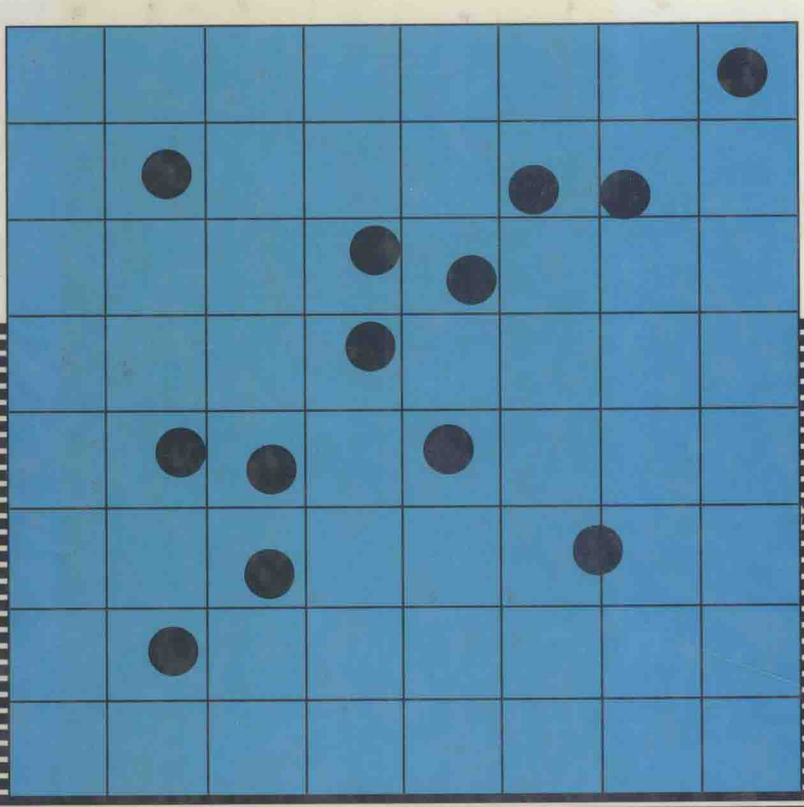
UNDERSTANDING AND CONDUCTING RESEARCH

APPLICATIONS IN EDUCATION AND THE BEHAVIORAL SCIENCES

EMANUEL J. MASON
WILLIAM J. BRAMBLE

SECOND EDITION



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To Susan, Sara, Sandy, and
Ellen, Anne Marie, Shelley, Billy, and
Our Parents

PREFACE

This book is intended to introduce beginning graduate-level students to the spectrum of thinking on research in education, the behavioral sciences, and related fields. However, unlike many of the other books in the field, this is not a cookbook of research techniques. It is not our view that research is a set of principles, activities, or methods that can be applied mechanically to any problem or situation. Research is about finding, structuring, and understanding the complexities of knowledge. This knowledge may be used to build theory, to develop policy, to support decision making, or just to find out something. Too often students dwell on the accoutrements of the researcher, such as statistics, measurement, or computers, thus reducing research to an affectation that lacks the riches and excitement of the real thing. The commitment is to look like a researcher, rather than to find dependable knowledge. It is hoped that the presentation, the many examples, and the issues raised in this book will help the student to appreciate research as a knowledge-building process with purposes, contexts, values and perspectives, and very definite limitations.

As was the first edition, this text is written for two groups of students. The first group includes graduate students in education and the behavioral and social sciences who are planning to become teachers, psychologists, counselors, managers, administrators, nurses, and other kinds of practitioners. They will not be likely to contribute extensively to the research literature, but in order to maintain their currency in their careers, they will require a modest level of literacy about scientific research. The second group to whom this text is directed includes the students who are preparing for careers that will be more directly involved in doing research.

We approached our task realistically. We expect many of the students who read this book will not have had extensive backgrounds in statistics, mathematics, philosophy of science, or even the social sciences. Every effort was

made to keep the level of discussion sophisticated while not assuming extensive technical background on the part of the student. For example, this text is not intended to be a textbook on data analysis suitable for a statistics course; but since statistics is used in much research, some attention has to be given to statistical analysis. The focus of the chapters on statistics is on the meaning of various statistical techniques as they are applied in research. We leave the chore of teaching how to derive and apply those techniques to courses in statistical analysis. We have found in our teaching that students benefit from a discussion of how statistics can be applied in research, regardless of whether or not they have taken courses in statistics. A similar approach was taken in other technical areas such as measurement and computer applications.

We feel that skill in research (reading about it as well as doing it) will only come with practice. For this reason, questions have been provided in the chapters. These questions can be answered by students individually, or they can be used as a basis for class or group discussions. Where appropriate, answers (or suggested answers) have been provided in Appendix C. Students should also get in the habit of critically reading the research literature in their fields as they go through the book.

Much of the material included in the first edition has been changed, not because of dramatic upheavals in the research field, however, but because of the subtle changes since 1978, comments we received from colleagues in formal and informal reviews, and considerable feedback from students. A number of relatively new research strategies have been mentioned, such as exploratory data analysis, meta-analysis, and new ways to use computer technology in research. Chapters have been restructured, and the order of presentation has been changed. The orientation of the experimental design chapters (Chapters 4 and 5) more clearly emphasizes design principles rather than the strengths and weaknesses of preexisting designs. A new chapter (Chapter 11) discusses putting together all the various parts, the thinking, the tools, and the procedures, to create a research study. In addition, there has been a general updating of references, discussion, and illustrative material.

The book is divided into three parts. Part One establishes the foundation for the material covered in the book. To use a rather worn metaphor, Part One sets the stage for the rest of the book. How the researcher reasons, thinks, perceives, and knows are discussed. Further, the scientific method and examples of descriptive, experimental, historical, and evaluation research are presented. Part Two introduces the tools of the researcher. First the vocabulary of the researcher is explained, and there is a short discussion on the use of the library. Then there are chapters on experimental and quasi-experimental design, statistical analysis, measurement, observation, scaling, and computer applications. Chapters in Part Three are designed to help the student understand how the techniques discussed in Part Two are used to produce, recognize, evaluate, and write about research. In addition, such topics as research funding, ethics, and the social context of research are covered in the final chapters.

As with any book, a number of people besides the authors have made con-

tributions and should be recognized for them. In the case of the present text, a complete list would be too extensive. However, certain contributions cannot be overlooked. We are particularly in the debt of the many students in EDP 656, Introduction to Research Methods in Education, who over the years have told us how this text should be written. We hope we learned those lessons well. We also wish to express our appreciation to some of our colleagues for their reviews of parts of the manuscript as it was being prepared, most notably, Phil Berger, James R. Barclay, and Tim Smith, were supportive in their willingness to discuss with us our ideas. Chia Hsin Lin helped by suggesting many of the recent illustrative examples from the literature. We wish to express our appreciation to our families, and to all the others whose patience and support helped make the completion of the final manuscript possible.

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CONTENTS

PART ONE

THE FIELD OF RESEARCH: AN OVERVIEW

Part I, consisting of two chapters, provides an introduction to the diversity and flavor of the spectrum of research in education and the behavioral sciences. Chapter 1 presents an introduction to such fundamental concepts as the relationship between philosophy and science, causation, basic versus applied research, and the kinds of reasoning used by researchers. In Chapter 2, the scientific method is portrayed as a way of thinking about and systematically investigating a problem area. Chapter 2 also provides specific illustrations of how the scientific method is applied by presenting examples from the literature. These two chapters provide a background for topics that come later.

CHAPTER 1

SCIENCE AND RESEARCH

Research is concerned with finding answers. Some forms of research are commonplace in everyday life. For example, a commuter wonders, "What is the quickest way to get to work?" Elsewhere a chef is asking, "How much salt should go into the soup?" At an elementary school, a teacher planning daily routines inquires, "When is the best time of day to recess the class?" and in a laboratory, a physicist wants to know, "What is the maximum velocity of an object in space?" Each of these people is asking questions of varying degrees of complexity and general importance and, by asking the questions, suggesting that answers can be found. *Research* may be defined simply as "the search for answers to questions." Thus if the commuter, the chef, the teacher, and the physicist search for the answers to their questions, they will each be doing research. Their research may be carefully and systematically done, or it may be haphazard. Perhaps the commuter and chef, preferring the trial-and-error approach, will not follow a carefully prescribed program to find solutions, but the physicist will probably organize the investigation carefully. In this text, we will emphasize the kind of systematic organized search for knowledge used in scientific investigations in education and the behavioral sciences rather than the more haphazard approaches many of us use for everyday problems.

Research activities can be viewed from three perspectives. For example, a pharmacologist might do some research on the side effects of a certain medication. A person who does not have an extensive background in biology or medicine reads about the finding in the newspaper and feels that the work is interesting but does not affect him or her personally very much. That person's physician, however, alters the prescriptions he issues as a result of the report.

The physician in this case plays the role of *consumer*. The person reading the newspaper is more of a *spectator,* while the pharmacologist is a *participant* in the research activity.

Understanding the principles and techniques of research can be useful to spectators and consumers as well as to participants in the research process. In education and the behavioral sciences, three categories of involvement in research also exist. Specifically in education, on the front line so to speak, consumers of research are the guidance counselors, teachers, school psychologists, and social workers, who offer direct services as part of the school program. The spectators, often with more than a passing interest, may be parents, taxpayers, and politicians. Participant researchers attempt to provide answers to the questions raised about education and schools.

THE CHARACTERISTICS OF SCIENCE AND RESEARCH

To most people, the word *science* brings visions of test tubes, microscopes, complicated laboratory equipment, and expressionless white-coated people turning dials, peering into glass tubing, and briskly jotting notes on clipboards. There is an air of mystery surrounding the whole scene. Another mistake that people make is to give the status of science to the tools that scientists use. For example, behavioral scientists commonly use tests, computers, and statistics as tools in their work. These tools assist in the scientist's work. Few people would confuse sawing wood with the highly skilled craft of furniture making. Similarly, definitions of *science* that focus on what some scientists do or the instruments they use are lacking in utility.

Probably the most parsimonious definition of *science* is that it is "the systematic development and organization of a body of knowledge." The material is organized to provide structure by which phenomena can be explained. By *phenomena,* we mean facts or events that can be observed. Thus Sir Isaac Newton, well known for his seventeenth-century work concerning the physics of moving objects, based his explanation of gravity upon observations he and others made about falling objects. Newton was able to integrate these observations into a universal explanation in the form of a mathematical relationship that indicated that the force of gravitation between two masses equaled the product of the masses multiplied by a constant and divided by the squared distance between the masses.* The use of a simple mathematical relationship to explain a phenomenon occurring naturally is a good example of the content of the physical sciences. The behavioral and social sciences have not yet been able to develop explanatory relationships that are quite so elegant in their simplicity.

It would be natural to ask at this point "Why have science? What is its purpose?" The answer to such a question is not a simple one. There are at

* Andrade, E. N. da C. (1958). *Sir Isaac Newton.* Garden City, NY: Doubleday (Anchor Books).

least two purposes, depending upon one's audience. The lay person usually looks toward science to improve the quality of life. According to this view, science holds the key to elimination of disease, the solution of social and economic problems, and the improvement of life generally. Many scientists, however, do not share this view. They think that improvement of life may be a useful by-product of science, but it cannot be the main purpose. Rather, the purpose of science, according to this position, is the formation of general explanatory principles explaining the relationships among phenomena that occur naturally. These principles can then be utilized to predict future events. Underlying this position is the proposition that knowledge is important in itself and that the significance of a piece of information is not tied to its applicability to the problems of everyday life. Another way of stating this aim would be to say that the purpose of science is to develop *theory,* which can be defined as "a set of formulations designed to explain and predict phenomena." We will have more to say about theories later.

One might ask, "Where does research fit into science?" To answer this question, we must go back to the definition of *research* given earlier, "the search for answers to questions." We could say that research is the process that scientists use to find the knowledge they need to formulate and evaluate theories. But that would be true for only some research. Other research does not have a scientific purpose at all. Consider, for example, research to determine the effectiveness of an advertising campaign for a certain brand of toothpaste. The researcher might look at the sales record of the product and also survey the attitudes of a sample of consumers to determine whether the advertising was effective. But he or she is probably not interested in developing generalizable knowledge, knowledge that can be used to formulate a theory of advertising to explain consumer reaction to a product. More likely, the researcher's sole interest is in being able to recommend to company executives the continuation or discontinuation of the advertising campaign.

Clearly, then, it is possible for a particular research investigation to be designed for reasons other than to support the aims of science. To clarify further what we mean by the term *research* in this text, we will restrict our interest to research that is scientific. However in this context, *scientific* does not necessarily mean "science." Rather, it refers to a manner of doing research known as the *scientific method.* We will go into the scientific method in some detail in Chapter 2. For the present, we will simply state that the scientific method provides for *systematic* investigation of a question or problem. The scientific method is extremely versatile. It has been adopted for use in virtually all kinds of research. Indeed, historians, physicists, and psychologists all use basically the same steps in conducting their investigations, although the specific techniques they use to observe, gather, and interpret data may be very different.

We have stated that we will emphasize scientific research in this book. Research that is not systematic would be haphazard. Occasionally a scientific discovery is precipitated by a serendipitous finding. Pasteur's chance finding of a