# NATURE OF DEVELOPMENTAL RESEARCH

**GENERAL OBJECTIVES OF THE SUBJECT**
At the end of the course, Individuals will analyze the elements of the communication and will explain the basic principles of this course.

## 7. The Nature of Developmental Research



### 7.1 <u>The Nature of Developmental Research</u>

The Nature of Developmental Research The task of science is to make the world intelligible to us. Albert Einstein once observed that "the whole of science is nothing more than a refinement of everyday thinking." So we do scientific research in much the same way that we ask questions and come to conclusions in our everyday lives. We make guesses and mistakes; we argue our conclusions with one another; we try out our ideas to see what fits, and we get rid of what doesn't. There is one important way scientific inquiry differs from ordinary inquiry: It specifies a systematic and formal process for gathering facts and searching for a logical explanation of them (Graziano & Rualin, 2007).

This process, called the **scientific method,** is a series of steps that allow us to be clear about what we studied, how we studied it, and what our conclusions were. Sufficient detail must be given to allow others to replicate our research and verify our conclusions. These steps of the scientific method provide a framework for objective inquiry:

1) select a researchable problem;
2) formulate a **hypothesis**—a tentative proposition that can be tested;
3) test the hypothesis;
4) draw conclusions about the hypothesis; and
5) make the findings of the study available to the scientific community.

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How do we use this method to help us understand and explain human development? First, let's consider some questions we might ask about development: Are there certain measurable factors in childhood predictive of success in different areas of adult life? Which children are more prone to violence, and what can be done to teach these children self-control and conflict resolution techniques? Who is likely to be affected by anorexia, and what steps can we take to save this person's life? Does everyone's memory decline with age? What aspects of personality and social competency are related to longevity?

Are there peaks in the frequency of sexual activity for men and women, or does it generally increase or decrease with age? It is easy to choose any one of these questions and come up with a researchable problem. Perhaps through your reading and life experience you could suggest a hypothesis—a proposition that can be tested scientifically—that might answer one of these questions. Next you need to test your hypothesis. To do that requires choosing a ***research design*** that will provide valid (accurate) and reliable (consistent) information to support or reject your hypothesis.

## 7.2 Research Design

In developmental psychology, research focuses on change that occurs over time or with age. Three basic kinds of designs are used: longitudinal, cross-sectional and sequential. Each of these designs is of interest for answering scientific questions in the developmental sciences (Schaie, 2007). Experimental designs, although powerful, are seldom used in developmental studies because usually it is not possible to exercise the control necessary for experimental design. Interesting variables such as ***spatial ability***, memory, and physical characteristics cannot be assigned to groups of individuals or manipulated in terms of quantity or quality presented. Other methods used in developmental research include case studies, observational methods, surveys, and cross cultural studies. Throughout our discussion of various research designs, you will see examples of ***spatial ability*** tasks.

So what are **spatial relations,** you ask? This is a complex sense that develops in infancy and is vital to our functioning. There are two categories, visual-spatial and motor-spatial, and in most instances children learn to coordinate these two skills in completing tasks. Spatial skills involve size, distance, order, position, shape, volume, movement, and time intervals (Silverman, 2002). *Babies and toddlers use their eyes and hands to begin to recognize the shape, size, position, and distance of objects. School-age children develop skills such as printing and then writing letters of the alphabet and numbers, coloring within the lines, lining up the amounts in a math problem, and recognizing the sequence* *of letters to read words, and throwing or kicking a ball—to name only a few. Older students must visualize internal structures of a plant in biology; recognize, create, and understand geometric shapes; and demonstrate understanding of the rules of English grammar, punctuation, and capitalization in more complex essays.*

Applying a sense of organization and timeliness to the completion of tasks is another vital skill. Although some people are considered to have ***"weak"*** spatial skills, others are labeled as having a ***"dysfunction"*** or a specific learning disability in visual- or motor-spatial skills.

### 7.3 The Longitudinal Design

The longitudinal design is used to study the same individuals at different points in their lives. We can then compare the group at these regular intervals and describe their behavior and characteristics of interest. This method allows us to look at change sequentially and offers insight into why people turn out similarly or differently in adulthood.

The Terman Life-Cycle Study, a classic longitudinal study—indeed, the grandparent of life-course research—was begun by psychologist Lewis Terman in 1921–1922 (Friedman & Brownell, 1995). Terman followed 1,528 gifted boys and girls from California public schools—who later nicknamed themselves "Termites"—and a control group of children of average intelligence from preadolescence through adulthood. These subjects were studied at 5- to 10-year intervals ever since. The 856 boys and 672 girls were selected on the basis of their intelligence quotients, or IQs (between 135 and 200 on the Stanford-Binet scale), which were said to represent the top 1 percent of the population. Terman found that the gifted youngsters were generally taller, heavier, and stronger than ones with average IQs. Moreover, they tended to be more active socially and to mature faster than average children (Terman & Merrill, 1937). One of the effects of the study has been to dispel the belief that the acceleration of bright children in school is harmful.

After Terman's death, other psychologists continued the project and their research has provided longitudinal data on religion and politics, health, marriage, emotional development, family history and careers, longevity, and cause of death (Holahan & Suzuki, 2004). One notable recent finding is that "Termites" whose parents divorced had a greater risk of early death (the average age of death for men was 76, compared with age 80 for those whose parents remained married; for women the corresponding ages of death were 82 and 86 years). Researchers speculate that the stress and anxiety associated with their parents' strife took its toll in earlier mortality (Martin & Friedman, 2000).

**Limitations of the Longitudinal Design -** Although the longitudinal design allows us to study development over time, it has a number of disadvantages. Two major problems are selective attrition and dropout. Subjects drop out because they become ill or die, move away and are difficult to locate, or become disinterested in continuing the study. **Selective attrition** means simply that the individuals who drop out tend to be different from those who remain in the study. For example, those who remain might come from the most cooperative and stable families or be more intelligent or successful.

These changes can bias the sample of subjects as it becomes smaller over time (surprisingly enough, only 10 percent of the “Termites” were unaccounted for in 1995). Other problems include testing and tester consistency over the length of the study. It is impossible to test every person at every scheduled testing on every test item. They might refuse to comply on some items. And children or their parents occasionally forget appointments (Willett, Singer, & Martin, 1998). Comparable data might not be collected from every subject at every time interval. Likewise changes, such as turnover or burnout, in the staff that tests or observes the participants can result in inconsistencies in the measurements taken.

More importantly, longitudinal studies cannot control for unusual events during this group’s life span. Effects of such economic and social events can make it difficult to generalize findings from one age cohort to another age cohort born 10 or 20 years later and can distort the amount or direction of the change reported: War, depression, changing cultures, and technological advances all make considerable impacts. What are the differential effects on 2-year-olds of depression-caused worries and insecurities, of TV or no TV, of the shifting climate of the baby-experts’ advice from strict-diet, let-him-cry, no-pampering schedules to permissive, cuddling, “enriching” loving care? (Bayley, 1965).

The time and money required to complete a long term study can also be prohibitive (Brooks-Gunn, Phelps, & Elder, 1991). For example, 20 national agencies collaborate annually to fund and report research on the well-being of America’s children (Federal Interagency Forum, 2007). Finally, there is the problem of finding out tomorrow what relevant factors should have been considered yesterday. Once set in motion the project is difficult to alter even when newer techniques might improve the overall design.

For example, computerized testing or a survey on a Web page could make it easier for participants to record their data and would be less expensive than bringing individuals into a research lab, but would the data be comparable to the data collected earlier? What would be the effect of having no tester participant interaction? Would participants’ responses be affected by their computer experience or comfort level working electronically? Despite these limitations, longitudinal studies have direct implications for explaining theories of development and aging (Hofer & Sliwinski, 2006). For example, if our research interest is the effect of aging on a vital life skill called *spatial ability*, we might design the following study: Select a sample of 20-year-olds and measure their spatial ability. Spatial ability tests might measure individual understanding of such qualities as size, distance, volume, order, and time and can include drawing a specific triangle from memory, arranging blocks to re-create a given pattern, or reading a dial, graph, or map.

Tests of spatial ability are used as a means of determining vocational skills and to predict success with specific school-related subjects such as principles of geometry, molecular structure of chemicals, illustrations in mechanical drawing, map reading, learning to drive a car through busy city street locations, and so on. We would bring this same group (cohort) back to our lab every 10 years and repeat this measurement.

## 7.4 The Cross-Sectional Design

The hallmark of the longitudinal design is taking successive measurements of the same individuals. In contrast, the **cross-sectional design** investigates development by simultaneously comparing different age groups. Unlike our longitudinal research example just described, we would investigate spatial ability and age by selecting a group of 20-year-olds, a group of 30-year-olds, a group of 40-year-olds, and so on, through our last group, 70-yearolds.

We would test the spatial ability of all six groups at the same time. What savings in time and money! You don't have to wait 50 years for the data to be complete, nor do you have to worry about locating your participants and bringing them back for retesting. Staff turnover is not an issue nor in most cases there are problems with participant cooperation and testing inconsistencies. These findings seem to fit the hypothesis that spatial ability declines with age. But can we really say that? Could there be other differences (besides age) among these selected groups that are affecting spatial ability?

## 7.5 Limitations of the Cross-Sectional Design

The confounding of age and cohort is the major disadvantage in cross-sectional research. **Confounding** in research means the elements are mingled so they cannot be distinguished or separated. We can never be sure that the reported age-related differences between participants are not the product of other differences between the groups.

For instance, the groups might differ in social environment, intelligence, or diet. So the comparability of the groups can be substantiated only through careful sampling and measurement techniques. For example, if you were to investigate how many years of formal schooling your grandparents received, versus your parents, versus yourself, you are most likely to determine that your generation has the resources to earn a higher level of education, delaying full-time work status and most likely delaying childbearing. We know that the life experiences of a typical 20-year-old today are much different from those of a 20-year-old in the 1930s or the 1950s.

These problems are highlighted by cross-sectional studies of intelligence. Such studies rather consistently show that average scores on intelligence tests begin to decline around 20 years of age and continue to drop throughout adulthood. Cross-sectional studies do not make allowance for ***cohort differences*** in performance on intelligence tests. Each successive generation of Americans has received more schooling than the preceding generation. Consequently, the overall performance of each generation of Americans on intelligence tests improves. Improvement caused by increasing education creates the erroneous conclusion that intelligence declines with chronological age.

## 7.6 Sequential Design

All **sequential designs** involve measuring more than one cohort over time. This combination of collecting data over time as well as across groups overcomes the age/cohort confounding found in cross-sectional studies as well as the effect of unique events found in longitudinal designs. If we consider our example of age and spatial ability, this time we could select a sample of 25-year-olds and a sample of 35-year-olds, measure their spatial ability and then bring each cohort back for successive measurements at specific time intervals.

Spatial ability was measured in adults born in 1930 for the ages 35, 45, 55, and 65. For adults born in 1940, measurements were taken at ages 25, 35, 45, and 55. Each spatial ability score reported in the table is the group average for a particular time interval. First, study the scores of the 1930 group over time and then look at the scores for the 1940 group. Finally, compare the scores of the two groups at a particular age—for example, when both groups were measured at age 35.

**Limitations of Sequential Designs** Sequential designs can be complex and difficult to analyze if the groups measured longitudinally (over time) are found to be very different in the variable under study. For example, if 25-year-olds in 1935 have significantly lower spatial ability scores than 25-year-olds in 1965, it is difficult to combine these scores for an overall measurement. Doing so might distort the sequential changes in spatial ability throughout the study. The issues of time and money continue to be a limitation as when any group is followed over a longer period of time.

The **experimental design** is one of the most rigorously objective techniques available to science. An **experiment** is a study in which the investigator manipulates one or more variables and measures the resulting changes in the other variables to attempt to determine the cause of a specific behavior. Experiments are “questions put to nature.” They are the only effective technique for establishing a cause-and-effect relationship. This is a relationship in which a particular characteristic or occurrence (X) is one of the factors that causes another characteristic or occurrence (Y).

Scientists design an experimental study so that it is possible to determine whether X does or does not cause Y. To say that X causes Y is simply to indicate that whenever X occurs, Y will follow at some later time. In an experiment, researchers try to find out whether a causal relationship exists between two variables, X and Y. They systematically vary the first variable (X) and observe the effects on the second variable (Y). Factor X, the factor that is under study and is manipulated in an experiment, is the **independent variable.**

It is independent of what the participant or participants do. The independent variable is assumed to be the causal factor in the behavior being studied. Researchers must also attempt to control for **extraneous variables,** factors that could confound the outcome of the study; these could include the age and gender of the participants, the time of day the study is conducted, the educational attainment of the subjects, and so on.

The study is planned such that the individuals in the **experimental group** are administered the independent variable (some refer to this as the “treatment”). In comparison, the **control group** of participants should be identical to the experimental group except they will not be administered the independent variable while they perform the same task as the experimental group. We need to determine if the independent variable has made any difference in the performance of the experimental group of participants. We call the end result of the experiment—the factor that is affected—the **dependent variable,** which is some measure of the participants’ behavior.

For instance, dependent variables are often administered in the form of paper-and-pencil tests or performance tests, for the researcher must quantify data in some measurable way. The researcher then performs various statistical analyses to be able to compare results and to look for any significant differences (e.g., How did the performance of the experimental group vary from the performance of the control group?).

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Let's think back to the relationship between age and spatial ability. In a true experiment we would have to vary age systematically and measure its effect on spatial ability. The problem is that we can't manipulate age—we cannot assign the same person to different age groups. But what if, after reviewing the literature and the results from our longitudinal and cross-sectional studies, we hypothesize that the decrease in spatial ability in older participants is due, in part, to a lack of recent experience in spatial ability tasks?

In this spatial ability experiment, we would develop a two-week training and practice course that would give older participants a chance to practice special spatial ability problems. We would randomly assign half of the older participants to the practice course (the experimental group who will receive the training) while the other half of the participants (the control group) would receive a two-week period of time together to share information and have social conversation. In this example, the training in spatial relations would be the independent variable (practice with spatial relations versus no practice).

At the end of the two-week period, we would most likely use some type of paper-and-pencil or performance test to measure the dependent variable (spatial ability). If the average spatial ability scores for the group who trained and practiced were significantly higher than the average for the group who did not practice, our hypothesis would be supported. Experiments must be replicated by other researchers with different groups of subjects to see if there is consistency in results before any major theory can be significantly substantiated.

## 7.7 Limitations of the Experimental Design in Developmental Psychology

It is difficult to use an experimental approach in developmental psychology, for several reasons. The first, as indicated earlier, is the inability to assign participants to the variable of interest. Developmental psychologists cannot manipulate many of the variables they study—such as age, gender, abusive family background, or ethnicity. These variables come with the individual along with many other variables that can confuse us when interpreting their effects on the dependent variable. Second, many of the questions we ask involve the effects of stressful or dangerous experiences, such as tobacco or alcohol use, medical procedures, or the withholding of treatments thought to be beneficial.

Manipulations of these variables would be unethical, if not impossible. Third, some argue that how people behave or perform in an experimental lab setting is not how they actually behave in a ***"real-world"*** setting. Fourth, planning, designing, conducting, and evaluating a true experimental design is very time-consuming and costly, as you can imagine from reflecting on the actual small-group lab experiment.

The **case-study method** is a longitudinal design that focuses on a single individual rather than a group of subjects. Its aim is the same as that of other longitudinal approaches—the accumulation of developmental information. An early form of the case-study method was the ***"baby biography."*** Over the past two centuries, a small number of parents have kept detailed observational diaries of their children's behavior. Charles Darwin, for example, wrote a biographical account of his infant son. A good deal of the early work of Jean Piaget, an influential Swiss developmental psychologist, was based on the case-study approach (Wallace, Franklin, & Keegan, 1994). Piaget (1952) carefully observed the behavior of his three children—Lucienne, Laurent, and Jacqueline—and used this information to formulate hypotheses about cognitive development.

Case studies have also had a prominent place in the clinical treatment of maladjusted and emotionally disturbed individuals. Sigmund Freud and his followers have stressed the part that early experience plays in mental illness. According to this view, the task of the therapist is to help patients reconstruct their own histories so that, in the process, they can resolve their inner conflicts. An example of a classic case study, published in the late 1950s, is *The Three Faces of Eve,* about a woman with multiple personality disorder (now called dissociative identity disorder). More recently, the clinical approach has been extended to the study of healthy individuals. Case studies are often used by researchers who study individuals who exhibit behavior that is an exception from the norm, such as a child genius or a serial murderer.

**Limitations of the Case-Study Method** The case study method has a number of drawbacks. The data are recorded on only one individual, and it is difficult to generalize from one case to the whole population of interest. Of course, if the kind of case study is repeated many times, on many individuals, as was the research Piaget did with children, the findings are more valuable. A second problem is the extended interaction between the observer or experimenter and the subject under study. Because case studies normally involve frequent contact between researcher and subject over a long period of time, researchers and subjects become familiar with each other, and the objectivity of the results may be in question. The experimenter might even become a part of the subject's treatment, and the same results would not necessarily be found by a different researcher.