Introduction

Research is simply a scientific, methodical way of finding answers to questions. Research methods are useful to effectively evaluate an educational program or its participants in the most objective way. The type of research used is based on the purposes of your study. Here is an overview of the types of research, organized by the possible reasons for your study.

Quantitative vs. Qualitative Research?

Quantitative research focuses on measurement and counting, attempting to categorize and summarize using numbers and labels. Qualitative research aims more at thoroughly describing a situation or explaining reasons for a problem or circumstance. It is typically thorough and provides in-depth understanding of a situation or group of people but does not attempt to quantify results. Often, both quantitative and qualitative approaches are used in a research study or evaluation effort as they provide complementary information. This fact sheet primarily deals with quantitative methods.

Basic Definitions

- **Variable**—Characteristics by which people or things can be described. Must have more than one level—in other words, to be able to change over time for the same person/object, or from person to person, or object to object. Some variables, called attributes, cannot be manipulated by the researcher (e.g., socioeconomic status, IQ score, race, gender, etc.). Some variables can be manipulated but are not in a particular study. This occurs when subjects self-select the level of the independent variable, or the level is naturally occurring (as with *ex post facto* research).

- **Manipulation**—Random assignment of subjects to levels of the independent variable (treatment groups).

- **Independent variable**—The treatment, factor, or presumed cause that will produce a change in the dependent variable. This is what the experimenter tries to manipulate. It is denoted as “X” on the horizontal axis of a graph.

- **Dependent variable**—The presumed effect or consequence resulting from changes in the independent variable. This is the observation made and is denoted by “Y” on the vertical axis of a graph. The score of “Y” depends on the score of “X.”

- **Population**—The complete set of subjects that can be studied: people, objects, animals, plants, etc.

- **Sample**—A subset of subjects that can be studied to make the research project more manageable. There are a variety of ways samples can be taken. If a large enough random sample is taken, the results can be statistically similar to taking a census of an entire population—with reduced effort and cost.
Match the purpose of your study with the type of research to use.

**Purpose: Explore or Describe**

Type of research to use: Descriptive Study

If you are looking to gain insight into a problem or issue to better focus additional study or develop a clear research hypothesis, then the end sought is **exploration**. If you want to illustrate accurately and clearly the characteristics of a group or situation, then the purpose is **description**.

It is common for any type of research to include descriptive methods. Also, a descriptive method (such as a survey) is often used as the data collection technique for all kinds of research.

Start with a research question or research objective.

Examples of research questions:

- How many farmers use no-till methods in the county?
- What is the household income of EFNEP participants?
- How many projects does a typical 4-H member complete each year?

Examples of research objectives:

- To determine the average number of acres of corn planted by dairy farmers.
- To determine the average cost per meal served in the household.
- To determine the median family income of children enrolled in after-school child care programs.

Types of descriptive studies include:

**Survey Research**

The researcher gathers data from a large group of subjects, usually via mail, telephone, or in-person interviews. Since information is gathered at one point in time, survey research is sometimes referred to as a status or normative study. Relationships between variables are not explored. Examples include public opinion surveys, needs assessments, follow-up studies, etc.

**Developmental study**

A developmental study is survey research where surveys are taken at different points in time and compared. For instance, longitudinal studies:

- **Trend study**—General populations are sampled at each collection point. (Example: a sample of participants from a specific Extension course is taken and studied every year. The sample differs each year.)

- **Cohort study**—A specific population is followed over a period of time and sampled at each data collection point. (Example: a sample of this year’s participants in an Extension course is taken and studied, and a different sample taken from this year’s participants is taken and studied next year and successive years.) Although the same population is studied each year, the sample from that population is different each year.

- **Panel study**—An identical sample taken from the initial population at the initial data collection point is used at each data collection point. (Example: a sample of this year’s participants in an Extension course is taken and studied, and a different sample taken from this year’s participants is taken and studied next year and successive years.) Although difficult to keep in contact with an identical group over a long period of time, this allows changes in both the group and the individuals in the group to be studied over time.

**Case study**

A case study is conducted for similar purpose as the above but is usually done with a smaller sample size for more in-depth study. Often involves direct observation or interviews with single subjects or single small social units such as a family, club, school classroom, etc. This is typically considered qualitative research.

**Purpose: Explain or Predict**

Type of research to use: Relational study

Start with a research hypothesis.

Examples:

- The older the person, the more health problems he or she encounters.
- 4-H members attending 4-H summer camp stay enrolled in 4-H longer.
The greater the number of money management classes attended, the greater the amount of annual savings achieved.

There are different types of relational studies:

**Correlational study**

A correlational study compares two or more different characteristics from the same group of people. *Explains* how two characteristics vary together and how well one can be *predicted* from knowledge of the other.

- A *concurrent* correlational study draws a relationship between characteristics at the same point in time. For instance, a student’s grade point average is related to his or her class rank.

- A *predictive* correlational study could predict a later set of data from an earlier set. For instance, a student’s grade point average might predict the same student’s grade point average during senior year. It could also use one characteristic to predict what another characteristic will be at another time. For example, a student’s SAT score is designed to predict college freshman grade point average.

**Ex post facto (“after the fact”) study**

An *ex post facto* study is used when experimental research is not possible, such as when people have self-selected levels of an independent variable or when a treatment is naturally occurring and the researcher could not “control” the degree of its use. The researcher starts by specifying a dependent variable and then tries to identify possible reasons for its occurrence as well as alternative (rival) explanations. Such confounding (intervening, contaminating, or extraneous) variables are “controlled” using statistics. This type of study is very common and useful when using human subjects in real-world situations and the investigator comes in “after the fact.” For instance, it might be observed that students from one town have higher grades than students from a different town attending the same high school. Would just “being from a certain town” explain the differences? Specific reasons for the differences would be explored: such as differences in income, ethnicity, parent support, etc.

**A note of caution**

It is important to recognize that, in a relational study, “cause-and-effect” cannot be claimed but only that there is a *relationship* between the variables. For that matter, variables that are completely unrelated could, in fact, vary together due to nothing more than coincidence. That is why the researcher needs to establish a plausible reason (research hypothesis) why there might be a relationship between two variables before conducting a study. For instance, it might be found that all football teams with blue uniforms won last week. There is no likely reason why the uniform color had any relationship to the games’ outcomes and certainly was not the *cause* for victory.

**Purpose: Determine Cause and Effect**

**Type of research: Experimental or Quasi-experimental Study**

Start with a *research hypothesis*.

Examples:

- Participants who complete the training program will have higher math scores.
- Flossing teeth daily prevents gum disease.
- High blood pressure causes heart attacks.
- “Pesticide B” eliminates “Disease A” in corn crops.

Experimental research is a methodical way of comparing two or more groups to determine differences in the effect of different treatments received by each group. In experimental research, the researcher purposely manipulates a treatment (independent variable) to see if it causes a change in the dependent variable (effect). A treatment can be an educational program, new drug, herbicide, or procedure that is being tested for its “effect” on the dependent variable. For instance, giving a new reading program to one group of students and using the old way of teaching reading to a different group of students to see if the new way yields higher reading scores. Extraneous variables are also controlled by the researcher so they can be ruled out as other possible “causes.” Experimental research is the only type of study where true “cause-and-effect” can be claimed.

*A true experiment* requires the random assignment of subjects (such as people, animals, or plants) to a treatment group. Random assignment is the only way that groups can be considered statistically equivalent.
In a quasi-experiment, groups of subjects are constructed using a method other than random assignment. When using human subjects, it is often impossible to do random assignment. They are often part of intact groups such as school classrooms, community organizations, neighborhoods, 4-H clubs, or nursing homes. Although groups might be reasonably similar in a practical sense, using data from intact groups limits the conclusions that can be drawn regarding program effects. Still, quasi-experiments are useful in providing valuable evidence of program impacts.

A pre-experimental design has little control over environmental factors that could affect the outcome of a study. For example, a one-group, pretest/posttest design doesn’t even use another group for comparison. But such a design does provide some evidence of program impact (with major limitations in the conclusions that can be drawn) and is commonly used when more elaborate designs are not possible.

Summary

Each research method has benefits, but no method alone is likely to solve all your problems or answer all your research questions. That is why methods are often combined. It just may not be possible to conduct a single study to give a complete and definitive result. Studies are often repeated over time. The most important recommendation is to choose methods(s) that meet your needs and to conduct the study in a careful, thorough, and objective way. That way, you can be confident that your findings can be believed. Therefore, pay attention to the purpose of your study and match up the method(s) that help achieve that purpose.

References


Miller, Larry E. Course notes from Research Methods, Department of Agricultural Education, The Ohio State University, 1985.