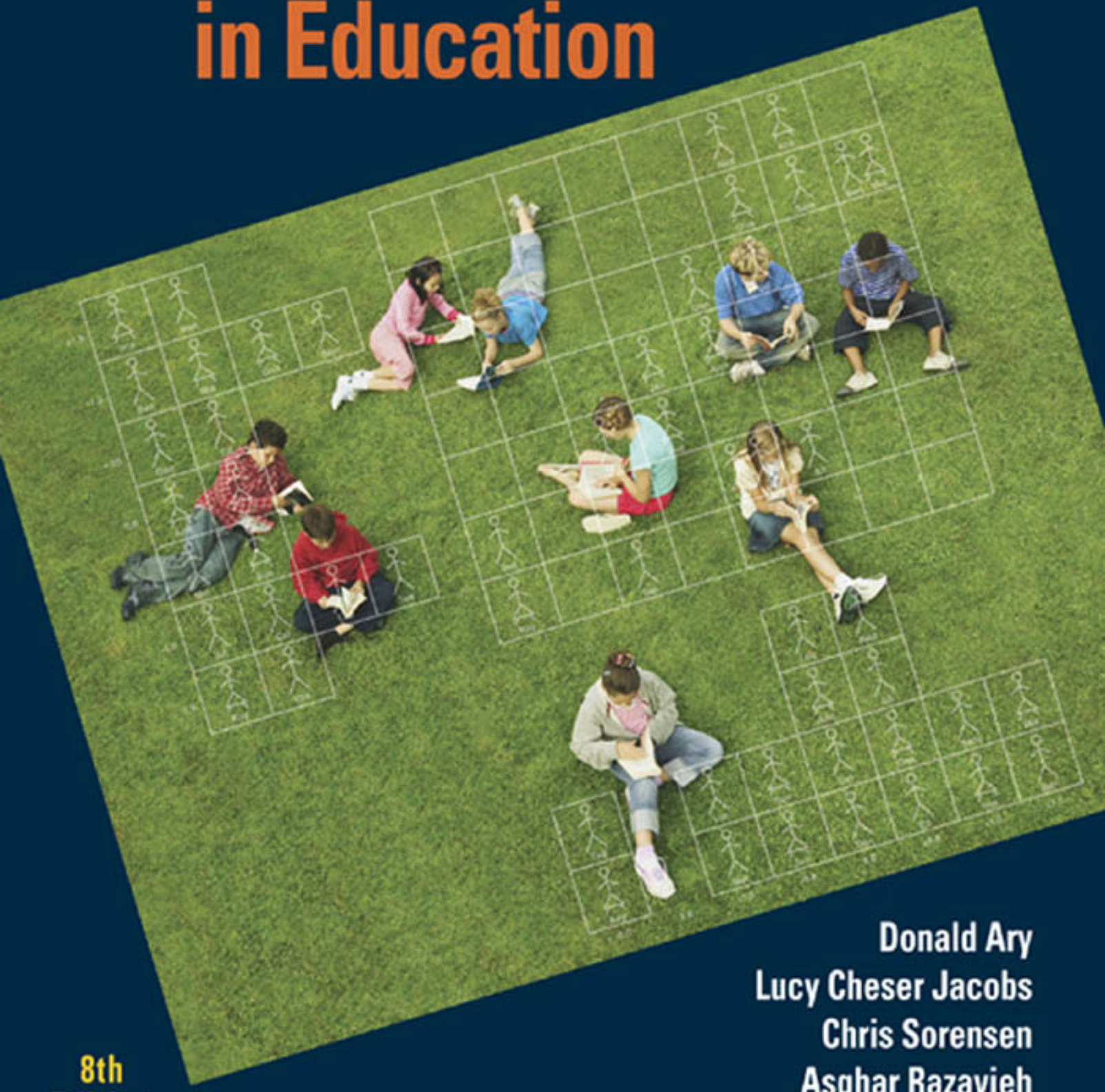
Introduction to Research in Education



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8th Edition

Introduction to Research in Education

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EIGHTH EDITION

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To Sheila, Marion, and Steve

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Preface

Educational research is a vigorous, dynamic enterprise. We are amazed at not only how much more knowledge there is in the field but also how many new ways of seeking knowledge are included. At the same time, there is more technology to focus, simplify, and organize research in education.

Many changes have taken place since the first edition was published in 1972. Never once did the phrase "qualitative research" occur. The only research we included that is now classified as qualitative was historical research. The current edition includes four chapters on qualitative research, including a new one on the types of qualitative research and a chapter titled "Mixed Methods Research," which discusses combining quantitative and qualitative methods.

Not only is knowledge expanding but also tools that facilitate the pursuit of knowledge are expanding our capacity to generate new knowledge with greater precision and less effort. Among these tools are computers, the Internet, and indexing and abstracting databases. The latter necessitated a major rewrite of our chapter on searching for related literature. This endeavor, once a difficult to organize, time-consuming, imprecise task, can now be accomplished quickly, precisely, and completely through searching electronic databases.

Through all this we have endeavored to continue to present a text that is reader friendly and to make even advanced concepts understandable. We think the fact that this book lasted through seven editions so far is reasonable evidence that we have succeeded.

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Knowledge is power.

CHAPTER 1

The Nature of Scientific Inquiry

INSTRUCTIONAL OBJECTIVES

After studying this chapter, the student will be able to:

1. List five major sources of knowledge and comment on the strengths and weaknesses of each source.
2. Describe the characteristics of the scientific approach.
3. State the assumptions underlying science and the attitudes expected of scientists.
4. Specify the purpose and characteristics of scientific theory in the behavioral sciences.
5. Indicate the limitations involved in the application of the scientific approach in the social sciences.
6. Define educational research and give examples.

Educators are, by necessity, decision makers. Daily they face the task of deciding how to plan learning experiences, teach and guide students, organize a school system, and a myriad other matters. Unlike unskilled workers, who are told what to do and how to do it, professionals must plan for themselves. People assume that professionals have the knowledge and skills necessary to make valid decisions about what to do and how. We generally define knowledge as justified true belief. How are educators to know what is true? How do they acquire reliable information? Although there are other sources of knowledge, such as experience, authority, and tradition, scientific knowledge about the educational process makes the most valuable contribution to decision making in education. Educators can turn to this source for reliable information and suggestions to be used in decision making. This fund of knowledge has been made available to educators by scientific inquiry into educational problems. However, education has not always been influenced by the results of such careful and systematic investigations. In fact, the development of an educational science is at a comparatively early stage

SOURCES OF KNOWLEDGE

Before we further pursue the role of scientific inquiry in education, let us review some of the ways in which human beings throughout history have sought knowledge. The major sources of knowledge can be categorized under five headings: (1) experience, (2) authority, (3) deductive reasoning, (4) inductive reasoning, and (5) the scientific approach.

EXPERIENCE

Experience is a familiar and well-used source of knowledge. After trying several routes from home to work, you learn which route takes the least time or is the most free of traffic or is the most scenic. By personal experience, you can find the answers to many of the questions you face. Much wisdom passed from generation to generation is the result of experience. If people were not able to profit from experience, progress would be severely retarded. In fact, this ability to learn from experience is a prime characteristic of intelligent behavior.

Yet for all its usefulness, experience has limitations as a source of knowledge. How you are affected by an event depends on who you are. Two people will have very different experiences in the same situation. The same forest that is a delightful sanctuary to one person may be a menacing wilderness to another. Two supervisors observing the same classroom at the same time could truthfully compile very different reports if one focused on and reported the things that went right and the other focused on and reported the things that went wrong.

Another shortcoming of experience is that you so frequently need to know things that you as an individual cannot learn by experience. A child turned loose to discover arithmetic alone might figure out how to add but would be unlikely to find an efficient way to compute square roots. A teacher could learn through experience the population of a classroom on a particular day but could not personally count the population of the United States.

AUTHORITY

For things difficult or impossible to know by personal experience, people frequently turn to an *authority;* that is, they seek knowledge from someone who has had experience with the problem or has some other source of expertise. People accept as truth the word of recognized authorities. We go to a physician with health questions or to a stockbroker with questions about investments. To learn the size of the U.S. population, we can turn to reports by the U.S. Bureau of the Census. A student can look up the accepted pronunciation of a word in a dictionary. A superintendent can consult a lawyer about a legal problem at school. A beginning teacher asks an experienced one for suggestions and may try a certain technique for teaching reading because the teacher with experience suggests that it is effective.

Throughout history you can find examples of reliance on authority for knowledge, particularly during the Middle Ages when people preferred ancient scholars, such as Plato and Aristotle, and the early Fathers of the Church as sources of information—even over direct observation or experience. Although authority

PICTURE THIS

Joe Rocco

is a very useful source of knowledge, you must always ask, How does authority know? In earlier days, people assumed an authority was correct simply because of the position he or she held, such as king, chief, or high priest. Today, people are reluctant to rely on an individual as an authority merely because of position or rank. They are inclined to accept the assertions of an authority only when that authority is indeed a recognized expert in the area.

Closely related to authority are *custom* and *tradition*, on which people depend for answers to many questions related to professional as well as everyday problems. In other words, people often ask, "How has this been done in the past?" and then use the answer as a guide for action. Custom and tradition have been prominent influences in the school setting, where educators often rely on past practices as a dependable guide. However, an examination of the history of education reveals that many traditions that prevailed for years were later found to be erroneous and had to be rejected. For generations, it was considered good practice to humiliate students who made mistakes with dunce caps and the like. It is wise to appraise custom and tradition carefully before you accept them as reliable sources.

Authority is a quick and easy source of knowledge. However, as a source of knowledge, authority has shortcomings that you must consider. First, authorities can be wrong. People often claim to be experts in a field when they do not really have the knowledge to back up the claim. Second, you may find that authorities disagree among themselves on issues, indicating that their authoritative statements are often more personal opinion than fact.

DEDUCTIVE REASONING

Ancient Greek philosophers made perhaps the first significant contribution to the development of a systematic approach for gaining knowledge. Aristotle and his followers introduced the use of **deductive reasoning,** which can be described as a thinking process in which one proceeds from general to specific knowledge through logical argument. An argument consists of a number of statements standing in relation to one another. The final statement is the conclusion, and the rest, called *premises*, offer supporting evidence. A major kind of deductive reasoning is the syllogism. A syllogism consists of a major premise and a minor premise followed by a conclusion. For example, "All men are mortal" (major premise); "The king is a man" (minor premise); "Therefore, the king is mortal" (conclusion). In deductive reasoning, if the premises are true, the conclusion is necessarily true. Deductive reasoning lets you organize premises into patterns that provide conclusive evidence for a conclusion's validity. Mystery fans will recall that Sherlock Holmes frequently would say, "I deduce …" as he combined previously unconnected facts in such a way as to imply a previously unsuspected conclusion.

Deductive reasoning can answer the question, "How likely is it that a student could pass a 20-item multiple choice test with five options per item by chance alone?" Given the premise that there is a 20 percent chance of getting a single item right and an 80 percent chance of getting it wrong and the premise that these same chances are true for every item, Figure 1.1 shows the probability of getting the following outcomes with three items.

The probability of getting three right is .008. There are three ways to get two right and one wrong, so the probability of two right is (.032)(3) = .096. The probability of getting one right and two wrong is (.128)(3) = .384. There is only one way to get three wrong; the probability of that is .512.

If we extended Figure 1.1 to determine the likelihood of getting a passing 60 percent (12 correct items in a 20-item test), we would find there is approximately one chance in 10,000 of passing. The probability of passing two 20-item tests is $(1/10{,}000)^2$ or one chance in 100 million. The notion that one has a reasonable chance of passing a test through sheer guessing is a myth.

Deductive reasoning has its limitations. To arrive at true conclusions, you must begin with true premises. The conclusion of a syllogism can never exceed the content of the premises. Because deductive conclusions are necessarily elaborations on previously existing knowledge, you cannot conduct scientific inquiry through deductive reasoning alone because it is difficult to establish the universal truth of many statements dealing with scientific phenomena. Deductive reasoning can organize what people already know and can point out new relationships as you proceed from the general to the specific, but it is not sufficient as

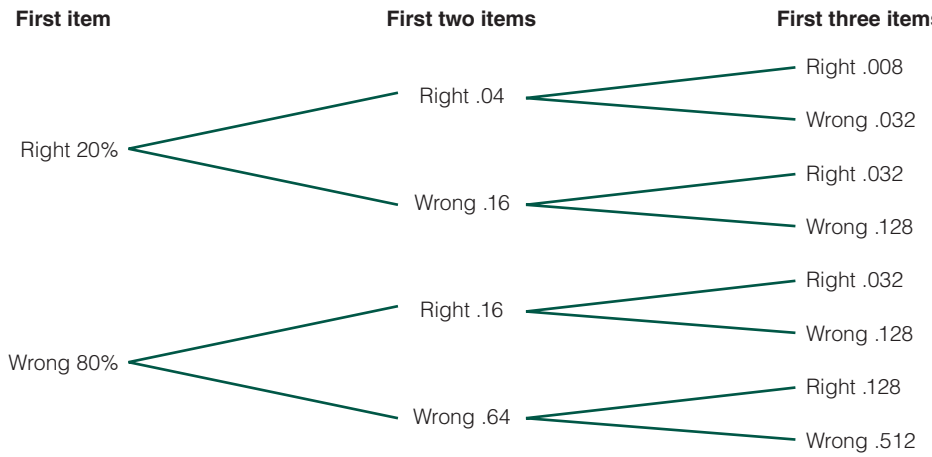

Figure 1.1 Probabilities of Getting Various Outcomes with Three Items

a source of new knowledge. Despite its limitations, deductive reasoning is useful in research because it provides a way to link theory and observation. It lets researchers deduce from existing theory what phenomena they should observe. Deductions from theory can help build hypotheses, which are a vital part of scientific inquiry.

INDUCTIVE REASONING

As noted previously, the conclusions of deductive reasoning are true only if the premises on which they are based are true. But how are you to know if the premises are true? In the Middle Ages, people often substituted dogma for true premises, so they reached invalid conclusions. It was Francis Bacon (1561–1626) who first called for a new approach to knowing. He held that thinkers should not enslave themselves by accepting premises handed down by authority as absolute truth. He believed that an investigator should establish general conclusions on the basis of facts gathered through direct observation. Bacon advised the seeker of truth to observe nature directly and to rid his or her mind of prejudice and preconceived ideas, which Bacon called "idols." For him, obtaining knowledge required that the thinker observe nature itself, gather particular facts, and formulate generalizations from these findings. You can see the importance of observation in the following anecdote (probably apocryphal), attributed to Bacon:

> In the year of our Lord 1432, there arose a grievous quarrel among the brethren over the number of teeth in the mouth of a horse. For 13 days the disputation raged without ceasing. All the ancient books and chronicles were fetched out, and wonderful and ponderous erudition, such as was never before heard of in this region, was made manifest. At the beginning of the 14th day, a youthful friar of goodly bearing asked his learned superiors for permission to add a word, and straightway, to the wonderment of the disputants, whose deep wisdom he sore vexed, he beseeched them to unbend in a manner coarse and unheard-of, and to look in the open mouth of a horse and find an answer to their questionings. At this, their dignity being grievously hurt, they waxed exceedingly wroth; and, joining in a mighty

> uproar, they flew upon him and smote him hip and thigh, and cast him out forthwith. For, said they, surely Satan hath tempted this bold neophyte to declare unholy and unheard-of ways of finding truth contrary to all the teachings of the fathers. After many days more of grievous strife the dove of peace sat on the assembly, and they as one man, declaring the problem to be an everlasting mystery because of a grievous dearth of historical and theological evidence thereof, so ordered the same writ down. (Mees, 1934, p. 115)

The youth in this story was calling for a new way of seeking truth: namely, seeking the facts rather than depending on authority or on sheer speculation. This became the fundamental principle of all science.

In Bacon's system, the investigator made observations on particular events in a class (or category) and then, on the basis of the observed events, made inferences about the whole class. This approach, known as **inductive reasoning**, is the reverse of the deductive method. You can see the difference between deductive and inductive reasoning in the following examples:

Deductive: Every mammal has lungs.
All rabbits are mammals.
Therefore, every rabbit has lungs.

Inductive: Every rabbit that has ever been observed has lungs.
Therefore, every rabbit has lungs.

Note that in deductive reasoning you must know the premises before you can reach a conclusion, but in inductive reasoning you reach a conclusion by observing examples and generalizing from the examples to the whole class or category. To be absolutely certain of an inductive conclusion, the investigator must observe all examples. This is known as **perfect induction** under the Baconian system; it requires that the investigator examine every example of a phenomenon. In the preceding example, to be absolutely sure that every rabbit has lungs, the investigator would have to have observations on all rabbits currently alive, as well as all past and future rabbits. Clearly, this is not feasible; you generally must rely on imperfect induction based on incomplete observation.

Imperfect induction is a system in which you observe a sample of a group and infer from the sample what is characteristic of the entire group. An example of a conclusion based on imperfect induction is the present thinking concerning the physical characteristics of very intelligent children. For many years, people generally believed that exceptionally bright children tended to be poor physical specimens. Even today, cartoonists usually portray the bright child as a scrawny creature with thick spectacles. Terman, a pioneer in the field of mental testing, was interested in the characteristics of exceptionally bright youngsters (Terman, 1926). In a landmark investigation, Terman intensively studied more than 1000 California children who scored higher than 140 on the Stanford–Binet intelligence test. He found the average height, weight, and general physical health of these children to be slightly above average for children of their age. From this and subsequent studies of the phenomenon, researchers have concluded that bright children, far from being scrawny, are slightly more likely to be above average in physical development than children with average IQ scores. Note that this conclusion has not been positively proved. It is simply highly probable. To