

The Nonexperimental and Quasi-Experimental Strategies: Nonequivalent Group, Pre–Post, and Developmental Designs

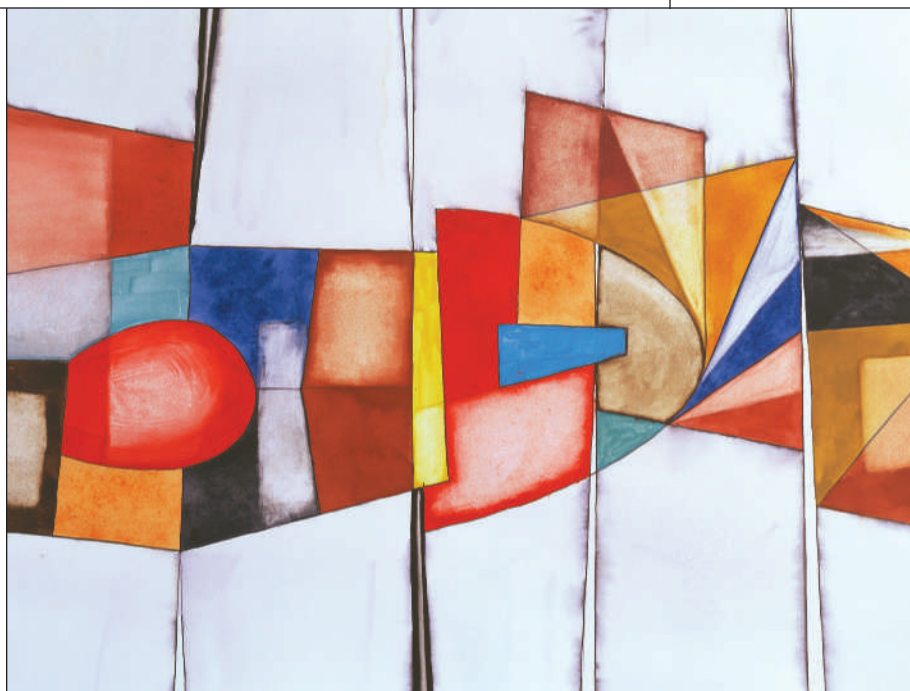
10.1 Nonexperimental and Quasi-Experimental Research Strategies

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CHAPTER LEARNING OBJECTIVES

- LO1** Define, compare, and contrast the experimental, nonexperimental, and quasi-experimental research strategies, and identify these strategies when they appear in a research report.
- LO2** Define a nonequivalent group design and identify examples of this research design when it appears in a research report.
- LO3** Explain how individual differences threaten the internal validity of a nonequivalent group design.
- LO4** Describe the two nonexperimental nonequivalent group designs (differential research and the posttest-only nonequivalent control group design) and the quasi-experimental nonequivalent group design (pretest–posttest nonequivalent control group design), and identify examples of these designs when they appear in a research report.
- LO5** Explain how a simple modification of the posttest-only nonequivalent control group design increases internal validity and produces a quasi-experimental design.

- LO6** Define a pre–post design and identify examples of this research design when it appears in a research report.
- LO7** Identify the threats to internal validity for pre–post designs.
- LO8** Describe the nonexperimental pretest–posttest design and the quasi-experimental time-series design, and identify examples of these designs when they appear in a research report.
- LO9** Explain how replacing the single observation before and after treatment with a series of observations converts the pretest–posttest design into a quasi-experimental time-series design by minimizing threats to internal validity.
- LO10** Define cross-sectional and longitudinal designs, identify these designs when they appear in a research report, and describe the strengths and weaknesses of each design.
- LO11** Identify the statistical techniques that are appropriate for each nonexperimental, quasi-experimental, and developmental design and explain the strengths and weaknesses of two-group compared to multiple-group designs.
- LO12** Explain how the terms quasi-independent variable and dependent variable are used in nonexperimental, quasi-experimental, and developmental research.

CHAPTER OVERVIEW

It appears that there is some truth to the old adage that whatever does not kill us makes us stronger. Seery, Holman, and Silver (2010) asked participants to report their lifetime exposure to a list of negative events such as illness, injury, assault, abuse, financial difficulty, and bereavement, and they obtained a variety of measurements of mental well-being. The authors summarize their results by comparing the outcomes for three groups of participants: individuals with some history of adversity report better mental health and higher well-being compared to either people with no history or people with a high history of adversity. It appears that adversity in moderation does make us stronger.

Because this study compares groups of scores, it may appear to be another example of the experimental strategy covered in Chapters 7–9. Specifically, it strongly resembles the between-subjects experiments presented in Chapter 8. However, you should also realize that the Seeley et al. study is missing one or two of the characteristics that are essential for a true experiment. Specifically, there is no manipulated independent variable. Instead, the three groups of participants are defined by the levels of adversity that they have experienced, which is not controlled or manipulated by the researchers. Also, the researchers have no control over the assignment of individuals to groups; a person who enters the study with a high level of adversity is automatically put into the high adversity group. Without manipulation and control, the study is definitely not an experiment. In fact, this kind of research is known as nonexperimental.

In Chapter 6, we noted that both the nonexperimental and quasi-experimental research strategies compare groups of scores, like true experiments, but do not manipulate an independent variable to create the groups. As a result, these two strategies do not have the internal validity of true experiments and cannot establish unambiguous cause-and-effect relationships. The distinction between the two strategies is that quasi-experimental studies make some attempt to minimize threats to internal validity, whereas nonexperimental studies typically do not. In this chapter, we discuss details of these two strategies, as well as different types of nonexperimental and quasi-experimental designs. Developmental designs, which are closely related to nonexperimental designs, are also presented.

10.1 Nonexperimental and Quasi-Experimental Research Strategies

LEARNING OBJECTIVE

LO1 Define, compare, and contrast the experimental, nonexperimental, and quasi-experimental research strategies, and identify these strategies when they appear in a research report.

In Chapter 6, we identified five basic research strategies: experimental, nonexperimental, quasi-experimental, correlational, and descriptive. In this chapter, we discuss the details of the nonexperimental and quasi-experimental strategies. (The experimental strategy is discussed in Chapter 7, the correlational strategy is discussed in Chapter 12, and the descriptive strategy is discussed in detail in Chapter 13.) The experimental research strategy was introduced in Chapter 7 as a means for establishing a cause-and-effect relationship between variables. Recall that the experimental strategy is distinguished from other research strategies by two basic requirements: manipulation of one variable and control of other, extraneous variables.

In many research situations, however, it is difficult or impossible for a researcher to satisfy completely the rigorous requirements of an experiment. This is particularly true for applied research in natural settings such as educational research in the classroom and clinical research with real clients. In these situations, a researcher can often devise a research strategy (a method of collecting data) that involves comparing groups of scores, like an experiment, but fails to satisfy at least one of the requirements of a true experiment. Although these studies resemble experiments, they always contain a confounding variable or other threat to internal validity that is an integral part of the design and simply cannot be removed. The existence of a confounding variable means that these studies cannot establish unambiguous cause-and-effect relationships and, therefore, are not true experiments. Such studies are generally called nonexperimental research studies.

Occasionally, a nonexperimental study is modified in an attempt to minimize the threats to internal validity. The resulting designs are called quasi-experimental studies. The distinction between the **nonexperimental research strategy** and the **quasi-experimental research strategy** is the degree to which the research strategy limits confounding and controls threats to internal validity. If a research design makes little or no attempt to minimize threats, it is classified as nonexperimental. A quasi-experimental design, on the other hand, makes some attempt to minimize threats to internal validity and approaches the rigor of a true experiment. As the name implies, a quasi-experimental study is almost, but not quite, a true experiment. In this chapter, we focus on nonexperimental designs and introduce some of the modifications that produce some closely related quasi-experimental designs. In each case, we discuss the aspect of the design that prevents it from being a true experiment.

DEFINITION

Like true experiments, the **nonexperimental research strategy** and the **quasi-experimental research strategy** typically involve comparison of scores from different groups or different conditions. However, these two strategies use a nonmanipulated variable to define the groups or conditions being compared. The nonmanipulated variable is usually a participant variable (such as college graduate vs. no college) or a time variable (such as before vs. after treatment). The distinction between the two strategies is that nonexperimental designs make little or no attempt to control threats to internal validity, whereas quasi-experimental designs actively attempt to limit threats to internal validity.

At the end of this chapter, we examine developmental research, which includes research designs intended to investigate how age is related to other variables. Because age is a variable that cannot be manipulated, developmental designs are not true experiments and can be included in other categories of nonexperimental research. However, developmental designs are generally presented as a separate group of research designs with their own terminology. As we introduce the basic developmental research designs, we discuss how they are related to other types of nonexperimental research.

The term *significant* means that it is very unlikely that the difference between the groups of scores would occur if there were no corresponding difference in the population (see Box 7.1, p. 161).

The Structure of Nonexperimental and Quasi-Experimental Designs

Nonexperimental and quasi-experimental studies often look like experiments in terms of the general structure of the research study. In an experiment, for example, a researcher typically creates treatment conditions by manipulating an independent variable, and then measures participants to obtain a set of scores within each condition. If the scores in one condition are significantly different from the scores in another condition, the researcher can conclude that the two treatment conditions have different effects (Figure 10.1).

Similarly, a nonexperimental or quasi-experimental study also produces groups of scores to be compared for significant differences. One variable is used to create the groups or conditions, and then a second variable is measured to obtain a set of scores within each condition. In nonexperimental and quasi-experimental studies, however, the different groups or treatment conditions are not created by manipulating an independent variable. Instead, the groups are usually defined in terms of a specific participant variable (e.g., college graduate/no college) or in terms of time (e.g., before and after treatment). These two methods of defining groups produce two general categories of nonexperimental and quasi-experimental designs:

1. Between-subjects designs, also known as nonequivalent group designs
2. Within-subjects designs, also known as pre–post designs

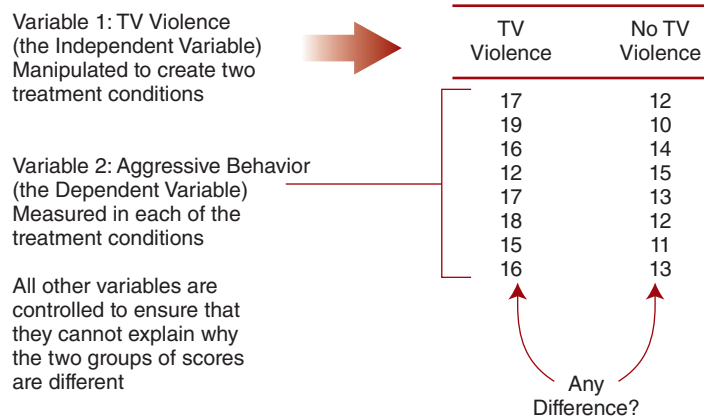


FIGURE 10.1
The Structure of an Experiment

An independent variable (in this case, violence on TV) is manipulated to create treatment conditions. Participants are then measured to obtain scores within each condition. Here, participants are observed during a free period at school and the score for each participant is a measure of aggressive behaviors. If there is a consistent difference between the scores in one condition and the scores in another condition, the difference is attributed to the treatment. In this case, a consistent difference would indicate that TV violence has an effect on aggressive behavior.

Examples of the two general types of nonexperimental and quasi-experimental research are shown in Figure 10.2, and Table 10.1 presents an overview of the nonexperimental and quasi-experimental research designs that are discussed in the following sections.

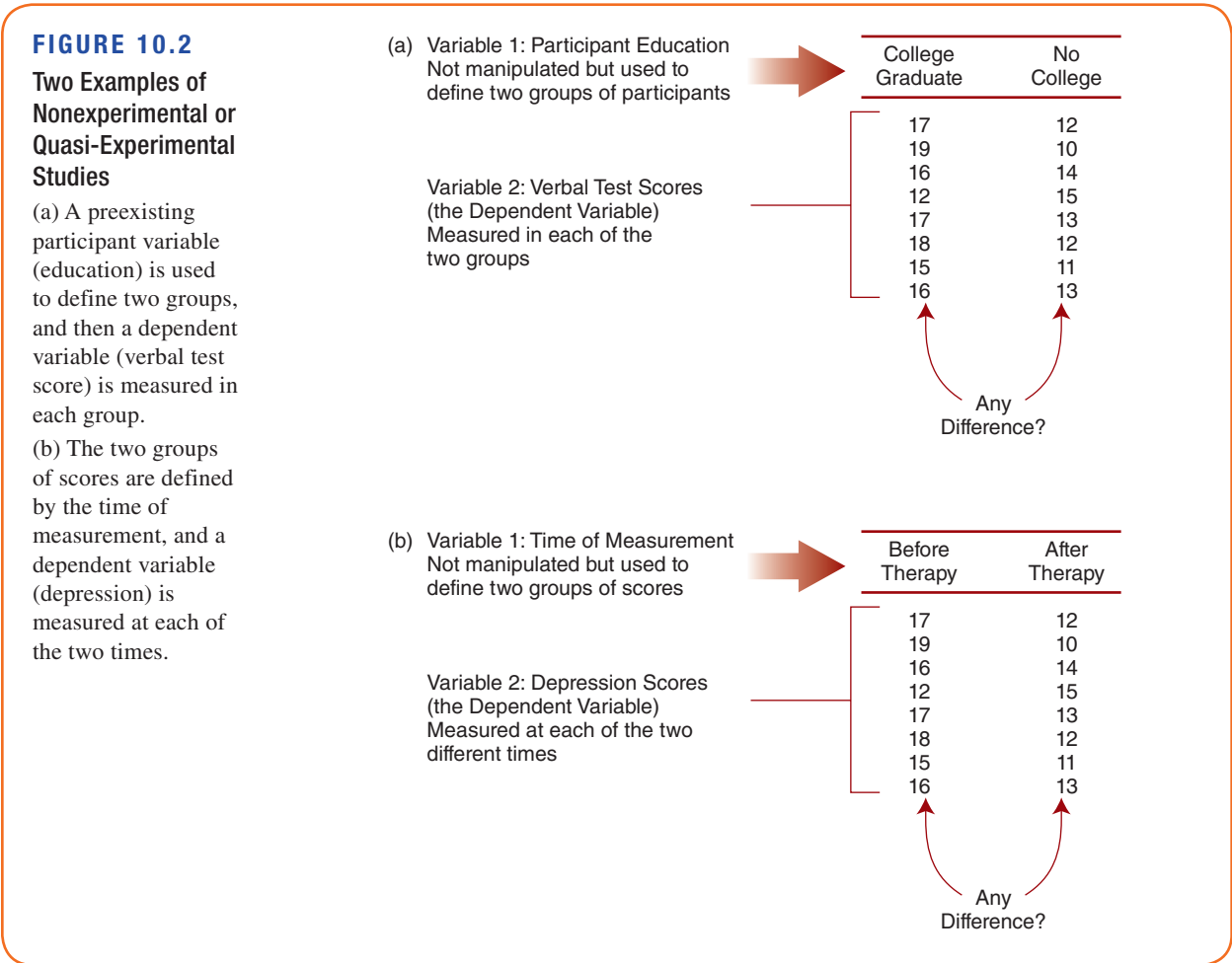


TABLE 10.1
An Overview of Research Designs for the Nonexperimental and Quasi-Experimental Research Strategies

	Between-Subjects Designs	Within-Subjects Designs
Type	Nonequivalent Group Designs	Pre-Post Designs
Purpose	Compares preexisting groups of individuals (i.e., groups that are not randomly assigned)	Compares two or more scores for one group of participants
Examples of designs	<ul style="list-style-type: none"> Differential research Posttest-only nonequivalent control group design Pretest-posttest nonequivalent control group design Cross-sectional developmental design 	<ul style="list-style-type: none"> Pretest-posttest design Time-series design Longitudinal developmental design

LEARNING CHECK

1. A nonexperimental design
 - a. makes no attempt to minimize threats to validity.
 - b. makes some attempts to minimize threats to validity.
 - c. controls extraneous variables, similar to an experiment.
 - d. manipulates one variable, similar to an experiment.
2. Which of the following is an example of a nonexperimental study?
 - a. A study comparing self-esteem scores for children with a learning disability versus scores for children without a learning disability
 - b. A study comparing depression scores for one group that is assigned to receive a therapy versus another group that is assigned not to receive a therapy
 - c. A study comparing performance in a room where the walls have been painted yellow versus performance in a room painted blue
 - d. A study comparing cognitive functioning scores for one group of Alzheimer's patients who are assigned to receive memory therapy versus another group that is assigned not to receive therapy

Answers appear at the end of the chapter.

10.2 Between-Subjects Nonexperimental and Quasi-Experimental Designs: Nonequivalent Group Designs

LEARNING OBJECTIVES

- LO2** Define a nonequivalent group design and identify examples of this research design when it appears in a research report.
- LO3** Explain how individual differences threaten the internal validity of a nonequivalent group design.
- LO4** Describe the two nonexperimental nonequivalent group designs (differential research and the posttest-only nonequivalent control group design) and the quasi-experimental nonequivalent group design (pretest–posttest nonequivalent control group design), and identify examples of these designs when they appear in a research report.
- LO5** Explain how a simple modification of the posttest-only nonequivalent control group design increases internal validity and produces a quasi-experimental design.

In Chapter 8, we introduced the between-subjects experimental design as a method of comparing two or more treatment conditions using a different group of participants in each condition. A common element of between-subjects experiments is the control of individual differences by assigning participants to specific treatment conditions. The goal is to balance or equalize the groups by using a random assignment process or by deliberately matching participants across treatment conditions. Note that the researcher attempts to create equivalent groups of participants by actively controlling which individuals go into which groups. There are occasions, however, when a researcher must examine preexisting groups. For example, a researcher may want to compare student performance for a high school that encourages students to use their phones and tablets during class with student performance in a high school that bans the use of electronic devices. In this study,

the researcher does not have control over which individuals are assigned to which group; the two groups of participants already exist. Because the researcher cannot use random assignment or matching to minimize the individual differences between groups, there is no assurance that the two groups are equivalent. In this situation, the research study is called a **nonequivalent group design**.

DEFINITION

A **nonequivalent group design** is a research study in which the different groups of participants are formed under circumstances that do not permit the researcher to control the assignment of individuals to groups, and the groups of participants are, therefore, considered nonequivalent. Specifically, the researcher cannot use random assignment to create groups of participants.

Threats to Internal Validity for Nonequivalent Group Designs

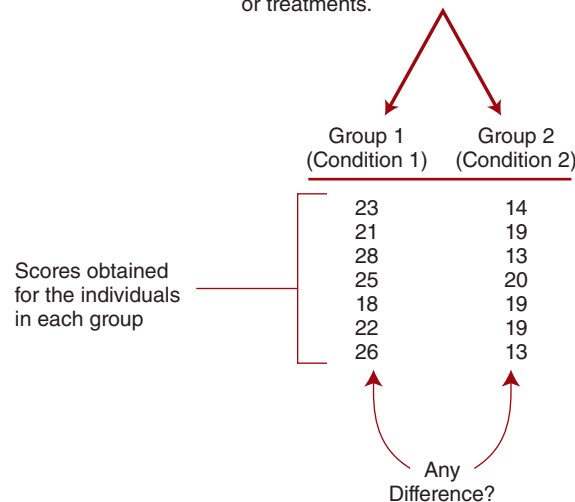
A general example of a nonequivalent group design is shown in Figure 10.3. Notice that the groups are differentiated by one specific factor that identifies the groups. In the example evaluating in-class electronic devices, the differentiating factor was the school policy: one high school encouraged use and one banned use. Typically, the purpose of the study is to show that the factor that differentiates the groups is responsible for causing the participants' scores to differ from one group to the other. For this example, the goal is to show that the school policy concerning electronic devices is responsible for the different levels of student performance in the two schools.

However, a nonequivalent group design has a built-in threat to internal validity that precludes an unambiguous cause-and-effect explanation. That threat was introduced in Chapter 6 as **individual differences** between groups. Recall that individual differences create a confound whenever the assignment procedure produces groups that have different participant characteristics. For example, the two high schools in the electronic device

FIGURE 10.3

The General Structure of a Nonequivalent Group Study

Nonequivalent groups (usually preexisting). The researcher has no control over the assignment of individuals to groups. The groups may experience different conditions or treatments.



study may differ in terms of student IQs, socioeconomic background, racial mixture, student motivation, and so on. These variables are all potentially confounding variables because any one of them could explain the differences between the two groups. Because the assignment of participants is not controlled in a study using nonequivalent groups, this type of research always is threatened by individual differences. You may recognize that a nonequivalent groups study is similar to the between-subjects experimental design presented in Chapter 8. However, the experimental design always uses some form of random assignment or matching to ensure equivalent groups. In a nonequivalent groups design, there is no random assignment and there is no assurance of equivalent groups.

In this section, we consider three common examples of nonequivalent group designs: (1) the differential research design, (2) the posttest-only nonequivalent control group design, and (3) the pretest–posttest nonequivalent control group design. The first two designs make no attempt to control or minimize individual differences as a confound and are nonexperimental designs. The third design is a modification of the posttest-only design and is classified as quasi-experimental because it does attempt to minimize the threat of individual differences as a confound.

Nonexperimental Designs with Nonequivalent Groups

The Differential Research Design

In most between-subjects research, individual differences are considered to be a problem that must be controlled by random assignment, matching groups, or some other process. However, there are research studies for which individual differences are the primary interest. For example, researchers are often interested in how behavior is influenced by gender differences, or how performance is influenced by age differences. In these situations, researchers deliberately create separate groups of participants based on a specific individual difference such as gender or age. Note that these studies involve no manipulation but simply attempt to compare preexisting groups that are defined by a particular participant characteristic. For example, a researcher may want to compare self-esteem scores for children from two-parent households with children from single-parent households. Note that the researcher does not control the assignment of participants to groups; instead, the participants are automatically assigned to groups based on a preexisting characteristic. For this example, the children are assigned to groups based on the number of parents in the household. Although this type of study compares groups of participants (like a between-subjects experiment), the researcher does not manipulate the treatment conditions and does not have control over the assignment of participants to groups. Again, this is not a true experiment.

A research study that simply compares preexisting groups is called a **differential research design** because its goal is to establish differences between the preexisting groups. This type of study often is called *ex post facto* research because it looks at differences “after the fact,” that is, at differences that already exist between groups. Because the differential research design makes no attempt to control the threat of individual differences between groups, it is classified as a nonexperimental research design. For example, a study by InsuranceHotline.com (Romanov, 2006) found significant differences in the number of car accidents and tickets for people with different astrological signs. Libras and Aquarians were the worst offenders, while Leos and Geminis had the best overall records. Clearly, people who have different astrological signs form preexisting groups that were not manipulated or created by the researchers. In another somewhat bizarre study, DeGoede, Ashton-Miller, Liao, and Alexander (2001) swung a pendulum at their participants and measured how quickly the participants moved their hands to intercept the approaching object. This study examined gender differences and age differences, once again comparing scores for preexisting groups.

Many research questions in social psychology and personality theory are focused on differences between groups or categories of people. Personality theorists, for example, often classify people according to attachment style, and then examine differences between individuals with different styles. Many research studies have demonstrated that the style of mother/child attachment formed in infancy persists as an individual develops and is related to adult intimacy and romantic relationships (Brennan & Morris, 1997; Feeney, 2004). Differential research and correlational research, which also examines relationships between variables, are compared in Box 10.1.

DEFINITION

A **differential research design** is a research study that simply compares preexisting groups. A differential study uses a participant characteristic such as gender, race, or personality to automatically assign participants to groups. The researcher does not randomly assign individuals to groups. A dependent variable is then measured for each participant to obtain a set of scores within each group. The goal of the study is to determine whether the scores for one group are consistently different from the scores of another group. Differential research is classified as a nonexperimental research design.

BOX 10.1 Differential Research and Correlational Research

Many researchers place differential research in the same category as correlational research. In many ways, differential research is similar to the correlational research strategy (introduced in Chapter 6 and discussed in Chapter 12). In differential and correlational studies, a researcher simply observes two naturally occurring variables without any interference or manipulation. The subtle distinction between differential research and correlational research is whether one of the variables is used to establish separate groups to be compared. In differential research, participant differences in one variable are used to create separate groups, and measurements of the second variable are made within each group. The

researcher then compares the measurements for one group with the measurements for another group, typically looking at mean differences between groups (Figure 10.4a). A correlational study, on the other hand, treats all the participants as a single group and simply measures the two variables for each individual (Figure 10.4b). Although differential research and correlational research produce different kinds of data and involve different statistical analyses, their results should receive the same interpretation. Both designs allow researchers to establish the existence of relationships and to describe relationships between variables, but neither design permits a cause-and-effect explanation of the relationship.

The Posttest-Only Nonequivalent Control Group Design

Nonequivalent groups are commonly used in applied research situations in which the goal is to evaluate the effectiveness of a treatment administered to a preexisting group of participants. A second group of similar but nonequivalent participants is used for the control condition. Note that the researcher uses preexisting groups and does not control the assignment of participants to groups. In particular, the researcher does not randomly assign individuals to groups.

For example, Skjoeveland (2001) used a nonequivalent group study to examine the effects of street parks on social interactions among neighbors. Parks were constructed in one area, and the people living in that neighborhood were compared with two control groups that did not get new parks. Similarly, Goldie, Schwartz, McConnachie, and

FIGURE 10.4
Comparison of Differential Research and Correlational Research

(a) The structure of a differential study examining the relationship between self-esteem and academic performance. Note that one of the two variables (self-esteem) is used to create groups, and the other variable (academic performance) is measured to obtain scores within each group.

(b) The structure of a correlational study examining the relationship between self-esteem and academic performance. Note that there is only one group of participants with two scores (self-esteem and academic performance) measured for each individual.

(a) A differential study examining the relationship between self-esteem and academic performance.

Variable 1: Self-Esteem
 Not manipulated but used to define two groups of participants

Variable 2: Academic Performance (the Dependent Variable)
 Measured in each of the two groups

	High Self-Esteem Group	Low Self-Esteem Group
	17	12
	19	10
	16	14
	12	15
	17	13
	18	12
	15	11
	16	13

Any Difference?

(b) A correlational study examining the relationship between self-esteem and academic performance.

Participant	Variable 1 Self-Esteem	Variable 2 Academic Performance
A	84	16
B	72	10
C	90	19
D	68	13
E	77	16
F	81	12
G	85	17
H	76	13

Morrison (2001) evaluated a new ethics course for medical students by comparing the group of students who took the new course with a nonequivalent group who did not take the course. This type of research is called a **nonequivalent control group design**.

DEFINITION

A **nonequivalent control group design** uses preexisting groups, one of which serves in the treatment condition and the other in the control condition. The researcher does not randomly assign individuals to the groups.

A **posttest-only nonequivalent control group design** is one common example of a nonequivalent control group design. This type of study is occasionally called a *static group comparison*. In this design, one group of participants is given a treatment and then is measured after the treatment (this is the posttest). The scores for the treated group are then compared with the scores from a nonequivalent group that has not received the treatment (i.e., the control group). This design can be represented schematically using a series of Xs and Os to represent the series of events experienced by each group. In this notation system, developed by Campbell and Stanley (1963), the letter X corresponds to the

treatment, and the letter *O* corresponds to the observation or measurement. Thus, the treatment group experiences the treatment first (X) followed by observation or measurement (O). The control group does not receive any treatment but is simply observed (O). The two groups are represented as follows:

X O (treatment group)
O (nonequivalent control group)

If a design includes random assignment of participants to groups in the study, an R is placed as the first symbol in each line of notation. The absence of an R in this schematic reflects the use of preexisting groups, as in a nonequivalent control group design.

DEFINITION

A **posttest-only nonequivalent control group design** compares two nonequivalent groups of participants. One group is observed (measured) after receiving a treatment, and the other group is measured at the same time but receives no treatment. This is an example of a nonexperimental research design.

The posttest-only nonequivalent control group design is commonly used when a treatment is given to a well-defined, isolated cluster of individuals, such as the students in a classroom or the patients in a clinic. In these situations, a separate cluster (e.g., another classroom or another clinic) is often selected as the nonequivalent control group. The neighborhood parks program discussed earlier is a good example of this type of study. The program is administered in one neighborhood, and other neighborhoods that do not receive the parks serve as a nonequivalent control group. Note that the purpose of the study is to show that the parks have an effect by demonstrating a difference in social interactions for the two groups.

Although this kind of research design appears to ask a cause-and-effect question (Do the parks cause a difference?), the research design does not protect against individual differences as a confound. As we noted earlier, the people in the two neighborhoods could differ on a variety of variables (in addition to the parks), and any of these other variables could be responsible for the difference in social interactions. Because the posttest-only nonequivalent control group design does not address the threat of individual differences as a confound, it is considered a nonexperimental design.

A Quasi-Experimental Design with Nonequivalent Groups

The Pretest–Posttest Nonequivalent Control Group Design

A much stronger design can be created with a small modification of the posttest-only nonequivalent control group design. The modification involves adding a pretest that obtains measurements of both groups before the treatment is administered. The resulting design is called a **pretest–posttest nonequivalent control group design** and can be represented as follows:

O X O (treatment group)
O O (nonequivalent control group)

In this design, the first step is to observe (measure) both groups. The treatment is then administered to one group, and, following the treatment, both groups are observed again.

The addition of the pretest measurement allows researchers to address the problem of individual differences as a confound that exists with all nonequivalent group research. Specifically, the researcher can now compare the observations before treatment to establish whether the two groups really are similar. If the groups are found to be similar before

treatment, the researcher has evidence that the participants in one group are not substantially different from the participants in another group, and the threat of individual differences is reduced. Note, however, that the pretest scores simply allow the researcher to ensure that the two groups are similar with respect to one specific variable. Other potentially important variables are not measured or controlled. Thus, the threat of individual differences is reduced, but it is certainly not eliminated.

This type of design also allows a researcher to compare the pretest scores and posttest scores for both groups to help determine whether the treatment or some other, time-related factor is responsible for changes. In Chapter 9, we introduced a set of time-related factors such as history and maturation that can threaten internal validity. In the pretest–posttest nonequivalent groups design, however, these time-related threats are minimized because both groups are observed over the same time period and, therefore, should experience the same time-related factors. If the participants are similar before treatment but different after treatment, the researcher can be more confident that the treatment has an effect. On the other hand, if both groups show the same degree of change from the pretest to the posttest, the researcher must conclude that some factor other than the treatment is responsible for the change. Thus, the pretest–posttest nonequivalent control group design reduces the threat of individual differences, limits threats from time-related factors, and can provide some evidence to support a cause-and-effect relationship. As a result, this type of research is considered quasi-experimental.

DEFINITION

A **pretest–posttest nonequivalent control group design** compares two nonequivalent groups. One group is measured twice, once before a treatment is administered and once after. The other group is measured at the same two times but does not receive any treatment. Because this design attempts to limit threats to internal validity, it is classified as quasi-experimental.

Although the addition of a pretest to the nonequivalent control group design reduces some threats to internal validity, it does not eliminate them completely. In addition, the fact that the groups are nonequivalent and often are in separate locations creates the potential for other threats. Specifically, it is possible for a time-related threat to affect the groups differently. For example, one group may be influenced by outside events that are not experienced by the other group. The students in one high school may be enjoying a winning football season, whereas students in another school may be depressed because their team is losing every game. In Chapter 9, we identified the influence of outside events as history effects. When history effects differ from one group to another, they are called differential history effects. The **differential effects** can be a confounding variable because any differences observed between the two groups may be explained by their different histories. In a similar way, other time-related influences such as maturation, instrumentation, testing effects, and regression may be different from one group to another, and these differential effects can threaten the internal validity of a nonequivalent group study.

LEARNING CHECK

1. For which of the following studies does the researcher not control which individuals are assigned to which group?
 - a. Between-subjects experiment
 - b. Within-subjects experiment
 - c. Nonequivalent group design
 - d. Pre–post design

2. Which of the following is the primary threat to internal validity for nonequivalent group designs?
 - a. History effects
 - b. Instrumentation effects
 - c. Regression toward the mean
 - d. Individual differences between treatment groups
3. Which research design is used by a researcher comparing self-esteem scores for children from divorced families versus scores for children from families with no divorce?
 - a. Differential research design
 - b. Pretest-only nonequivalent control group design
 - c. Pretest–posttest nonequivalent control group design
 - d. Time-series design
4. Which of the following is the primary advantage of a pretest-posttest nonequivalent control group design, in comparison to other nonequivalent group designs?
 - a. The posttest scores can help reduce threats from history effects.
 - b. The posttest scores can eliminate threats from history effects.
 - c. The pretest scores can help reduce the threat of individual differences between groups.
 - d. The pretest scores can eliminate the threat of individual differences between groups.

Answers appear at the end of the chapter.

10.3

Within-Subjects Nonexperimental and Quasi-Experimental Designs: Pre-Post Designs

LEARNING OBJECTIVES

- LO6** Define a pre–post design and identify examples of this research design when it appears in a research report.
- LO7** Identify the threats to internal validity for pre–post designs.
- LO8** Describe the nonexperimental pretest–posttest design and the quasi-experimental time-series design, and identify examples of these designs when they appear in a research report.
- LO9** Explain how replacing the single observation before and after treatment with a series of observations converts the pretest–posttest design into a quasi-experimental time-series design by minimizing threats to internal validity.

The second general category of nonexperimental and quasi-experimental designs consists of studies in which a series of observations is made over time. Collectively, such studies are known as **pre–post designs**. In a typical pre–post study, one group of participants is observed (measured) before and after a treatment or event. The goal of the pre–post design is to evaluate the influence of the intervening treatment or event by comparing the observations made before treatment with the observations made after treatment.

You may have noticed that a pre–post design is similar to the pretest–posttest nonequivalent control group design discussed earlier. However, a pre–post design has no control group. In addition, the primary focus of a pretest–posttest nonequivalent control group design is to compare the treatment group and the control group, not to compare the pretest scores with the posttest scores. As a result, the pretest–posttest nonequivalent control group design is primarily a nonequivalent group design, and we have classified it in that category.

DEFINITION

A **pre–post design** is a research study in which a series of observations is made over time for one group of participants.

Threats to Internal Validity for Pre–Post Designs

Whenever the same group of individuals is observed repeatedly over time, time-related factors can threaten internal validity. As we noted in Chapter 9, the five categories of time-related threats are **history**, **instrumentation**, **order effects**, **maturation**, and **statistical regression**. Clearly, pre–post studies are vulnerable to these threats; any differences found between the pretreatment observations and the posttreatment observations could be explained by history, instrumentation, order effects, maturation, or regression (see Chapter 9, pp. 214–217). You may recognize that a pre–post design is similar to the within-subjects experimental design presented in Chapter 9. However, the experimental design uses counterbalancing to control order effects and other time-related threats to internal validity. In a pre–post design, it is impossible to counterbalance the order of treatments. Specifically, the before-treatment observations (pretest) must always precede the after-treatment observations (posttest).

In general, the internal validity of a pre–post study is threatened by a variety of factors related to the passage of time. During the time between the first observation and the last observation, any one of these factors could influence the participants and cause a change in their scores. Unless these factors are controlled or minimized by the structure of the research design, a pre–post study cannot approach the internal validity of a true experiment. In this section, we introduce two examples of pre–post studies: the one-group pretest–posttest design and the time-series design. The first of these designs makes no attempt to control the threats to internal validity and, therefore, is classified as nonexperimental. The second design manages to minimize most threats to internal validity and is classified as quasi-experimental.

A Nonexperimental Pre–Post Design

The Pretest–Posttest Design

The simplest version of the pre–post design consists of one observation for each participant made before the treatment or event, and one observation made after it. Schematically, this simple form can be represented as follows:

O X O

This type of study is called a **pretest–posttest design**. For example, a political consultant could evaluate the effectiveness of a new political television commercial by assessing voters' attitudes toward a candidate before and after they view the commercial. The results from this study may demonstrate a change in attitude. However, because this design makes no attempt to control the many threats to internal validity, the study cannot conclude that the change was caused by the intervening commercial. Because the pretest–posttest study precludes a cause-and-effect conclusion, this type of research is classified as nonexperimental.

DEFINITION

In the nonexperimental **pretest–posttest design**, each individual in a single group of participants is measured once before treatment and once after treatment.

A Quasi-Experimental Pre–Post Design

The Time-Series Design

A simple modification of the pretest–posttest design minimizes the threats to internal validity and produces a much stronger research design. The modification consists of using a series of observations, in place of the single observation, before and after the treatment or event. The result is called a **time-series design** and can be represented as follows:

O O O X O O O

DEFINITION

A **time-series design** has a series of observations for each participant before a treatment or event and a series of observations after the treatment or event. A treatment is a manipulation administered by the researcher, and an event is an outside occurrence that is not controlled or manipulated by the researcher.

The intervening treatment or event (X) may or may not be manipulated by the researcher. For example, a doctor may record blood pressure for a group of executives before and after they complete relaxation training. Or a researcher may evaluate the effect of a natural disaster such as earthquake or flood on the well-being of a group of students by recording visits to the school nurse for the months before and after the disaster. In one case, the researcher is manipulating a treatment (the relaxation training) and in the other case, the researcher is studying a nonmanipulated event (an earthquake). A study in which the intervening event is not manipulated by the researcher is sometimes called an **interrupted time-series design**.

Occasionally, a time-series study is used to investigate the effect of a predictable event such as a legal change in the drinking age or speed limit. In this case, researchers can begin collecting data before the event actually occurs. However, it often is impossible to predict the occurrence of an event such as an earthquake, so it is impossible for researchers to start collecting data just before one arrives. In this situation, researchers often rely on archival data, such as police records or hospital records, to provide the observations for the time-series study.

In a time-series design, the pretest and posttest series of observations serve several valuable purposes. First, the pretest observations allow a researcher to see any trends that may already exist in the data before the treatment is even introduced. Trends in the data are an indication that the scores are influenced by some factor unrelated to the treatment. For example, practice or fatigue may cause the scores to increase or decrease over time before a treatment is introduced. Similarly, instrumentation effects, maturation effects, or regression should produce noticeable changes in the observations before treatment. On the other hand, if the data show no trends or major fluctuations before the treatment, the researcher can be reasonably sure that these potential threats to internal validity are not influencing the participants. Thus, the series of observations allows a researcher to minimize most threats to internal validity. As a result, the time-series design is classified as quasi-experimental.

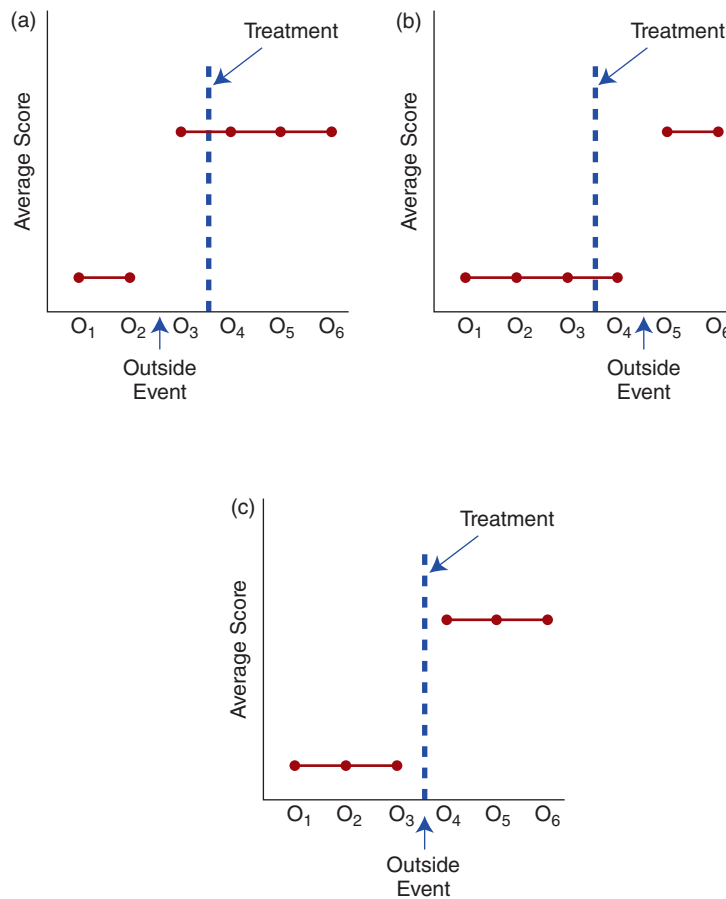
It is possible for an external event (history) to be a threat to internal validity in time-series designs, but only if the event occurs simultaneously with the treatment. If the outside event occurs at any time other than the introduction of the treatment, it should be easy to separate the history effects from the treatment effects. For example, if the participants are affected by an outside event that occurs before the treatment, the effect should be apparent in the observations that occur before the treatment. Figure 10.5 shows three possible outcomes in which the treatment has no effect but instead the participants are

FIGURE 10.5
How Data in a Time-Series Study Might Be Affected by an Outside Event

(a) The event occurs and influences scores before the treatment is introduced.

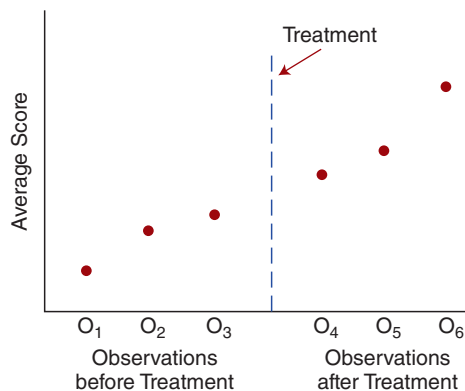
(b) The event occurs and influences scores after the treatment.

(c) The event and the treatment occur simultaneously, and it is impossible to determine which is influencing the scores.



influenced by an outside event. Notice that a problem occurs only when the treatment and the outside event coincide perfectly. In this case, it is impossible to determine whether the change in behavior was caused by the treatment or by the outside event. Thus, history effects (outside events) are a threat to validity only when there is a perfect correspondence between the occurrence of the event and the introduction of the treatment. Suppose, for example, that a clinical researcher uses a time-series design to evaluate a treatment for depression. Observations are made for a group of depressed clients for a week before therapy begins, and a second series of observations is made for a week after therapy. The observations indicate significant improvement after therapy. However, suppose that, by coincidence, there is an abrupt change in the weather on the same day that therapy starts; after weeks of cold, dark, rainy days, it suddenly becomes bright, sunny, and unseasonably warm. Because the weather changed at the same time as the treatment, it is impossible to determine what caused the clients' improvement. Was the change caused by the treatment or by the weather?

The series of observations after the treatment or event also allows a researcher to observe any posttreatment trends. For example, it is possible that the treatment has only a temporary effect that quickly fades. Such a trend would be seen in the series of posttreatment observations. Figure 10.6 demonstrates how a series of observations can be more informative than single observations made before and after treatment. The figure shows a

**FIGURE 10.6****A Time Series Study with Multiple Observations before and after Treatment**

The series of observations makes it possible to see the trend in the data that existed before the treatment was administered and that continues after the treatment.

series of scores that are consistently increasing before treatment and continue to increase in an uninterrupted pattern after treatment. In this case, it does not appear that the treatment has any effect on the scores. However, if the study included only one observation before treatment and only one observation after treatment (O_3 and O_4), the results would indicate a substantial increase in scores following the treatment, suggesting that the treatment did have an effect.

Single-Case Applications of Time-Series Designs

The time-series design was introduced as a research study that involves observing a group of participants at several different times. However, this design is often applied to single individuals or single organizations. For example, a high school could evaluate the effects of an anger-management program by monitoring the number of fights at the school for 3 months before the program is enacted and for 3 months afterward. This is an example of a time-series design, but it involves measurements for one high school, not for individual participants. Similarly, a therapist could monitor instances of compulsive behavior in one client for 3 weeks before therapy and for 3 weeks after. This is an example of a time-series design applied to a single individual. Research designs that focus on a single case, rather than a group of participants, are occasionally called single-case time-series designs but are more often classified as **single-case** or **single-subject designs**. Single-case designs are discussed in Chapter 14.

LEARNING CHECK

1. What design is being used by a researcher comparing depression scores before and after treatment in one group of clients?
 - a. Pretest–posttest nonequivalent control group design
 - b. Differential research design
 - c. Pre–post design
 - d. Posttest-only nonequivalent control group design

2. Which of the following is common in within-subjects experimental designs but is impossible in a pre–post design?
 - a. Randomly assign participants
 - b. Counterbalance order of treatments
 - c. Control for differential effects
 - d. Generalize the results
3. A clinical psychologist measures body satisfaction for a group of clients diagnosed with anorexia nervosa each day for 1 week before and for 1 week after the psychologist begins a series of group therapy sessions. What kind of design is being used?
 - a. Time-series
 - b. Interrupted time-series
 - c. Equivalent time-samples
 - d. Pretest–posttest design
4. What can a researcher determine by using a series of observations before treatment?
 - a. If the treatment has a temporary effect.
 - b. If the treatment has a permanent effect.
 - c. If scores are influenced by individual differences between groups.
 - d. If scores are influenced by some factor unrelated to the treatment.

Answers appear at the end of the chapter.

10.4 Developmental Research Designs

LEARNING OBJECTIVE

LO10 Define cross-sectional and longitudinal designs, identify these designs when they appear in a research report, and describe the strengths and weaknesses of each design.

Developmental research designs are another type of nonexperimental research that can be used to study changes in behavior that relate to age. The purpose of developmental research designs is to describe the relationship between age and other variables. For example, if a researcher is interested in how language ability changes with age, a developmental research design would be appropriate.

DEFINITION

Developmental research designs are used to examine changes in behavior related to age.

Two basic types of developmental research designs are the cross-sectional design and the longitudinal design. Each has its strengths and weaknesses.

The Cross-Sectional Developmental Research Design

The **cross-sectional developmental research design** is a between-subjects design that uses a separate group of participants for each of the ages being compared. A dependent variable is measured for the individuals in each group, and the groups are compared to determine whether there are age differences. For example, a researcher who wants to

examine the relationship between IQ and aging could select three different groups of people—40-year-olds, 60-year-olds, and 80-year-olds—and could then measure IQ for each group (see Figure 10.7).

DEFINITION

The **cross-sectional developmental research design** uses different groups of individuals, each group representing a different age. The different groups are measured at one point in time and then compared.

The term *cross-sectional* is also used to describe surveys that classify people into different categories or subgroups. Here we are discussing cross-sectional developmental designs.

For example, Oppenheimer (2006) used a cross-sectional study to examine changes in people's belief in a just and orderly world as they mature from 12 to 22 years of age. Comparing results from six age groups of students from secondary school through college, the study found that belief in a just world declined as the students aged.

A cross-sectional design is an example of a between-subjects nonexperimental design, specifically, a nonequivalent group design. The different groups of participants are not created by manipulating an independent variable; instead, the groups are defined by a preexisting participant variable (age). Also, the researcher does not randomly assign participants to groups; instead, group assignment is predetermined by each participant's age. Earlier in this chapter, we defined this kind of study as differential research. However, when a study evaluates differences related to age, the design is typically called a cross-sectional study.

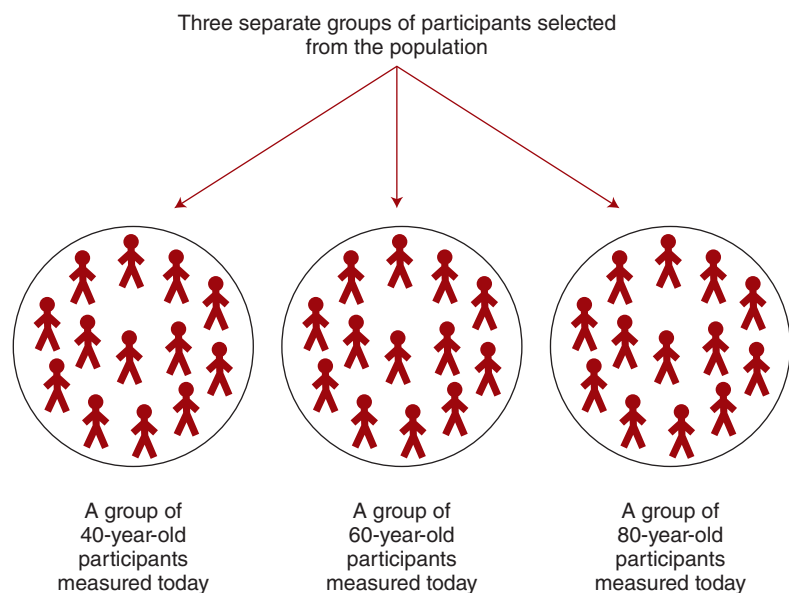
Strengths and Weaknesses of the Cross-Sectional Developmental Design

One obvious advantage of the cross-sectional design is that a researcher can observe how behavior changes as people age without waiting for a group of participants to grow older. The example in Figure 10.7 shows that we do not need to follow a group of people over the next 40 years to observe the differences that occur during 40 years of aging. With the cross-sectional design, data can be collected in a short period of time. In addition, cross-sectional research does not require long-term cooperation between the researcher

FIGURE 10.7

The Structure of a Cross-Sectional Developmental Research Design

Three separate groups of participants are selected to represent three different ages.



and the participant; that is, the researcher does not have to incur the time and expense of tracking people down for 40 years and encouraging them to continue in the research.

The cross-sectional research design is not without its weaknesses. One weakness is that a researcher cannot say anything about how a particular individual develops over time because individuals are not followed over years. A more serious problem is that factors other than age may differentiate the groups. For example, 40-year-old women not only are younger than 80-year-old women but also grew up in very different environments. Opportunities for education, employment, and social expectations were very different for these two groups of women. In general, individuals who are the same age and have lived in similar environments are called **cohorts**. For example, today's preschool children, today's adolescents, and today's college students would be three sets of cohorts. In addition to being different ages, these three groups have also experienced different social and cultural environments. The environmental factors that differentiate one age group from another are called **cohort effects**, or **generation effects**, and they may be responsible for differences observed between the groups instead of age. As a result, generation effects are a threat to internal validity for a cross-sectional design. Specifically, in a cross-sectional study, the generation of the participants changes from one group to another so that the apparent relationship between age and other variables may actually be caused by generation differences. For example, suppose that you compared computer literacy for three groups: one with 40-year-olds, one with 60-year-olds, and one with 80-year-olds. Almost certainly, the data would show a decline in literacy as the participants grow older. However, you should not assume that this difference should be attributed to age. Specifically, you should not conclude that losing computer literacy is a consequence of aging. The 80-year-old participants did not lose computer literacy as they aged; instead, they spent most of their lives in an environment without computers and never had computer literacy to start with.

DEFINITIONS

Cohorts are individuals who were born at roughly the same time and grew up under similar circumstances.

The terms **cohort effects** and **generation effects** refer to differences between age groups (or cohorts) caused by unique characteristics or experiences other than age.

A great example of how cohort effects can influence the results of research comes from studies on the relationship between IQ and age (Baltes & Schaie, 1974). Many research studies show that IQ declines between the ages of 20 and 50. On the other hand, a separate group of studies shows little or no decline in IQ between the ages of 20 and 50. How can these two sets of data be so completely different? One answer lies in the designs of the studies. The data that show IQ declining with age are generally obtained with cross-sectional studies. The problem with cross-sectional designs is that the results may be influenced by cohort effects because the groups being compared are not only different in age but also lived in different decades. The fact that the groups grew up and lived in different environments could affect their IQ scores and be the source of the IQ differences between the groups. Cohort effects are more likely when there are large age differences between groups. The second set of studies, showing stable IQ, monitored the same set of people over a long period of time. This type of research design is called the longitudinal research design and is discussed next. Incidentally, other researchers have raised serious questions about this interpretation of the aging and IQ relationship (Horn & Donaldson, 1976).

The Longitudinal Developmental Research Design

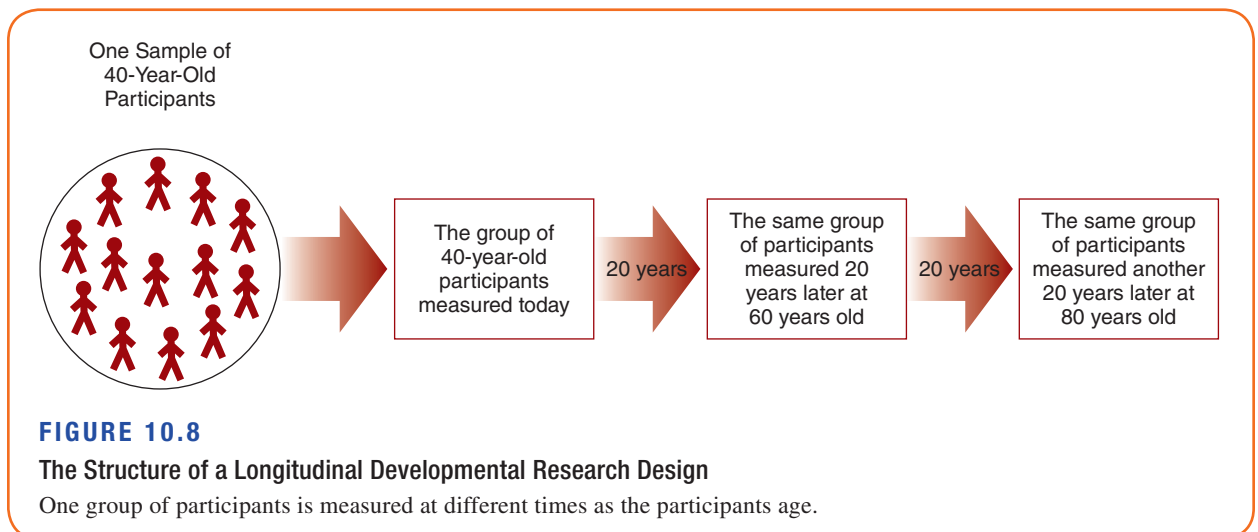
The **longitudinal developmental research design** involves measuring a variable in the same group of individuals over a period of time (typically every few months or every few years). The individuals are usually cohorts, roughly the same age, who have grown up in similar circumstances. Several measurements of a particular variable are made in the same individuals at two or more times in their lives to investigate the relationship between age and that variable. For example, to examine IQ and age using the longitudinal approach, a researcher might measure IQ in a group of 40-year-olds and then measure the same individuals again at ages 60 and 80 (Figure 10.8).

DEFINITION

The **longitudinal developmental research design** examines development by observing or measuring a group of cohorts over time.

A longitudinal study is an example of a within-subjects nonexperimental design, specifically, a one-group pretest–posttest design. In a longitudinal design, however, no treatment is administered; instead, the “treatment” is age. That is, a longitudinal study can be described as a set of observations followed by a period of development or aging, then another set of observations. The differences between the initial observations and the final observations define the effects of development. Thus, longitudinal studies can be viewed as a kind of pretest–posttest study. However, when this type of research is used to evaluate development or the effects of age, the design is typically called a longitudinal study.

The distinction between a longitudinal design and a time-series design is not always clear. For example, Sun (2001) examined the well-being of a group of adolescents for an extended period before and after their parents’ divorces. This can be viewed as a longitudinal study because it examined the changes that occur over time for a group of participants. However, it also can be viewed as a pre–post time-series study that compared a series of observations made before an event (the divorce) with a series of observations made after the event.



Strengths and Weaknesses of the Longitudinal Developmental Design

A major strength of the longitudinal research design is the absence of cohort effects because the researcher examines one group of people over time rather than comparing groups that represent different ages and come from different generations. Second, with longitudinal research, a researcher can discuss how a single individual's behavior changes with age. However, longitudinal research is extremely time-consuming, both for the participants (it requires a big commitment to continue in the study) and the researcher (the researcher must stay interested in the research and wait for years to see the final results). In addition, these designs are very expensive to conduct because researchers need to track people down and persuade them, when necessary, to come back to participate in the study. If the study spans many years, there is the additional expense of training new experimenters to take over the study. Furthermore, these designs are subject to high dropout rates of participants. People lose interest in the study, move away, or die. When participants drop out of a study, it is known as **participant attrition** (or **participant mortality**), and it may weaken the internal validity of the research. Specifically, if the participants who drop out are systematically different from those who stay, the group at the end of the study may have different characteristics from the group at the beginning. For example, if the less-motivated individuals drop out, then the group at the end is more motivated than the group at the beginning. The higher level of motivation (rather than age) may explain any changes that are observed over time. (The issue of participant attrition is discussed in more detail in Chapter 9.) A final weakness of the longitudinal research design is that the same individuals are measured repeatedly. It is possible that the scores obtained late in the study are partially affected by previous experience with the test or measurement procedure. (In Chapter 9, we discussed order effects as a threat to internal validity.)

Table 10.2 summarizes the strengths and weaknesses of cross-sectional and longitudinal developmental research designs.

Cross-Sectional Longitudinal Designs

Although the term cross-sectional longitudinal design may appear to be internally contradictory, there are research studies for which this label is appropriate. Specifically, many research studies compare the results obtained from separate samples (like a cross-sectional design) that were obtained at different times (like a longitudinal design). Typically, this type of research is examining the development of phenomena other than individual aging. For example, Pope, Ionescu-Pioggia, and Pope (2001) examined how drug use and lifestyle have changed over the past 30 years by returning to the same college every 10 years to measure freshman attitudes and behaviors. Because Pope and his colleagues measured different individuals every 10 years, this research combines elements of cross-sectional

TABLE 10.2
Strengths and Weaknesses of Cross-Sectional and Longitudinal Developmental Research Designs

	Longitudinal Research	Cross-Sectional Research
Strengths	No cohort or generation effects Assesses individual behavior changes	Time-efficient No long-term cooperation required
Weaknesses	Time-consuming Participant dropout may create bias Potential for practice effects	Individual changes not assessed Cohort or generation effects

TABLE 10.3**A Summary of Nonexperimental and Quasi-Experimental Research Designs**

(Note that each quasi-experimental design is created by modifying a nonexperimental design.)

	Between-Subjects Designs (Nonequivalent Group Designs)	Within-Subjects Designs (Pre–Post Designs)
Nonexperimental	Differential research Compares preexisting groups (i.e., college grad/ no college) Posttest-only nonequivalent control group design Compares preexisting groups after one group receives a treatment Cross-sectional developmental design Compares preexisting groups differing in age	Pretest–posttest design Compares pretreatment and posttreatment scores for one group of participants Longitudinal developmental design Observes one group of individuals at different points in time
Quasi-experimental	Pretest–posttest nonequivalent control group design Adds a pretest to the posttest-only design	Time-series design Replaces the single pre and post scores in a pretest– posttest design with a series of measurements

and longitudinal designs. In a similar study, Mitchell, Wolak, and Finkelhor (2007) examined trends in youth reports of unwanted exposure to pornography on the Internet. This study compared results from a survey of 10- to 17-year-old Internet users in the year 2000 with an equivalent survey of a different sample in the year 2005. Although both of these studies are examining development (or social evolution) over time, neither is a purely longitudinal or a purely cross-sectional design. Nonetheless, you are likely to find this type of research is occasionally described as longitudinal or cross-sectional. Because the design is not clearly one or the other, we hedge a little and classify this research *cross-sectional longitudinal*.

The complete set of quasi-experimental and nonexperimental research designs, including developmental designs, is summarized in Table 10.3.

LEARNING CHECK

1. A research study evaluates changes in behavior related to age by examining different groups of individuals with each group representing a different age. What is the name for this research design?
 - a. A time-series design
 - b. An interrupted time-series design
 - c. A cross-sectional developmental design
 - d. A longitudinal developmental design
2. A research study evaluates changes in behavior related to age by examining one group of participants who are all roughly the same age, at different times. What is the name for this research design?
 - a. A time-series design
 - b. An interrupted time-series design
 - c. A cross-sectional developmental design
 - d. A longitudinal developmental design

3. A cross-sectional developmental design is an example of which general category of research designs?
 - a. Nonequivalent group designs
 - b. Pretest–posttest designs
 - c. Time-series designs
 - d. Interrupted time-series designs

Answers appear at the end of the chapter.

10.5 Applications, Statistical Analysis, and Terminology for Nonexperimental, Quasi-Experimental, and Developmental Designs

LEARNING OBJECTIVES

- LO11** Identify the statistical techniques that are appropriate for each nonexperimental, quasi-experimental, and developmental design and explain the strengths and weaknesses of two-group compared to multiple-group designs.
- LO12** Explain how the terms quasi-independent variable and dependent variable are used in nonexperimental, quasi-experimental, and developmental research.

Application and Analysis

The application and analysis of the between-subjects designs presented in this chapter (non-equivalent group designs, including cross-sectional designs) follows exactly the same pattern as the application and analysis of between-subjects experiments presented in Chapter 8 (pp. 204–207). Similarly, the application and analysis of within-subjects designs (pre–post and longitudinal) is the same as that presented for within-subjects experiments in Chapter 9 (pp. 233–234). The only exception to this rule is the quasi-experimental pretest–posttest nonequivalent control group design, which includes within-subjects and between-subjects components and is discussed at the end of this section.

Two group designs have the advantage of simplicity; they are easy to set up and the results are easy to understand. However, a two-group does not provide the full functional relationship between variables that is available in a multigroup design. When the data consist of numerical scores, then the statistical analysis consists of comparing means with either a *t* test (independent- or repeated-measures) for two means or a single-factor analysis of variance (independent- or repeated-measures) for multiple means. For non-numerical data, the appropriate statistical analysis for a between-subjects design is a chi-square test for independence. These statistical tests are presented in Chapter 15.

The Pretest–Posttest Nonequivalent Control Group Design

If the data consist of numerical scores, then the appropriate statistical analysis is a two-factor, mixed design analysis of variance (the pre–post factor is within-subjects and the group factor is between-subjects). This analysis is not covered in this book but is available on most statistical software programs such as SPSS. If you are comparing the pre–post

means for one of the groups, then a repeated-measures t test can be used. Also, if you are comparing the two group means for either the pretest or the posttest scores, then an independent-measures t test is appropriate.

Terminology in Nonexperimental, Quasi-Experimental, and Developmental Designs

In a true experiment, the researcher manipulates an independent variable to create treatment conditions and then measures a dependent variable (scores) in each condition; scores in one condition are compared with the scores obtained in another condition. In nonexperimental and quasi-experimental research, no independent variable is manipulated. Nonetheless, nonexperimental studies do involve comparing groups of scores. In nonequivalent group studies, for example, the scores from one group of participants are compared with the scores from a different group. In pre–post studies, the scores obtained before the treatment are compared with the scores obtained after the treatment. In general, the variable that differentiates the groups (or sets of scores) is similar to the independent variable in an experiment and is often called an independent variable. However, this variable is more accurately referred to as a **quasi-independent variable**. As in an experiment, the score obtained for each participant is called the **dependent variable**.

DEFINITIONS

Within the context of nonexperimental and quasi-experimental research, the variable that is used to differentiate the groups of participants or the groups of scores being compared is called the **quasi-independent variable**, and the variable that is measured to obtain the scores within each group is called the **dependent variable**.

In nonequivalent control group studies, for example, one group receives the treatment and one does not. The group difference, treatment versus nontreatment, determines the quasi-independent variable. In time-series studies, the researcher compares one set of observations (scores) before treatment with a second set of observations after treatment. For these studies, the quasi-independent variable is defined as “before versus after treatment.”

Note that the same terminology is used for nonexperimental research as well as quasi-experimental studies. In differential research, for example, the participant variable used to differentiate the groups is called the quasi-independent variable. In a differential study comparing self-esteem scores for children from two-parent and single-parent homes, the number of parents is the quasi-independent variable, and self-esteem is the dependent variable. In a developmental study (either longitudinal or cross-sectional) examining changes in memory that occur with aging, the different ages are the quasi-independent variable and the memory scores are the dependent variable.

LEARNING CHECK

1. What is the appropriate statistical analysis for comparing non-numerical data for a differential design comparing samples representing two populations?
 - a. Independent-measures t test
 - b. Repeated-measures t test
 - c. Independent-measures analysis of variance
 - d. Chi-square test for independence

2. What is the appropriate statistical analysis for evaluating the after treatment mean difference for a posttest-only nonequivalent control group design?
 - a. Independent-measures *t* test
 - b. Repeated-measures *t* test
 - c. Repeated-measures analysis of variance
 - d. Chi-square test for independence
3. In a differential research design, what term is used identify the participant variable that is used to define the groups?
 - a. Independent
 - b. Dependent
 - c. Quasi-independent
 - d. Quasi-dependent

Answers appear at the end of the chapter.

CHAPTER SUMMARY

At this point, you should review the learning objectives presented at the beginning of each section and be sure that you have mastered each objective.

In many research situations, it is difficult or impossible for a researcher to satisfy completely the rigorous requirements of an experiment, particularly when doing applied research in natural settings. In these situations, a researcher may use the nonexperimental or the quasi-experimental research strategy. Nonexperimental and quasi-experimental studies always contain a threat to internal validity that is integral to the design and cannot be removed. As a result, these two research strategies cannot establish unambiguous cause-and-effect explanations. Quasi-experimental studies make some attempt to control threats to internal validity but nonexperimental studies typically do not.

Nonexperimental and quasi-experimental studies often look like experiments because they involve comparing groups of scores. Unlike experiments, however, the different groups are not created by manipulating an independent variable; instead, the groups are defined in terms of a preexisting participant characteristic (e.g., college graduate/no college) or defined in terms of time (e.g., before and after treatment). These two methods for defining groups produce two general categories of nonexperimental and quasi-experimental designs: nonequivalent group designs and pre–post designs.

In nonequivalent group designs, the researcher does not control the assignment of individuals to groups because the two groups already exist. Therefore, there is no assurance that the two groups are equivalent in terms of extraneous variables and internal validity is threatened by individual differences between groups. Three types of nonequivalent group designs are discussed: (1) the differential research design, (2) the posttest-only nonequivalent control group design, and (3) the pretest–posttest nonequivalent control group design. The first two designs make no attempt to limit the threat of individual differences between groups and are classified as nonexperimental. The pretest–posttest nonequivalent control group design does reduce the threat of individual differences and is classified as quasi-experimental.

The second general category is the pre–post design. The goal of a pre–post design is to evaluate the influence of the intervening treatment or event by comparing the observations before treatment with the observations made after treatment. Two examples of pre–post designs are considered: (1) the pretest–posttest design and (2) the time-series design. The first design makes no attempt to control time-related threats and is classified as nonexperimental. The second is quasi-experimental.

Developmental research designs are another type of nonexperimental research. The purpose of developmental designs is to describe the relationship between age and other variables. There are two types of developmental research designs. The cross-sectional research design

compares separate groups of individuals with each group representing a different age. The obvious advantage of this design is that the researcher need not wait for participants to age to examine the relationship between a variable and age. However, the cohort or generation effect is a major weakness. In the longitudinal research design, the same group of individuals is followed and measured at different points in time; hence, cohort effects are not a problem. However, longitudinal research is extremely time-consuming for participants and researchers, and participant dropout can create a biased sample.

KEY WORDS

nonexperimental research strategy	nonequivalent control group design	pretest–posttest design	cohort effects, or generation effects
quasi-experimental research strategy	posttest-only nonequivalent control group design	time-series design	longitudinal developmental research design
nonequivalent group design	pretest–posttest nonequivalent control group design	developmental research designs	quasi-independent variable
differential research design	pre–post design	cross-sectional developmental research design	dependent variable
		cohorts	

EXERCISES

The exercises are identified with specific learning objectives and are intended to assess your mastery of the objectives. You should be aware that exam items are also generated to assess learning objectives.

- In addition to the key words, you should also be able to define the following terms:
 - individual differences
 - differential effects
 - history
 - instrumentation
 - order effects
 - maturation
 - statistical regression
 - interrupted time-series designs
 - single-case, or single-subject designs
 - participant attrition, or participant mortality
- (LO1)** Explain the distinction between experimental and nonexperimental research strategies.
- (LO1)** Why are studies that examine the effects of aging not considered true experiments?
- (LO1)** Explain why we can be more confident about causal relationships between variables when a quasi-experimental design is used instead of a nonexperimental design.
- (LO2)** Give an example of a situation (aside from gender) in which a researcher must examine preexisting groups.
- (LO3)** Mueller and Oppenheimer (2014) conducted a series of studies comparing the effectiveness of taking classroom notes on laptops versus writing longhand. In one study, students were instructed to use their normal classroom note taking strategy using either a notebook or a laptop while they watched a brief lecture. A short time later, the students were given a quiz on the lecture material. Although the quiz results showed no difference between the two strategies for factual questions, the students using longhand had significantly higher scores for conceptual questions. Explain why the researchers cannot conclude that taking longhand notes causes better conceptual learning than taking notes on a laptop.
- (LO4)** A researcher measures personality characteristics for a group of participants who successfully lost weight in a diet program, and compared their scores with a second group consisting of individuals who failed to lose weight in the program. Is this study a differential design? Explain your answer.
- (LO4 & 8)** A researcher wants to describe the effectiveness of a new program (compared to the old program) for teaching reading to elementary school children. Describe how this study could be done as a posttest-only nonequivalent control group design. Next, describe how this study could be done as a nonexperimental pretest-posttest design.

9. (LO5) Explain how the pretest helps minimize the threat to internal validity from individual differences in a pretest–posttest nonequivalent control group design.
10. (LO6) Describe the basic characteristics of a pre–post design and explain why these designs are not true experiments.
11. (LO7) To evaluate the effectiveness of a new television commercial, a researcher measures attitudes toward the advertised product for a group of consumers before and after they view the commercial. Identify one factor that threatens the internal validity of this study.
12. (LO8) What characteristic differentiates a pretest–posttest design from a time-series design?
13. (LO9) Explain how a time-series design minimizes most threats to internal validity from time-related variables.
14. (LO10) A researcher wants to describe how fine motor skills change as a group of infants age from 18 to 24 months. Describe how this study could be done as a cross sectional design. Next, describe how this study could be done as longitudinal design.
15. (LO10) Although the cohort effect can be a serious problem for cross-sectional research, it is not a problem for longitudinal designs. Explain why not.
16. (LO11) Identify the appropriate statistical test for each of the following nonexperimental and quasi-experimental designs.
- A differential design
 - A cross-sectional design comparing children at ages 10, 14, and 18
17. (LO12) The college offers all students an optional seminar on note taking and study skills. Suppose that a researcher compares personality scores for students who elected to take the seminar with the scores for students who did not. Identify the quasi-independent variable and the dependent variable for this study.

LEARNING CHECK ANSWERS

Section 10.1

1. a, 2. a

Section 10.2

1. c, 2. d, 3. a, 4. c

Section 10.3

1. c, 2. b, 3. a, 4. d

Section 10.4

1. c, 2. d, 3. a

Section 10.5

1. d, 2. a, 3. c