

A longitudinal research study is one in which the same individual or group is observed performing the same tasks or behaviors on numerous occasions over a long time.

A cross-sectional research study is one in which developmental change is inferred by observing individuals or groups of varying ages at one point in time.

Researching Developmental Change

In the study of development, we ideally watch an individual or group change with age for the entire length of the period we are interested in. This is termed a **longitudinal research study**. The difficulty here comes when our frame of reference is years or decades. For example, a teacher may be interested in the changes in locomotor skills across childhood. We can see that an individual researcher might be able to do only a few such studies in his or her lifetime. This approach would not inform us about motor development very quickly!

Researchers have several ways of learning more in a shorter time. One of these techniques is termed a **cross-sectional research study**. In a cross-sectional study, researchers select individuals or groups at chosen points in the age span of interest. For example, researchers interested in change during adolescence might measure a group of 13-year-olds, a group of 15-year-olds, a group of 17-year-olds, and so on. When the measurements of each group are plotted, we assume that any observed change reflects the same change we would observe in a single group over the whole time period. The advantage of this method is that researchers can study development in a short time. The disadvantage is that we never really observe change; we merely infer it from age group differences. If something else were responsible for the age group differences, we could be fooled into thinking the differences were caused by developmental change.

Consider the example of tricycles. At one time, all tricycles were metal and shaped so that the seat was relatively high off the ground. Children under 3 years of age had difficulty just getting on the tricycle. Then someone invented the Big Wheel tricycle, with the large front wheel and the seat only inches off the ground. Toddlers can easily sit on this vehicle.

Can You Tell It's Developmental? A Litmus Test

Armed with definitions of motor development and motor learning, you still might find it difficult to distinguish whether a particular behavior is a matter of learning or development. Mary Ann Roberton (1988, p. 130) suggests that the answers to three questions help us distinguish developmental issues and topics.

1. Are we interested in what behavior is like now and why the behavior is the way it is?
2. Are we interested in what behavior was like before our present observation, and why?
3. Are we interested in how the present behavior is going to change in the future, and why?

Students of both motor learning and motor development answer yes to the first question, but only developmentalists answer yes to the second and third questions. Motor learning specialists are concerned with making changes that bring about a relatively permanent change in behavior within a short time. Motor developmentalists focus on a longer time during which a sequence of changes occurs. Developmentalists might introduce a change in task or environmental constraints to make either or both age appropriate while realizing that the task or environment will have to change again and again as individuals age and change.

Let's pretend that a researcher did a cross-sectional study on coordination of the cycling motion of the legs in toddlers at the ages of 1.5, 2.0, 2.5, and 3.0 years. The study was done just 1 year after the Big Wheel tricycle came on the market (note: as a piece of equipment, the Big Wheel is a task constraint). The researcher observed that toddlers 2.5 and 3.0 years of age could coordinate this movement and concluded that approximately 2.5 years was the age at which toddlers could coordinate the cycling movement of the legs. But what if the researcher had done the study a year earlier, before any of the children would have been on a Big Wheel? The researcher might have observed that *none* of the children could coordinate the cycling movement because none would have been able to ride the high-seat tricycle. The researcher would then have concluded that this coordination developed after the age of 3.0 years.

The invention of the Big Wheel gave a **cohort**, or mini-generation, of toddlers earlier practice in coordinating the cycling movement. Older cohorts could not practice the movement until they were big enough to get up on the higher tricycle. Thus, one cohort had an experience that another did not. Such a cohort difference can fool researchers in a cross-sectional study, leading them to associate performance differences between age groups with age alone and not factors such as exposure to new inventions. Researchers must be particularly aware of cohort differences when examining aging populations due to rapidly changing technologies. For example, many older adults may not own or frequently use computers. Let's say a researcher wants to examine differences in driving techniques among drivers of different age groups and uses a computer simulation in which the car is controlled by a joystick. Older adults may show differences in performance because they are unfamiliar with computer joysticks rather than because of true differences in driving technique. (In fact, children who are not yet eligible to drive may perform better because of their experiences with video games.) Researchers must take care to control for cohort differences.

Researchers have, however, devised a clever way to identify cohort influences while at the same time conducting developmental research in less time than required by a longitudinal study. They do it by combining longitudinal and cross-sectional studies. In effect, they conduct several small longitudinal studies with subjects of different ages of the period of interest. For example, in the first year they would measure three groups of children, one at 4 years of age, one at 6 years of age, and one at 8 years of age. Notice that if the researchers stopped here they would have a cross-sectional study. Instead, a year later they measure all the children again. This time the children are 5, 7, and 9 years of age. They do the same thing another year later, when the children are 6, 8, and 10. In the end they have done three small longitudinal studies: one cohort that was the original 4-year-olds at 4, 5, and 6; one cohort that was the original 6-year-olds at 6, 7, and 8; and one cohort that was the original 8-year-olds at 8, 9, and 10.

Thus, information is made available about ages 4 through 10, but only 2 years were needed to obtain it. What about the possibility of cohort differences? Note that the mini-longitudinal studies cover overlapping ages. Two groups were tested at age 6 and two groups were tested at ages 7 and 8. If performance of the different cohorts is the same at a given age, then it is likely that cohort differences are not present. If the cohorts perform differently at the same age, cohort influences might well be present. This type of design is called a **mixed-longitudinal, or sequential, research study**.

New students of motor development can tell whether a research study is developmental by considering the design of the study. The study is developmental if the

A **cohort** is a group whose members share a common characteristic, such as age or experience.

In a **mixed-longitudinal, or sequential, research study**, several age groups are observed at one time or over a shorter time span, permitting observation of an age span that is longer than the observation period.

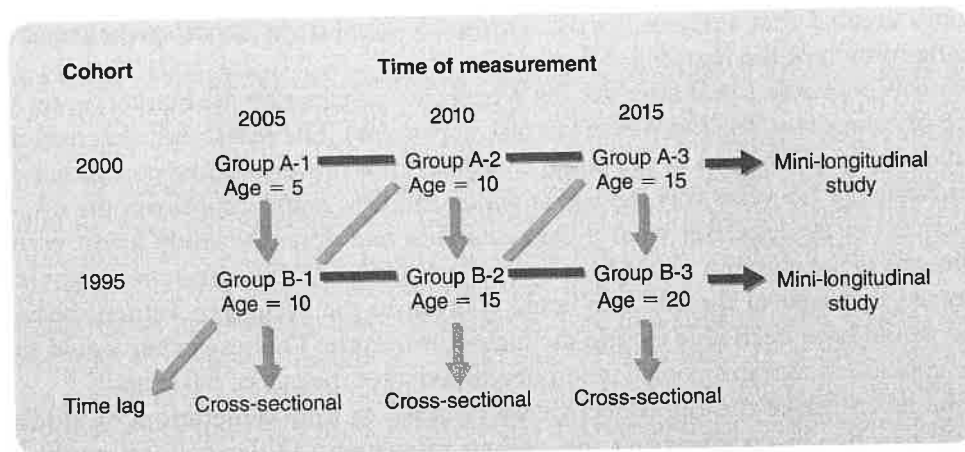


FIGURE 1.4 A model of a sequential research design. Note that each row is a short longitudinal study and that each column is a small cross-sectional study. The time-lag component of sequential research design, shown by the diagonal lines, allows comparison of groups from different cohorts but at the same chronological age, thus identifying any cohort differences. Ages 5 to 20 can be studied in 10 years—1990 to 2000.

design is longitudinal, cross-sectional, or sequential (figure 1.4). Research studies that focus on one age group at one point in time are not developmental.

A Developmental Paradox: Universality Versus Variability

Picture yourself in a gymnasium filled with preschool students. Many children move similarly: They begin to display rudimentary catching and throwing; they walk and run with proficiency but have difficulty skipping. On average, the children perform many of the same motor skills. Yet if you look at an individual child, he or she may move in more or less advanced ways than a child standing a foot away. This difference highlights the paradox of universality of development as opposed to individual differences (Thelen & Ulrich, 1991). Individuals in a species show great similarity in their development in that they go through many of the same (stereotypical) changes. You have heard reference to “stages of development.” Stages, of course, describe the emergence of universal behaviors. Those who anticipate working with individuals in a particular age range are often interested in the behaviors typical of those in that range.

However, individual differences in development do exist. Any individual we observe is more likely to be above or below average, or to achieve a milestone earlier or later than average, than he or she is to be exactly average. In addition, children can arrive at the same point in development by very different pathways (Siegler & Jenkins, 1989). All individuals, even identical twins, have different experiences, and people who work with any group of individuals supposedly at the same stage of development are usually amazed by the variability in the group.

Thus, developmentalists, educators, parents, and health professionals must consider an individual’s behavior in the context of both universal behaviors and individual differences. It is also important to recognize when others are using a perspective that focuses on the universality of behavior and when they are focusing on variability in behavior. Systematic and controlled observation—that is, *research*—helps us distinguish between behaviors that tend to be universal and behaviors that reflect human variability. Research also helps us identify the role

of constraints such as the environment and individual experiences in creating variability of behavior.

As much as possible, the ideas presented in this text are based on research studies; the information comes from an objective source. Keep in mind that this is not the same as saying that any one or two research studies provide us with all the answers we need. Individual research studies do not always rule out all the other possible explanations for the results—to do that, additional research might be required.

Deriving the principles and theories from research to guide educational and health care practice is a *process*. Although practitioners are sometimes frustrated to see that researchers are only in the middle of the process, it is better to recognize that this is the case than to take all research results as the final word. Our goal here is not only to use available research information to make insightful conclusions and decisions about the motor development of individuals but also to learn how to obtain and analyze further research information as it becomes available.



Think of generalizations we tend to make about people, such as “tall people are thin,” and then think of at least one person you know who is an exception to this “rule.” What is the consequence of expecting a student or patient to follow a generalization?

Summary and Synthesis

Now that we understand the developmental perspective, it is easy to see why a documentary series on motor development spanning several decades would be of interest to many viewers. At the present moment each of us is a product of “what we were like before,” and each of us will change to become something different in the future. We are all developing, and our individual constraints constantly change! Add changing environmental and task constraints and you have a very interesting mix related to motor development.

Many professions involve relationships with people at critical points of the life span—points at which the change taking place influences life thereafter. This is especially true in regard to the physical being and physical skills. As a result, your knowledge of motor development and the constraints related to it will help you and those around you throughout life. If you choose a profession such as teacher, coach, or therapist, this knowledge will help you help others by providing developmentally appropriate activities.

Your study of motor development will be easier if you equip yourself with a few basic tools. Most important is a framework or model to which you can relate new information, and we use Newell’s model of constraints throughout this text. Another important tool is knowledge of how research in motor development is designed, which helps you understand how researchers address developmental issues.

Yet another important tool, which we have yet to discuss, is knowledge of the various perspectives that developmentalists adopt as they approach their research. Because the same problem can be approached from many perspectives, it is valuable to know which approach is taken. The next chapter explores various approaches and discusses the theoretical roots of motor development.