

## WHAT IS AN EXPERIMENTAL RESEARCH?

As we saw earlier in the book, an **experimental research** is a type of study designed specifically to answer the question of whether there is a causal relationship between two variables. In other words, whether changes in an independent variable cause a change in a dependent variable. Experiments have two fundamental features. The first is that the researchers manipulate, or systematically vary, the level of the independent variable. The different levels of the independent variable are called **conditions**. The second fundamental feature of an experiment is that the researcher controls, or minimizes the variability in, variables other than the independent and dependent variable. These other variables are called **extraneous variables**. To make an experimental study, researchers should put all the participants in the same room, exposed them to the same emergency situation, and so on. They also randomly assigned their participants to conditions so that the experiment and control groups would be similar to each other to begin with. Notice that although the words manipulation and control have similar meanings in everyday language, researchers make a clear distinction between them. They manipulate the independent variable by systematically changing its levels and control other variables by holding them constant.

### MANIPULATION OF THE INDEPENDENT VARIABLE

Again, to **manipulate** an independent variable means to change its level systematically so that different groups of participants are exposed to different levels of that variable, or the same group of participants is exposed to different levels at different times. For example, to see whether expressive writing affects people's health, a researcher might instruct some participants to write about traumatic experiences and others to write about neutral experiences. As discussed earlier in this chapter, the different levels of the independent variable are referred to as conditions, and researchers often give the conditions short descriptive names to make it easy to talk and write about them. In this case, the conditions might be called the "traumatic condition" and the "neutral condition."

Notice that the manipulation of an independent variable must involve the active intervention of the researcher. Comparing groups of people who differ on the independent variable before the study begins is not the same as manipulating that variable. For example, a researcher who compares the health of people who already keep a journal with the health of people who do

not keep a journal has not manipulated this variable and therefore has not conducted an experiment. This distinction is important because groups that already differ in one way at the beginning of a study are likely to differ in other ways too. For example, people who choose to keep journals might also be more conscientious, more introverted, or less stressed than people who do not. Therefore, any observed difference between the two groups in terms of their health might have been caused by whether or not they keep a journal, or it might have been caused by any of the other differences between people who do and do not keep journals. Thus the active manipulation of the independent variable is crucial for eliminating potential alternative explanations for the results.

### **CONTROL OF EXTRANEOUS VARIABLES**

As we have seen previously in the chapter, an extraneous variable is anything that varies in the context of a study other than the independent and dependent variables. In an experiment on the effect of expressive writing on health, for example, extraneous variables would include participant variables (individual differences) such as their writing ability, their diet, and their gender. They would also include situational or task variables such as the time of day when participants write, whether they write by hand or on a computer, and the weather. Extraneous variables pose a problem because many of them are likely to have some effect on the dependent variable. For example, participants' health will be affected by many things other than whether or not they engage in expressive writing. This influencing factor can make it difficult to separate the effect of the independent variable from the effects of the extraneous variables, which is why it is important to **control** extraneous variables by holding them constant.

### **WHAT IS QUASI-EXPERIMENTAL RESEARCH?**

**Quasi-experimental research** is research that lacks the manipulation of an independent variable. Rather than manipulating an independent variable, researchers conducting quasi-experimental research simply measure variables as they naturally occur (in the lab or real world).

Most researchers consider the distinction between experimental and quasi-experimental research to be an extremely important one. This is because although experimental research can provide strong evidence that changes in an independent variable cause differences in a dependent variable, quasi-experimental research generally cannot. As we will see, however, this inability

to make causal conclusions does not mean that quasi-experimental research is less important than experimental research.

### **WHEN TO USE QUASI-EXPERIMENTAL RESEARCH**

As we saw in the last chapter, experimental research is appropriate when the researcher has a specific research question or hypothesis about a causal relationship between two variables—and it is possible, feasible, and ethical to manipulate the independent variable. It stands to reason, therefore, that non-experimental research is appropriate—even necessary—when these conditions are not met. There are many times in which non-experimental research is preferred, including when:

- the research question or hypothesis relates to a single variable rather than a statistical relationship between two variables (e.g., How accurate are people's first impressions?).
- the research question pertains to a non-causal statistical relationship between variables (e.g., is there a correlation between verbal intelligence and mathematical intelligence?).

Again, the choice between the experimental and quasi-experimental approaches is generally dictated by the nature of the research question. Recall the three goals of science are to describe, to predict, and to explain. If the goal is to explain and the research question pertains to causal relationships, then the experimental approach is typically preferred. If the goal is to describe or to predict, a quasi-experimental approach will suffice. But the two approaches can also be used to address the same research question in complementary ways.

### **WHAT IS NON-EXPERIMENTAL RESEARCH?**

When the independent variable cannot be manipulated and participants cannot be randomly assigned to conditions or orders of conditions for some reasons (e.g., does damage to a person's hippocampus impair the formation of long-term memory traces?), it is non-experimental research. The research question is broad and exploratory, or is about what it is like to have a particular experience (e.g., what is it like to be a working mother diagnosed with depression?).

### **TYPES OF NON-EXPERIMENTAL RESEARCH**

Non-experimental research falls into three broad categories: ex post facto research, correlational research, and survey research.

First, **ex post facto research** involves comparing two or more pre-existing groups of people. What makes this approach non-experimental is that there is no manipulation of an independent variable and no random assignment of participants to groups. Imagine, for example, that a researcher administers the Rosenberg Self-Esteem Scale to 50 American college students and 50 Japanese college students. Although this “feels” like a between-subjects experiment, it is an ex post facto study because the researcher did not manipulate the students’ nationalities. As another example, if we wanted to compare the memory test performance of a group of cannabis users with a group of non-users, this would be considered an ex post facto study because for ethical and practical reasons we would not be able to randomly assign participants to the cannabis user and non-user groups. Rather we would need to compare these pre-existing groups which could introduce a selection bias (the groups may differ in other ways that affect their responses on the dependent variable). For instance, cannabis users are more likely to use more alcohol and other drugs and these differences may account for differences in the dependent variable across groups, rather than cannabis use per se.

Second, the most common type of non-experimental research conducted in education is **correlational research**. Correlational research is considered non-experimental because it focuses on the statistical relationship between two variables but does not include the manipulation of an independent variable. More specifically, in correlational research, the researcher measures two continuous variables with little or no attempt to control extraneous variables and then assesses the relationship between them. As an example, a researcher interested in the relationship between self-esteem and school achievement could collect data on students’ self-esteem and their GPAs to see if the two variables are statistically related. Correlational research is very similar to cross-sectional research, and sometimes these terms are used interchangeably. The distinction that will be made in this book is that, rather than comparing two or more pre-existing groups of people as is done with cross-sectional research, correlational research involves correlating two continuous variables (groups are not formed and compared).

Third, **observational research** is non-experimental because it focuses on making observations of behavior in a natural or laboratory setting without manipulating anything.

Fourth, **survey research** is non-experimental as the studies in this category typically asks participants' opinions or feelings such as learning satisfaction, degree of agreement on certain variables (e.g., motivation, involvement, degree of learning, etc.)

### INTERNAL VALIDITY ISSUES FOR DIFFERENT RESEARCH DESIGN

Recall that internal validity is the extent to which the design of a study supports the conclusion that changes in the independent variable caused any observed differences in the dependent variable. Figure 1 shows how experimental, quasi-experimental, and non-experimental (correlational) research vary in terms of internal validity. Experimental research tends to be highest in internal validity because the use of manipulation (of the independent variable) and control (of extraneous variables) help to rule out alternative explanations for the observed relationships. If the average score on the dependent variable in an experiment differs across conditions, it is quite likely that the independent variable is responsible for that difference. Non-experimental (correlational) research is lowest in internal validity because these designs fail to use manipulation or control. Quasi-experimental research (which will be described in more detail in a subsequent chapter) is in the middle because it contains some, but not all, of the features of a true experiment.

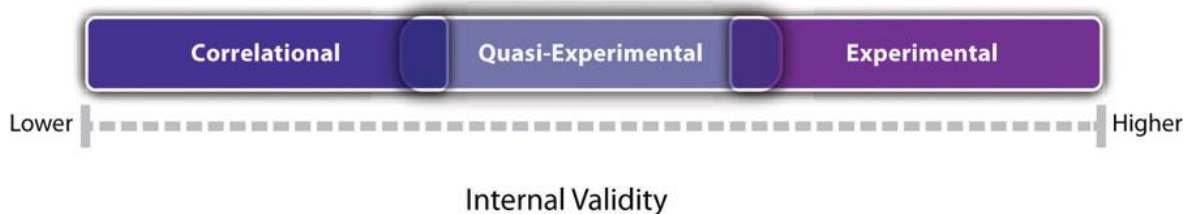


Figure 1 Internal Validity of Correlation, Quasi-Experimental, and Experimental Studies. Experiments are generally high in internal validity, quasi-experiments lower, and correlation studies lower still.

\*This article is adapted from:

<https://opentext.wsu.edu/carriecuttler/chapter/overview-of-non-experimental-research/>

