study to see whether there is any support for this hypothesis.

Another nonexperimental research method is called correlational research. As in causal-comparative research, there is no manipulation of an independent variable in correlational research. In **correlational research**, the researcher studies the relationship between one or more quantitative independent variables and one or more quantitative dependent variables; that is, in correlational research, the independent and dependent variables are quantitative. In this chapter, we will discuss the basic case in which the researcher has a quantitative independent variable and a quantitative dependent variable. To understand how to study the relationship between two variables when both variables are quantitative, you need a basic understanding of a correlation coefficient.

A **correlation coefficient** is an index that provides information about the strength and direction of the relationship between two variables. It provides information about how two

- **Correlational research**

A form of nonexperimental research in which the primary independent variable of interest is a quantitative variable

- **Correlation coefficient**

An index that indicates the strength and direction of the relationship between two variables

variables are associated. More specifically, a correlation coefficient is a number that can range from -1 to 1 , with zero standing for no correlation at all. If the number is greater than zero, there is a positive correlation. If the number is less than zero, there is a negative correlation. If the number is equal to zero, then there is no correlation between the two variables being correlated. If the number is equal to $+1.00$ or equal to -1.00 , the correlation is called perfect; that is, it is as strong as possible. Now we provide an explanation of these points.

Positive correlation

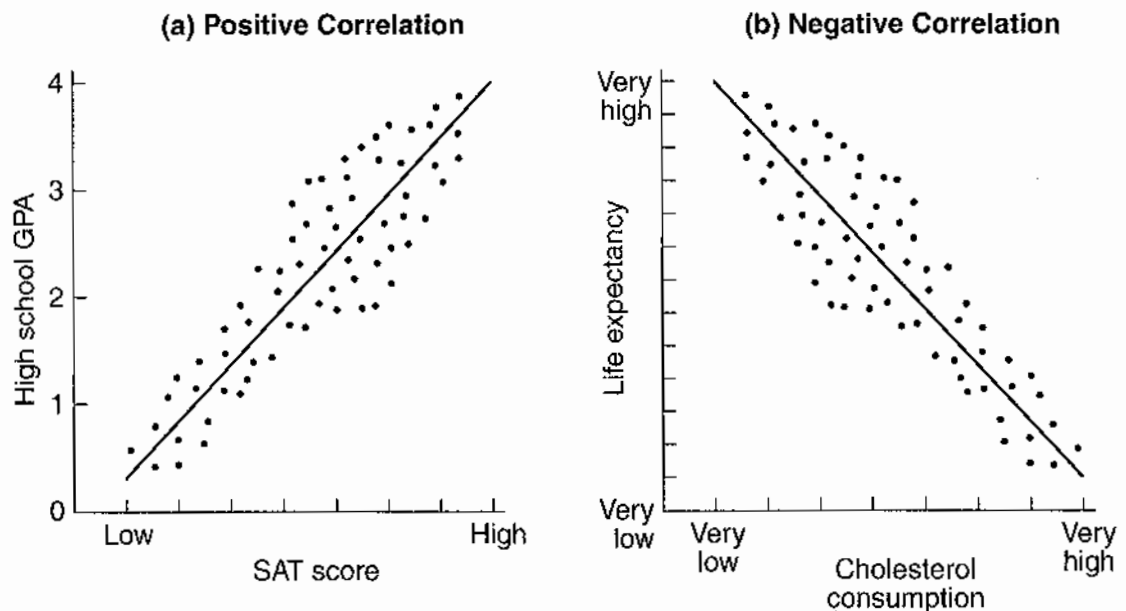
The situation when scores on two variables tend to move in the same direction

A **positive correlation** is present when scores on two variables tend to move in the same direction. For example, consider the variables high school GPA and SAT (the college entrance exam). How do you think scores on these two variables are related? A diagram of this relationship is shown in Figure 2.1(a). As you can see in Figure 2.1(a), the students who have high GPAs tend also to have high scores on the SAT, and students who have low GPAs tend to have low scores on the SAT. That's the relationship. We say that GPA and SAT are positively correlated because as SAT scores increase, GPAs also tend to increase (i.e., the variables move in the same direction). Because of this relationship, researchers can use SAT scores to help make predictions about GPAs. However, because the correlation is not perfect, the prediction is also far from perfect.

Negative correlation

The situation when scores on two variables tend to move in opposite directions

A **negative correlation** is present when the scores on two variables tend to move in opposite directions. For example, consider the variables amount of daily cholesterol consumption and life expectancy. How do you think these variables are related? Do you think the relationship meets the definition of a negative correlation? A diagram of this relationship is shown in Figure 2.1(b). You can see that as daily cholesterol consumption increases, life expectancy tends to decrease. That is, the variables move in opposite directions. As one variable goes up, the other tends to go down and vice versa. Therefore, researchers can use information about cholesterol consumption to help predict life expectancies. High values



■ FIGURE 2.1 Examples of positive and negative correlation

on one variable are associated with low values on the other variable and vice versa. This is what we mean by a negative correlation.

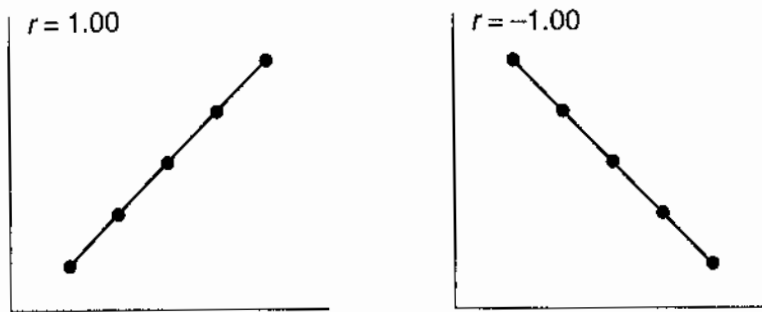
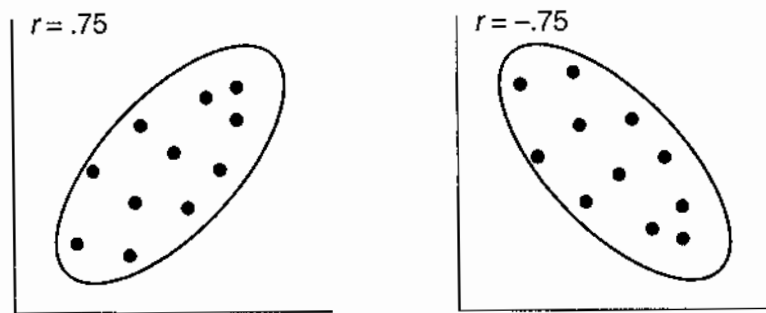
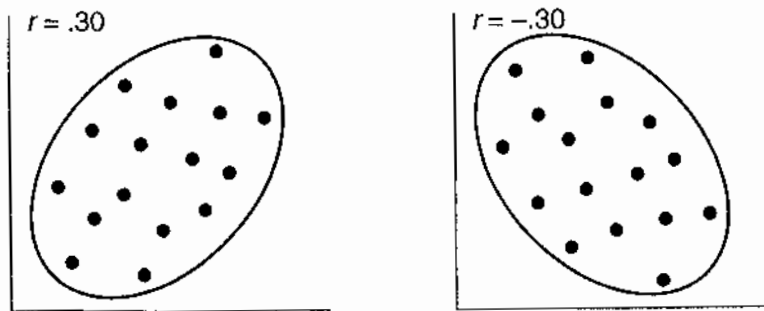
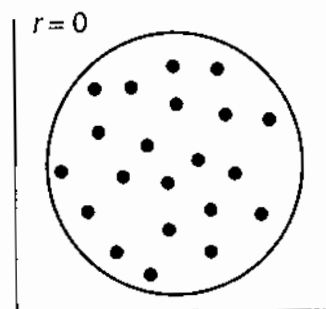
At this point, you know the difference between a positive correlation (the variables move in the same direction) and a negative correlation (the variables move in opposite directions). There is, however, one more point about a correlation coefficient that you need to know. In addition to the direction of a correlation (positive or negative), we are interested in the strength of the correlation. By *strength*, we mean “How strong is the relationship?” Remember this point: Zero means no relationship at all, and +1.00 and -1.00 mean that the relationship is as strong as possible.

The higher the number, ignoring the sign if it is negative, the stronger is the relationship. For example, if you have a correlation of $-.5$, then ignore the negative sign and you have $.5$, which shows the strength of the correlation. Therefore, a correlation of $-.5$ and a correlation of $+.5$ have the same strength. The only difference between the two is the direction of the relationship ($-.5$ is a negative correlation, and $+.5$ is a positive correlation). When you are interested in its strength, it does not matter whether a correlation is positive or negative. The strength of a correlation operates like this: Zero stands for no correlation at all (i.e., it is the smallest possible strength), and +1.00 and -1.00 are as strong as a correlation can ever be. That is, +1.00 and -1.00 are equally strong; in research jargon, we say that both +1.00 and -1.00 are *perfect correlations*. The only difference between +1.00 and -1.00 is the direction of the relationship, not the strength. You can see some diagrams of correlations of different strengths and directions in Figure 2.2.

If you found the previous paragraph a little hard to take, here is a different way to determine how strong a correlation is. Simply check to see how far away the number is from zero. The farther the number is from zero, the stronger is the correlation. A correlation of $.9$ is stronger than a correlation of $.2$ because it is farther from zero. Likewise, a correlation of $-.9$ is stronger than a correlation of $-.2$ because it too is farther from zero. Now for a trick question. Which correlation do you believe is stronger: $-.90$ or $+.80$? The answer is $-.90$ because $-.90$ is farther from zero than $+.80$. (I think you’ve got it!)

This is only a brief introduction to the idea of a correlation coefficient. You will become more comfortable with the concept the more you use it, and we will be using the concept often in later chapters. For now, you should clearly understand that you can have positive and negative correlations or no correlation at all and that some correlations are stronger than other correlations. You have learned more already than you thought you would, haven’t you?

In the most basic form of correlational research, the researcher examines the correlation between two quantitative variables. For example, perhaps an educational psychologist has a theory stating that global self-esteem (which is a relatively stable personality trait) should predict class performance. More specifically, the educational psychologist predicts that students entering a particular history class with high self-esteem will tend to do better than students entering the class with low self-esteem and vice versa. To test this hypothesis, the researcher could collect the relevant data and calculate the correlation between self-esteem and performance on the class examinations. We would expect a positive correlation (i.e., the higher the self-esteem, the higher is the performance on the history exam). In our hypothetical example, let’s say that the correlation was $+.5$. That is a medium-size positive correlation, and it would support our hypothesis of a positive correlation.

(a) Perfect Correlations**(b) Large or Strong Correlations****(c) Small or Weak Correlations****(d) No Correlation**

■ FIGURE 2.2 Correlations of different strengths and directions

The researcher would be able to say virtually nothing about cause and effect based on the correlation of .5 in our example of self-esteem and class performance. About all that one can claim is that there is a relationship between self-esteem and class performance: The higher the self-esteem, the better is the class performance. This is the same problem that we experienced in the basic case of causal-comparative research, in which there is one independent variable and one dependent variable. In short, there are three main problems with the basic cases of correlational and causal-comparative research described in this chapter:

1. There is no manipulation of the independent variable by the researcher.
2. It is difficult to determine the temporal order of the variables (i.e., which variable occurs first).
3. There are usually too many other reasons why we might observe the relationship; that is, there are usually too many extraneous variables that are unexplained.

Remember this important point: You must not jump to a conclusion about cause and effect in a nonexperimental research study in which the researcher has examined only the relationship between two variables, such as examining a correlation coefficient in correlational research or comparing two group means in causal-comparative research. Simply finding a relationship between self-esteem and class performance (correlational research) or between gender and class performance (causal-comparative research) is not sufficient evidence for concluding that the relationship is causal. Therefore, you must not jump to that conclusion. We will discuss the issue of cause and effect more in later chapters. We will also show how you can obtain some evidence of cause and effect using nonexperimental research by improving on the basic cases discussed in this chapter. For now, make sure you remember that experimental research with random assignment is the single best method for determining cause-and-effect relationships and that nonexperimental research methods are much weaker.

- 2.3 What is the difference between a categorical variable and a quantitative variable? Think of an example of each.
- 2.4 Why is experimental research more effective than nonexperimental research when a researcher is interested in studying cause and effect?
- 2.5 What are the three main problems with the simple cases of causal-comparative and correlational research?
- 2.6 What are two variables that you believe are positively correlated?
- 2.7 What are two variables that you believe are negatively correlated?

REVIEW QUESTIONS

QUALITATIVE RESEARCH METHODS

As you saw in Table 2.1, qualitative research is based on qualitative data and tends to follow the inductive mode of the scientific method. In this book, we will be discussing five types of qualitative research: phenomenology, ethnography, case study, grounded theory, and historical research. Chapters 12 and 13 provide detailed discussions of these five kinds of



qualitative
research

research. We only introduce you to the key ideas of each of these research methods now to foreshadow our later, in-depth discussions of these methods.

Phenomenology

Phenomenology

A form of qualitative research in which the researcher attempts to understand how one or more individuals experience a phenomenon.

The first major type of qualitative research is **phenomenology**. When conducting a phenomenological research study, a researcher attempts to understand how one or more individuals experience a phenomenon. For example, you might conduct a phenomenological study of elementary school students who have lost a parent to better understand how schoolchildren experience bereavement. The key element of a phenomenological research study is that the researcher attempts to understand how people experience a phenomenon from the person's own perspectives. Your goal is to enter the inner world of each participant to understand his or her perspectives and experiences. Phenomenological researchers have studied many phenomena, such as what it is like to participate in a religious group that handles serpents as part of the worship service (Williamson & Pollio, 1999), the experience of grief (Bailley, Dunham, & Kral, 2000), the experience of learning to become a music teacher (Devries, 2000), the experience of living with alcoholism (Smith, 1998), the meaning of age for young and old adults (Adams-Price, Henley, & Hale, 1998), and elementary school children's experiences of stress (Omizo & Omizo, 1990).

Ethnography

Ethnography

A form of qualitative research focused on describing the culture of a group of people.

Culture
The shared attitudes, values, norms, practices, patterns of interaction, perspectives, and language of a group of people.

Holistic description
The description of how members of a group interact and how they come together to make up the group as a whole.

Ethnography is one of the most popular approaches to qualitative research in education. The word **ethnography** literally means "writing about people." When ethnographers conduct research, they are interested in describing the **culture** of a group of people and learning what it is like to be a member of the group from the perspective of the members of that group. That is, they are interested in documenting things like the shared attitudes, values, norms, practices, patterns of interaction, perspectives, and language of a group of people. They may also be interested in the material things that the group members produce or use, such as clothing styles, ethnic foods, and architectural styles. Ethnographers try to use **holistic descriptions**; that is, they try to describe how the members of a group interact and how they come together to make up the group as a whole. In other words, the group is more than just the sum of its parts. Just a few of the many groups that ethnographers have studied recently are a group of panhandlers living on the streets of Washington, D.C. (Lankenau, 1999), men with mental retardation living in a group home (Croft, 1999), black and white sorority members (Berkowitz & Padavic, 1999), students in a U.S. history class (Keedy, Fleming, Wheat, & Gentry, 1998), sixth-grade students in science classes (Solot & Arluke, 1997), karaoke bar performers (Drew, 1997), Puerto Rican American parents with children in special education (Harry, 1992), and a group of Native American students who had dropped out of school (Deyhle, 1992). In all of these studies, the researchers were interested in describing some aspect of the culture of the people in the study.

Case study research

A form of qualitative research that is focused on providing a detailed account of one or more cases.

Case Study Research

In **case study research**, the researcher provides a detailed account of one or more cases. Although case study research usually relies on qualitative data, multiple methods are also used. Case study research can be used to address exploratory, descriptive, and explanatory

research questions (Stake, 1995; Yin, 1994). Unlike phenomenology, which focuses on individuals' experience of some phenomenon, or ethnography, which focuses on some aspect of culture, or grounded theory, which focuses on developing an explanatory theory, case study research is more varied. What all pure case studies do have in common, however, is a focus on each case as a whole unit (i.e., case study research is holistic) as it exists in its real-life context. For example, in "Building Learning Organizations in Engineering Cultures," Ford and Voyer (2000) examined how a specific organization changed over time into a learning organization. Although their focus was on a single case, other organizations might be able to learn from Ford and Voyer's experiences. In "The Journey through College of Seven Gifted Females: Influences on their Related Career Decisions," Dale (2000) examined in detail the personal, social, and academic experiences of seven people. After analyzing each case, Dale made cross-case comparisons, searching for similarities and differences.

Grounded Theory

Grounded theory research is a qualitative approach to generating and developing a theory from the data you collect in a research study. You will recall from Chapter 1 that a theory is an explanation of how and why something operates. We will explain the details of grounded theory in Chapter 12; for now, remember that grounded theory is an inductive approach for generating theories or explanations. One example of a grounded theory is found in "An Analysis of Factors that Contribute to Parent-School Conflict in Special Education" by Lake and Billingsley (2000). Lake and Billingsley wanted to explain why conflict takes place between the parents of children in special education programs and school officials. Lake and Billingsley conducted in-depth interviews (lasting an average of one hour) with parents, principals, special education program directors, and mediators. They identified several factors as contributing to the escalation of parent-school conflict. The primary or core factor was a discrepancy in views about the child's needs. The other factors were lack of knowledge (e.g., lack of problem solving knowledge), disagreements over service delivery, the presence of constraints (e.g., such as the lack of funds to deliver services), differences in how a child is valued, unilateral use of power, poor communication, and lack of trust. In addition to discussing what factors lead to conflict, the authors discussed how conflict can be reduced and how it can be prevented. As you can see, the authors generated a tentative explanation about conflict based on their data. To strengthen their explanation, they would need to further develop and test their theory with new empirical data.

- **Grounded theory research**

A qualitative approach to generating and developing a theory from the data that the researcher collects

Historical Research

The last general type of research used by educational researchers and discussed in this chapter is **historical research**, or research about events in the past. Although in many ways historical research is mixed (e.g., quantitative data are often used), we place it under the heading of qualitative research because the data tend to be qualitative and the approach to the use of evidence and the forming of arguments is closer to qualitative research than to quantitative research. As you know, historical research is done so that researchers can better understand events that have already occurred.

- **Historical research**

Research about events in the past

Educational historians have been able to find historical data that lend themselves to data analysis and have studied how various educational phenomena operated in the past.

For example, educational researchers document the history of education and important events that occurred in the past, study trends in education occurring over time, study the multiple factors that led to certain events in the past, and study how things operated in the past (e.g., different teaching practices and the different outcomes that resulted from those practices). They might also study the origin of current practices and document any changes over time. *Historiography* is the word historians sometimes use to mean “research methods.” As you will learn in Chapter 13, historiography involves the posing of questions, the collection of authentic source materials, the analysis and interpretation of those materials, and the composition of the results into a final report. Historical research, like the other methods of research, has an important place in education.

REVIEW QUESTION

2.8 What are the different types of qualitative research, and what is the defining feature of each of these?



mixed method
multimethod
research

MIXED RESEARCH METHODS

As we discussed earlier, *mixed research* involves the mixing of quantitative and qualitative research methods, approaches, or paradigm characteristics. Because we have a full chapter on mixed research in this book (Chapter 14), we will only briefly discuss the two major types of mixed research to lay the foundation for the later discussion. The two major types are mixed method research and mixed model research (Tashakkori & Teddlie, 1998).

Mixed Method Research

Mixed method research is research in which the researcher uses the qualitative research paradigm for one phase of a research study and the quantitative research paradigm for a different phase of the study.

In **mixed method research**, the researcher uses the qualitative research paradigm for one phase of a research study and the quantitative research paradigm for another phase of the study. In other words, a qualitative research study and a quantitative research study are conducted either concurrently (conducting both at roughly the same time) or sequentially (conducting one first and the other second) to address a research topic. For example, let's say that you are interested in studying the phenomenon of living with dyslexia for high school students. You might decide to first conduct a qualitative study (phase one) by conducting open-ended or unstructured interviews with 10 or 20 high school students who have dyslexia so that you can hear from these students in their own words what it is like to live with dyslexia. On the basis of the data from this phase of your overall study and from your reading of the current research literature, you next develop a closed-ended and more structured questionnaire so that you can in a quantitative study (phase two) ask another group of high school students with dyslexia how descriptive the characteristics (identified in phase one) are of them. You select a larger sample of students with dyslexia from several high schools, and you have these students fill out your questionnaire. You then analyze your data and write up your findings from the qualitative and quantitative parts of your research study. By doing this, in effect, you conduct a qualitative study (phase one) and follow it with a quantitative study (phase two). Both of these phases are important for your broader study.

Mixed Model Research

The second major type of mixed research is mixed model research. In **mixed model research**, the researcher uses both qualitative and quantitative research within a stage or across two of the stages in the research process. In a simplified three-stage model of the research process, you first determine the research objective, then collect the data, and finally analyze and interpret the data. Here are the steps again:

1. *Research objective.* Typical objectives of qualitative research are exploration and description; typical objectives of quantitative research are explanation, prediction, and description.
2. *Type of data.* Quantitative research relies heavily on standardized, numerical data; qualitative research relies heavily on words and images.
3. *Type of analysis and interpretation.* Quantitative research involves statistical analysis; qualitative research relies on the searching for themes and patterns in narrative data.

You could mix within the research objective stage—for example, by designing a study to answer a research question that suggests both exploration and hypothesis testing (e.g., “What are the important factors that predict student attrition?”). This kind of movement back and forth between exploring and testing of working hypotheses is common in fieldwork. You could mix models within the type of data stage by using a questionnaire that includes closed-ended questions and open-ended questions. You could mix within the type of analysis stage by examining narrative data both qualitatively (searching for major themes) and quantitatively (counting the number of times key words occur). You can also mix across the three stages—for example, by collecting narrative data but analyzing those data using quantitative techniques.

Here is an example of a mixed model research study. In the dyslexia study just discussed, you might decide to collect only qualitative data based on open-ended or unstructured interviews with the high school students. Then, although you first analyze the qualitative research data using qualitative analysis techniques (e.g., reading the interview transcripts and looking for common themes or patterns in the data), you also decide to convert some of the data into variables and statistically analyze these data using quantitative analysis techniques. In other words, you have mixed the quantitative and qualitative research paradigms or models in a single study without conducting separate studies as was the case in mixed method research. In the example just given, the researcher mixed the models or paradigms across the data collection and analysis stages (qualitative data were followed by quantitative analysis) as well as within data analysis (by analyzing the data using both qualitative and quantitative techniques). For now, the key point is that using the mixed method means that you conduct separate studies within a broader research study, and using mixed models means that you mix the approaches within or across the stages of a study.

■ Mixed model research

Research in which the researcher uses both qualitative and quantitative research within a stage or across two of the stages in the research process

The Advantages of Mixed Research

We view the use of multiple perspectives, theories, and research methods as a strength in educational research. In fact, we view the quantitative and qualitative research approaches and the specific quantitative and qualitative research methods as complementary. When

Fundamental principle of mixed research
 Advises researchers to mix research methods or procedures in a way that the resulting mixture or combination has complementary strengths and nonoverlapping weaknesses.

mixing research or when you read and evaluate research that involved mixing, be sure to consider the **fundamental principle of mixed research**, which says that it is wise to collect multiple sets of data using different research methods in such a way that the resulting mixture or combination has complementary strengths and nonoverlapping weaknesses (Brewer & Hunter, 1989; Johnson & Turner, 2002; Webb, Campbell, Schwartz, Sechrest, & Grove, 1981). This helps to improve the quality of research because the different research methods have different strengths and different weaknesses.

By combining two (or more) research methods with different strengths and weaknesses in a research study, you can make it less likely that you will make a mistake. Lincoln and Guba (1985) explain this idea using the metaphor of fish nets. Perhaps a fisherman has several fishing nets, each with one or more holes. To come up with one good net, the fisherman decides to overlap the different fishing nets, forming one overall net. All the nets have holes in them; however, when the nets are put together, there will probably no longer be a hole in the overall net. In the case of research methods, an experimental research study might demonstrate causality well, but it might be limited in realism because of the confines of the research laboratory. On the other hand, an ethnographic research study might not demonstrate causality especially well, but it can be done in the field, which enables a researcher to observe behavior as it naturally takes place and therefore increases realism. When both methods are used, causality is strong, and realism is no longer a big problem. Although it is often not practical to use more than one research method or strategy in a single research study, you should be aware of the potential benefit of using multiple methods and strategies. Furthermore, even if a researcher does not use multiple methods in a single research study, the relevant set of published research studies will usually include research based on several different research methods. The research literature is therefore mixed method. As a result, the mixed method (or mixed fishing net) advantage will be gained in the overall area of research.

REVIEW QUESTION

2.9 What are the different types of mixed research, and what is the defining feature of each of these types of research?

OUR RESEARCH TYPOLOGY

The forms of research that we have covered in this chapter are shown in Figure 2.3. We will discuss each of these types of research in later chapters. It is important to understand that all of the major types of research that we discuss in this textbook have value. It is not uncommon for an educational researcher to use several different types of research at different times. A researcher should always select the appropriate research method on the basis of a consideration of the research question(s) of interest, the objective(s) of the research, time and cost constraints, available populations, the possibility (or not) of the manipulation of an independent variable, and the availability of data. Sometimes a researcher will use more than one research approach within a single study. However, even if researchers never used

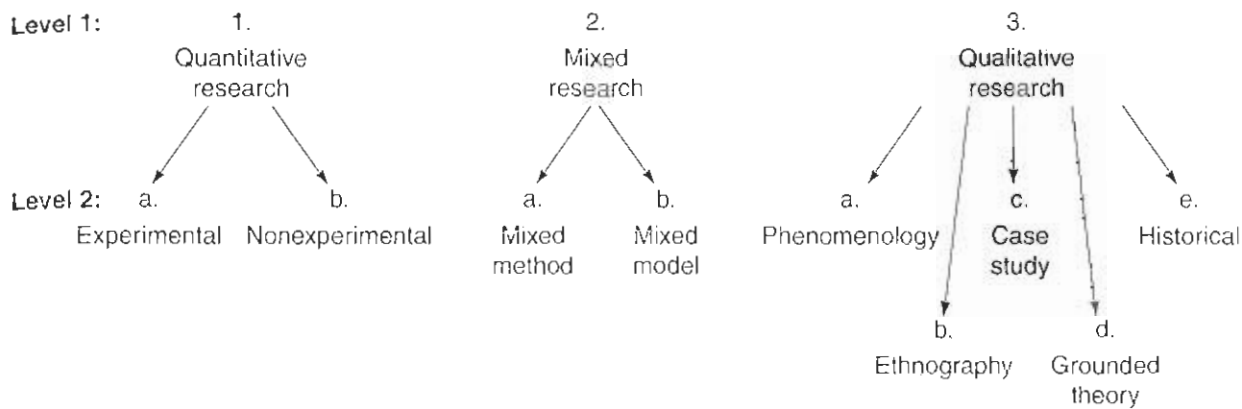


FIGURE 2.3 Research typology (Later chapters will add a third level to this typology.)

more than one method in a single study, published research literature would still tend to include articles based on different approaches and methods because of the diversity of the researchers working in the area.

When a research finding has been demonstrated by using more than one type of research, one can place more confidence in it. We say that a finding has been *corroborated* if the same result is found by using different types of research. Conversely, if different data sources or types of research result in conflicting information, then additional research will be needed to explore the nature of the phenomenon more completely and to determine the source of conflict. That is, if different types of research result in different findings, then the researcher should study the phenomenon in more depth to determine the exact reason for the conflicting findings. The world is a complex and ever-changing place. As we study it, it is helpful to be equipped with the best methods and approaches currently available. You will probably find that some methods and approaches we discuss will fit your style or personality better than others. However, we hope that you will keep an open mind as you learn about all of the kinds of research. All the research methods can be useful if used properly.

2.10 What are the three research paradigms in education and what are the major types of research in each of these paradigms? (Hint: We showed the answer in Figure 2.3.)

REVIEW
QUESTION

SUMMARY

The three major research traditions in educational research are qualitative research, quantitative research, and mixed research. All three of these traditions are important and have value. Qualitative research tends to use the inductive form of the scientific method to generate hypotheses and develop theory about phenomena in the world. It is discovery oriented and is conducted in naturalistic settings. Quantitative research is typically done under more tightly controlled conditions and tends to use the deductive form of the scientific method,

focusing on hypothesis testing and theory testing. Mixed research involves mixing qualitative and quantitative research in various ways. It is based on the philosophy of pragmatism (i.e., what works is what is important). Eight research types or methods were introduced in this chapter. These include two types of quantitative research (experimental and nonexperimental research), two types of mixed research (mixed method and mixed model research), and five types of qualitative research (phenomenology, ethnography, case study, grounded theory, and historical). We will elaborate on each part of our research typology (i.e., our classification of the different types of research) in later chapters.

KEY TERMS

case study research (p. 46)	extraneous variable (p. 39)	mixed research (p. 30)
categorical variable (p. 35)	fundamental principle of mixed research (p. 50)	moderator variable (p. 38)
causal-comparative research (p. 40)	grounded theory research (p. 47)	negative correlation (p. 42)
cause-and-effect relationship (p. 37)	historical research (p. 47)	nonexperimental research (p. 40)
confounding variable (p. 39)	holistic description (p. 46)	phenomenology (p. 46)
constant (p. 35)	incompatibility thesis (p. 30)	positive correlation (p. 42)
correlational research (p. 41)	independent variable (p. 36)	pragmatism (p. 30)
correlation coefficient (p. 41)	intervening variable (p. 38)	probabilistic causes (p. 32)
culture (p. 46)	manipulation (p. 39)	qualitative research (p. 30)
dependent variable (p. 37)	mediating variable (p. 38)	quantitative research (p. 30)
determinism (p. 32)	mixed method research (p. 48)	quantitative variable (p. 35)
ethnography (p. 46)	mixed model research (p. 49)	research paradigm (p. 29)
experimental research (p. 39)		variable (p. 35)

DISCUSSION QUESTIONS

- Which of the three research paradigms do you like the most? Why?
- If you find a statistical relationship between two variables (e.g., income and education, or gender and grades, or time spent studying and grades) in a nonexperimental research study, should you confidently conclude that one variable is the cause of the other variable?
- What is an example of a positive correlation? What is an example of a negative correlation?
- Following are several research questions. For each, list the research method that you believe would be most appropriate to use in answering the question.
 - How do individuals experience the phenomenon of being one of only a few minority students in a predominantly homogeneous high school?
 - What is the effect of a new teaching technique on elementary school students' arithmetic performance?
 - Does cognitive therapy or behavioral therapy work better for treating childhood depression?
 - What is the culture of the band at a high school in your local community?
 - What is the relationship between the GRE and student performance in graduate school?
 - Do males and females have different performance levels in high school English classes?
 - Does the student-to-teacher ratio have an effect on elementary students' level of performance in the classroom?
 - What was it like being a middle school student in 1921 in the four-room school (where primary through high school were taught) in Great Bridge, Virginia (which is located in the city of Chesapeake)?
 - Was John Dewey an effective school teacher?
 - Do students perform better on an academic test when they are exposed to a cooperative learning style or a lecture style of teaching?

RESEARCH EXERCISES

1. The abstract and the link to a full-length example of quantitative research is provided in Appendix A, a full-length example of qualitative research is linked in Appendix B, and a full-length example of mixed research is linked in Appendix C. Print out these articles and browse them so that you can see some examples of educational research published in academic journals. What do you consider as the key features of each of these articles? How are they different?
2. Using ContentSelect, locate a qualitative research article or a quantitative research article or a mixed research study. (Remember, to get to ContentSelect, go to the book web page and then select Research Navigator.) Explain why you classified the article you found as a qualitative, a quantitative, or a mixed research study.
3. Read the quantitative research study linked in Appendix A, and write a two-page (typed, double-spaced) summary of the article. Organize your paper into the following three sections: (1) purpose (What was the research study about? What did the researchers hope to learn?), (2) method (How did the researchers carry out their research study? What did they actually do?), and (3) results (What were the key findings of the research study?). Don't worry about the technical jargon in the research article. Just try to get the main ideas.
4. Read the qualitative research study linked in Appendix B, and write a two-page summary of the article. Organize your paper into the three sections described in Exercise 3 (purpose, method, and results).
5. Read the mixed research study linked in Appendix C, and write a two-page summary of the article. Organize your paper into the three sections described in Exercise 3 (purpose, method, and results).

RELEVANT INTERNET SITES

www.ablongman.com/

Quantitative research book materials and links. Go to Larry Christensen's *Experimental Methodology* textbook web page (under the Website Gallery section).

<http://ebook.stat.ucla.edu/textbook/> and

<http://glass.ed.asu.edu/stats/lesson4/>

Correlation coefficients.

www.nova.edu/ssss/QR/web.html

Qualitative research links.

RECOMMENDED READING

Christensen, L. B. (2003). *Experimental methodology* (9th ed.). Boston: Allyn and Bacon.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Pedhazur, E. J., & Schmelkin, L. P. (1991). *Measurement, design, and analysis: An integrated approach*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Tashakkori, A., & Teddlie, C. (Eds.) (2003). *Handbook of mixed methods in the social and behavioral sciences*. Thousand Oaks, CA: Sage.