UNDERSTANDING RESEARCH METHODS

Second Edition

An Overview of the Essentials

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Pyrczak Publishing
P.O. Box 39731 • Los Angeles, CA 90039

Cover design by Larry Nichols and Robert Kibler.

Editorial assistance provided by Sharon Young, Brenda Koplin, Elaine Fuess, Cheryl Alcorn, and Randall R. Bruce.

Printed in the United States of America.
10 9 8 7 6 5 4 3 2 DOC 05 04 03 02 01 00

ISBN 1–884585–22–1

INTRODUCTION

This book provides you with an overview of basic research methods.

The distinctive features of this book are:

- The division of the material into short sections instead of long chapters will help you take small steps through this exciting but highly technical field of study. The long chapters in other research methods books encourage students to take big gulps, which often are not easily digested.

- When one topic builds directly on the previous one, the second one begins with a reminder of what you should have mastered in the first. This helps you keep your eye on the big picture.

- Technical jargon is defined in plain English to the extent possible, and numerous examples make abstract research concepts concrete. Student reactions in field tests attest to success in the effort to make this book comprehensible.

- The material on statistics is presented at the conceptual level. It shows you how to interpret statistical reports but does not bog you down with computational details.

- The exercises at the end of the topics encourage you to pause to make sure you have mastered one topic before moving on to another. This is important because many topics are cumulative—thorough mastery of an earlier one is a prerequisite for mastering a later one with ease. The first part of each exercise tests your comprehension of factual material. The second part asks you to interpret and apply the material you have mastered. This will help you internalize the concepts as well as stimulate classroom discussions.

Why should you have an overview of research methods? Because . . .

- Leaders in all fields are increasingly relying on the results of research in making important decisions such as how to help those who are dependent on welfare, which types of educational programs to fund, and how to adjust work environments to improve employees' output and satisfaction. If you hope to become a decision-maker in your field, you must master research methods to be effective in sorting through the conflicting claims often found in the research literature on a topic.

- Many of you will be expected to do simple but important research on the job. Clinical psychologists are expected to track improvements made by their clients, teachers are expected to experiment with new methods in the classroom, and social workers are expected to collect data on their clients.

- All of you will be making lifestyle decisions based on research reported in the media. Should you take vitamin supplements? How should you dress for success on the job? Which make of automobile should you buy if your primary concern is safety? Answers based on research are often offered in newspapers, magazines, and television newscasts. As a result of studying research methods, you will become a sophisticated consumer. You'll consider questions such as "Was the sample biased?" and "Are the results statistically significant?"

- Finally, you may need to read and report on published research in other classes. You will be more skilled at doing this if you have an understanding of basic methods of research.

Acknowledgments

Dr. Anne Hafner and Dr. Robert Morman, both of California State University, Los Angeles, provided many helpful comments on the first draft of this book. Their assistance is greatly appreciated. Errors and omissions, of course, remain the responsibility of the author.

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PART A

INTRODUCTION TO RESEARCH METHODS

This part of the book defines what we mean by *empirical research* and provides an overview of the characteristics of major approaches to this type of research. Broad issues that underlie all types of research such as the nature of research hypotheses, how researchers define the variables they plan to study, ethical considerations in research, and the relationship between theory and research are also covered in this part.

Notes

TOPIC 1 INTRODUCTION TO EMPIRICAL RESEARCH

The *empirical* approach to knowledge is based on *observations*.[1] We all use the empirical approach in everyday living. For instance, if a teacher observes that students become restless during a certain lesson, he or she might say that they "know" that the lesson is boring. As useful as everyday observations often are, they can be misleading and often are misinterpreted. For example, the teacher may have misinterpreted reasons for the children's restlessness; it might be the time and day, such as a warm Friday afternoon, that is the culprit — not the inherent interest of the lesson. Even if the lesson is boring to this teacher's children, the teacher might conclude that the lesson is boring to children *in general*, when it might, in fact, be interesting to other children at other ability levels, with different backgrounds, and so on.

When scientists use the empirical approach, they strive to avoid misleading results and poor interpretations. The key to doing so is careful planning of *why* they want to make observations, *whom* they wish to observe, as well as *how* and *when* to observe.

The question of *why* to observe establishes the need for the study. Perhaps a better method for helping students acquire a certain mathematics skill is needed. After considering their own experiences and reviewing related literature on the topic, researchers prepare a formal statement of their research purpose such as "whether the use of hands-on manipulatives to teach Topic X will result in greater student achievement than a lecture and workbook approach." They might also arrive at a *hypothesis*, which is a statement of what they expect the results to show. For example, they might hypothesize that those who use manipulatives will have higher scores than those who are exposed to the lecture/workbook approach. The question of *why* is explored throughout Parts A and B of this book.

When they plan *whom* to observe, they first decide whether to observe an entire population (such as all fifth-grade children in a school district) or just a sample of the population. If a sample is to be observed, which is often the case, they consider how to obtain a sample that is not biased against any individuals or subgroups. For example, asking for students to volunteer to take a lesson might result in a sample of students who are more interested in the content of that lesson than the children in the population as a whole. Such a sample would be biased against those who are less interested in the first place. Methods of drawing unbiased samples are discussed in Part C of this book.

When scientists plan *how* to observe, they select among the available instruments such as objective tests, interviews, and direct observation of behavior, with an eye to selecting the most valid instrument(s). If none is judged to be reasonably valid for their purpose, they develop new instruments. Then, of course, they need to decide *when* they will use the instruments to obtain the most valid results. These issues are explored in detail in Part D of this book.

The observations scientists make may result in *data* in the form of numbers, which are analyzed statistically. Popular statistical techniques are described in Part F of this book. Note that some scientific observations are *not* reduced to numbers but are expressed in words. For example, interview data may be described in a narrative that points out themes and trends. The choice between the two approaches is described in Topics 9 and 10 of this book.

One of the most fundamental distinctions in scientific research is whether research is *experimental* or *nonexperimental*. In experimental research, treatments are given for the research purpose — such as treating some students with manipulatives and others with a lecture/workbook approach in order to determine which treatment *causes* greater achievement.

Of course, we are not always interested in cause-and-effect questions. For example, we

[1]Examples of other approaches are (1) *deduction* as when we deduce a proof in mathematics based on certain assumptions and definitions and (2) *reliance on authority* such as relying on a dictator's pronouncements as a source of knowledge.

might want to know whether teachers believe they need more training in the use of manipulatives for teaching mathematics. For this particular purpose, we merely need to ask teachers about their needs; we do not need to train or treat the teachers. The distinction between experimental and nonexperimental research is explored in the next two topics of this book.

EXERCISE ON TOPIC 1

1. What is the empirical approach to knowledge based on?

2. What does the question of *why* establish?

3. How is the term *hypothesis* defined in this topic?

4. According to the topic, are samples often observed?

5. What do scientists do when they plan *how* to observe?

6. Are the results of all scientific studies expressed as numbers?

7. Are treatments given for the research purpose in *experimental* or *nonexperimental* research?

Questions for Discussion

8. Briefly describe a time when you were misled by everyday observation, that is, when you reached a conclusion based on everyday observation that you later decided was an incorrect conclusion.

9. You have probably encountered conflicting research reported in the mass media. For example, one study might indicate that X increases blood pressure while another study indicates that X does not increase it. Speculate on the reasons why different researchers might obtain different results when studying the same problem.

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10. Name a general problem area in which you might conduct research. At this point, your problem area may still be broad such as "HIV education" or it may be narrow such as "effectivness of the Jones' HIV education program for high school juniors." Also, you may wish to name several problem areas for research and make a final selection at a later time.

11. Have you already made observations in your problem area(s)? If so, briefly describe them. (Keep in mind that observations may be *direct* such as observing aggressive behavior on a playground or *indirect* such as asking adolescents for self-reports on their alcohol consumption.)

12. If you answered yes to question 11, did you make informal observations *or* did you plan *why*, *whom*, and *how* to observe in advance of making the observations? Explain.

TOPIC 2 EXPERIMENTAL VS. NONEXPERIMENTAL STUDIES

In **experiments**, researchers give treatments and observe to see if they cause changes in behavior. A classic simple experiment is one in which we form two groups at random and give each group a different treatment. To form two groups at random, we can put the names of the available subjects on slips of paper, mix them thoroughly and pull some names for each group.[1] Notice that random assignment gives each subject an equal chance of being in either group.

Here are two examples of experiments:

EXAMPLE 1
Fifty students were divided into two groups at random. One group received math instruction via a correspondence course on the Internet. The other group was given instruction on the same math skills using a traditional textbook and workbook approach. The purpose was to see if instruction via the Internet was more effective than traditional instruction.

In Example 1, the group receiving the new type of instruction via the Internet is referred to as the *experimental group* while the group receiving traditional instruction is called the *control group*.

When the subjects are divided at random (such as drawing names out of a hat to determine who will be in the experimental and who will be in the control group), the experiment is called a *true experiment*. Not all experiments are true experiments,[2] as illustrated by Example 2.

EXAMPLE 2
A psychiatrist identified 100 clinically depressed clients who volunteered to take a new drug under her direction. She identified an additional 100 nonvolunteers with the same diagnosis and similar demographics (that is, background characteristics such as age and gender) to serve as controls. The study was conducted to investigate the effectiveness of the new drug in treating depression.

In Example 2, the experiment was conducted by comparing the volunteers who were given the new drug with the nonvolunteers. This study is an experiment even though random assignment was not used. Note that if a researcher administers treatments or arranges for their administration, the study is called an experiment whether or not groups of subjects are formed at random.

In **nonexperimental studies**, researchers do *not* give treatments. Rather, they observe subjects in order to describe them as they naturally exist without experimental intervention. One of the most common types of nonexperimental studies is the *survey* or poll in which subjects are interviewed, questioned, or otherwise observed in order to determine their attitudes, beliefs, and behavior as they exist without experimental intervention.

Nonexperimental studies come in many forms, which are explored in more detail in Topic 4. At this point, however, you should be able to distinguish between nonexperimental studies and experiments by determining whether treatments were administered for experimental purposes.

Note that you cannot distinguish between nonexperimental and experimental studies on the basis of the type of instrument (that is, measuring tool) used. Instruments such as paper-and-pencil tests, interview schedules, and personality scales are used in both types of studies. The act of measurement is usually not considered to be a treatment. In fact, researchers try to measure in such a way that the act of measuring does *not* affect or change the subjects. This is true in both experimental and nonexperimental studies.

By now, you may have inferred that the purpose of an experiment is to explore cause-and-effect relationships (that is, treatments are given to see how they affect the subjects). In the next topic, you will learn how nonexperimental studies also are sometimes used for this purpose.

[1]Other methods for drawing random samples are discussed in Part C of this book.
[2]Types of experiments are explored more fully in Part E, where you will learn the advantages of true experiments.

EXERCISE ON TOPIC 2

1. In which type of study are treatments given?

2. In an experiment, Group A was given verbal praise for being on time for appointments while Group B was given no special treatment. Which group is the control group?

3. When subjects are divided at random, what type of experiment is being conducted?

4. What is the purpose of a nonexperimental study?

5. Is a survey an experiment?

6. Does knowing that interviews were used in a study help you determine whether the study was experimental or nonexperimental?

7. What is the major purpose of an experiment?

8. A social worker surveyed clients to determine their satisfaction with the services provided. Is this an experimental study or nonexperimental study?

9. A teacher tried three methods of teaching handwriting by using different methods with different students. Is this an experimental study or nonexperimental study?

Questions for Discussion

10. Have you ever conducted an informal experiment by giving a treatment to a person or a group and observing the effects? If so, briefly describe it. Would you have obtained better information by including a control group? Explain.

11. Suppose you read that an outbreak of intestinal disorders occurred in a town and the source was traced to contaminated chicken served in a popular restaurant. Is it likely that the study that identified the source was experimental or nonexperimental? Why?

12. Suppose you wanted to know whether reading to preschool children has a positive effect on subsequent reading achievement. Do you think that it would be better to conduct an experimental or a nonexperimental study? Why?

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13. At this point, do you anticipate using an experimental or nonexperimental approach in your research? If it will be experimental, what treatments do you plan to administer?

TOPIC 3 EXPERIMENTAL VS. CAUSAL-COMPARATIVE STUDIES

As you know from Topic 2, an **experiment** is a study in which treatments are given in order to observe their effects. When we conduct experiments, we ask, "Do the treatments (i.e., the input or stimulus) *cause* changes in the subjects' behavior (i.e., the output or response)?"

When we want to investigate cause-and-effect relationships, we usually prefer experimental over nonexperimental studies. However, there are times when cause-and-effect is of concern, but conducting an experiment is not possible for physical, ethical, legal, or financial reasons. An example is the effects of smoking on health. It would be unethical (because of potential harm to the subjects) to treat some subjects with smoke (such as requiring them to smoke a pack of cigarettes a day for 15 years) in order to observe the effects in comparison with a nonsmoking control group (which is forbidden to smoke for 15 years). Clearly, for this research problem, we cannot conduct an experiment. Notice that even if it were ethical to conduct such an experiment, it may not be practical because we probably would not want to wait 15 years to determine the answer to such an important question.

When it is impossible or impractical to conduct an experiment on a question of causality, we must settle for information derived from nonexperimental studies. For example, we can identify both people who currently have lung cancer and a control group with similar demographics (that is, background characteristics such as socioeconomic status) and describe the differences between the two groups in terms of previous lifestyle characteristics that might affect health such as diet, exercise, smoking, prescription drug use, illicit substance abuse, and so on. A finding that smoking differentiates between the two groups while other lifestyle characteristics do not *points the finger* at smoking as a possible cause of lung cancer.

However, there are several dangers in this interpretation. First, smoking and cancer might have a common cause. For example, perhaps stress causes cancer, and stress also causes people to smoke excessively. If this is the case, banning smoking will not prevent cancer; only reducing stress will. Another danger is that the researcher may have failed to identify control subjects who were properly matched with those who have lung cancer. For instance, perhaps most of those with lung cancer reside in urban areas and those in the control group tend to reside in rural areas. Since urban areas tend to have more smog than rural areas, smog might be the cause, and smoking might be coincidental. These types of problems would not arise in a true experiment in which subjects are divided at random to form two groups — one of which will be made to smoke and the other forbidden to smoke. They would not be problems because the random assignment would produce two groups that are equally likely to experience stress and equally likely to live in either rural or urban areas—and, in fact, be about equal[1] in terms of all other potential causes of cancer.[2]

The example of smoking and lung cancer illustrates a specific type of nonexperimental study known as a **causal-comparative study** (sometimes called an *ex post facto study*).[3] The essential characteristics of this type of nonexperimental study are that (1) we observe and describe some current condition (such as lung cancer) and (2) we look to the past to try to identify the possible cause(s) of the condition. Notice that researchers do *not* give any treatments in causal-comparative studies. They only describe observations; hence, they are conducting nonexperimental studies. Although the causal-comparative method has more potential pitfalls than the experimental method, it is often the best we can do when attempting to explore causality. However, when it is used properly, the causal-comparative method is a powerful scientific tool that provides data for many important decisions that are made in all the sciences.

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[1]The larger the sample, the more likely they will be equal. Sample size is covered in Topics 21 and 22.

[2]The relationship between smoking and health has been examined in hundreds of causal-comparative studies. Most experts agree that alternative interpretations are without merit.

[3]Other types of nonexperimental studies are covered in the next topic.

EXERCISE ON TOPIC 3

1. According to the topic, are experimental or causal-comparative studies preferred for exploring cause-and-effect relationships?

2. We look to the past for a cause in which type of study?

3. Is causal-comparative research a type of experiment?

4. What is another name for a causal-comparative study?

5. Are treatments given by researchers in causal-comparative studies?

6. Random assignment to treatments is used in which type of study?

7. A researcher compared the health of adolescents who had received free lunches during their elementary school years with that of a comparable group of children who had not received free lunches. The purpose was to determine the effects of free lunch on health. Did the researcher conduct an experimental or causal-comparative study?

8. A researcher divided patients who were being released from the hospital into two groups. One group received the normal exit interview and counseling while another was given an extended exit interview and extended counseling. The purpose was to determine the effects of the two types of interviews and counseling on patients' compliance with physicians' orders during the first week after hospitalization. Did the researcher conduct an experimental or a causal-comparative study?

9. Suppose a researcher wants to know the effects of smog on lung cancer rates. Will a causal-comparative or experimental study provide an answer in a shorter amount of time?

Questions for Discussion

10. If you wanted to investigate the causes of child abuse, would you probably use the experimental or causal-comparative method? Why?

11. Suppose you read that a causal-comparative study indicates that those who take vitamins A and E tend to be less overweight than the general population. Are there any possible dangers in the interpretation that the vitamins *cause* people to maintain a healthy weight?

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12. If you will be conducting a nonexperimental study, will it be causal-comparative (i.e., will you be looking to the past for the causes of some current condition)? If yes, briefly explain why you chose this method of research instead of the experimental method.

TOPIC 4 TYPES OF NONEXPERIMENTAL RESEARCH

As you know from Topics 2 and 3, researchers do not give treatments to subjects in nonexperimental studies. Rather, they observe (that is, measure) in order to describe the subjects without trying to change them.

Nonexperimental studies take many forms because they serve many purposes. Some of the more common types of nonexperimental studies and their purposes are described here.

You learned in the previous topic about **causal-comparative research** in which we look to the past for the cause(s) of a current condition.

Another type you are already familiar with is the **survey** or *poll*. The purpose of surveys is to describe the attitudes, beliefs, and behavior of a population. We draw a sample of a population, study the sample and then make inferences to the population from the sample data. For example, we could survey a sample of all people receiving food stamps to determine what types of food they purchase with the stamps. What we learn from this sample, we can generalize to the population, assuming that we have drawn a good sample.[1] Note that if we decide not to sample but, instead, interview everyone in the population (that is, all people receiving food stamps), the study would be called a **census**. A census is a count or study of all members of a population.

While surveys usually include hundreds or thousands of subjects, a **case study** usually involves only one. For instance, many important theories in clinical psychology were developed based on intensive one-on-one case studies of individuals. In a case study, the emphasis is on obtaining thorough knowledge of an individual — sometimes over a long period of time. We do not confine ourselves to asking a limited number of questions on a one-shot basis as we usually do in surveys.

When we conduct a thorough, intensive case study of a group—such as a tribe or all people affiliated with a public school—we usually say that we are conducting **field research** (also called *ethnographic research*).[2] When conducting this type of research, we might observe as an outsider, or we might become a member of the group in order to make the observations. For example, a nurse researcher might join the staff of a hospital as an employee in order to conduct his or her field research on the hospital.

When we repeatedly measure trait(s) of the subjects over a period of time in order to trace developmental trends, we say that we are conducting **longitudinal research**. For example, we could measure the visual acuity of a sample of infants each week for a year to trace its development.

In **correlational research**, we are interested in the degree of relationship among two or more quantitative *variables*. For example, scores on a college admissions test and GPAs are quantitative and, because people *vary* or differ on both of them, they are variables.[3] If we conduct a study in which we are asking "Did those with high admissions scores tend to earn high GPAs?" and "Did those with low admissions scores tend to earn low GPAs?" we are asking a correlational question. If the answer is "yes," we can say that the test works (i.e., is valid for predicting GPAs).[4]

Finally, in **historical research**, we examine data in order to understand the past. Note that good historical research is not just a matter of developing a chronological list of so-called facts and dates. Rather, it is an attempt to understand the dynamics of human history. As such, it is driven by theories and hypotheses, just like other types of research. In other words, by reviewing historical evidence, researchers are able to develop theories that may explain historical events and patterns. These theories lead to hypotheses, which are evaluated in terms of additional historical data that are collected.

[1]Characteristics of good samples are explored in detail in Part C of this book.
[2]Ethnographic research is a type of qualitative research, which is discussed in more detail in Topics 9 and 10.
[3]Types of variables are described in Topics 5 and 6.
[4]Validity is explored in Part D. Correlational studies employ a statistic called a *correlation coefficient*, which is described in Topic 47.

EXERCISE ON TOPIC 4

1. Suppose a researcher annually administered an intelligence test to young children to study changes in intelligence over time. She was conducting what type of study?

2. Is the study in question 1 experimental?

3. If a researcher conducts a poll to estimate public support for free child care for welfare mothers, he is conducting what type of nonexperimental study?

4. An investigator determined the degree of relationship between vocabulary scores and reading comprehension scores. She was conducting what type of nonexperimental study?

5. What is another name for field research?

6. A case study usually involves how many subjects?

Questions for Discussion

7. Name a topic in your field of study that you might explore with a nonexperimental study. Which type of study would be most appropriate for your topic?

8. Think of a survey in which you were asked to serve as a subject. (You may have been sent a questionnaire in the mail such as a consumer satisfaction survey or been contacted in person or by phone.) Did you cooperate and respond? Why? Why not?

9. Name two quantitative variables that might be studied using correlational research.

10. Suppose someone prepared a list of educational events and their dates of occurrence in this century. Would the list be an example of "good" historical research? Explain.

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11. If you will be conducting a nonexperimental study, which type will it be? Explain the basis for your choice.