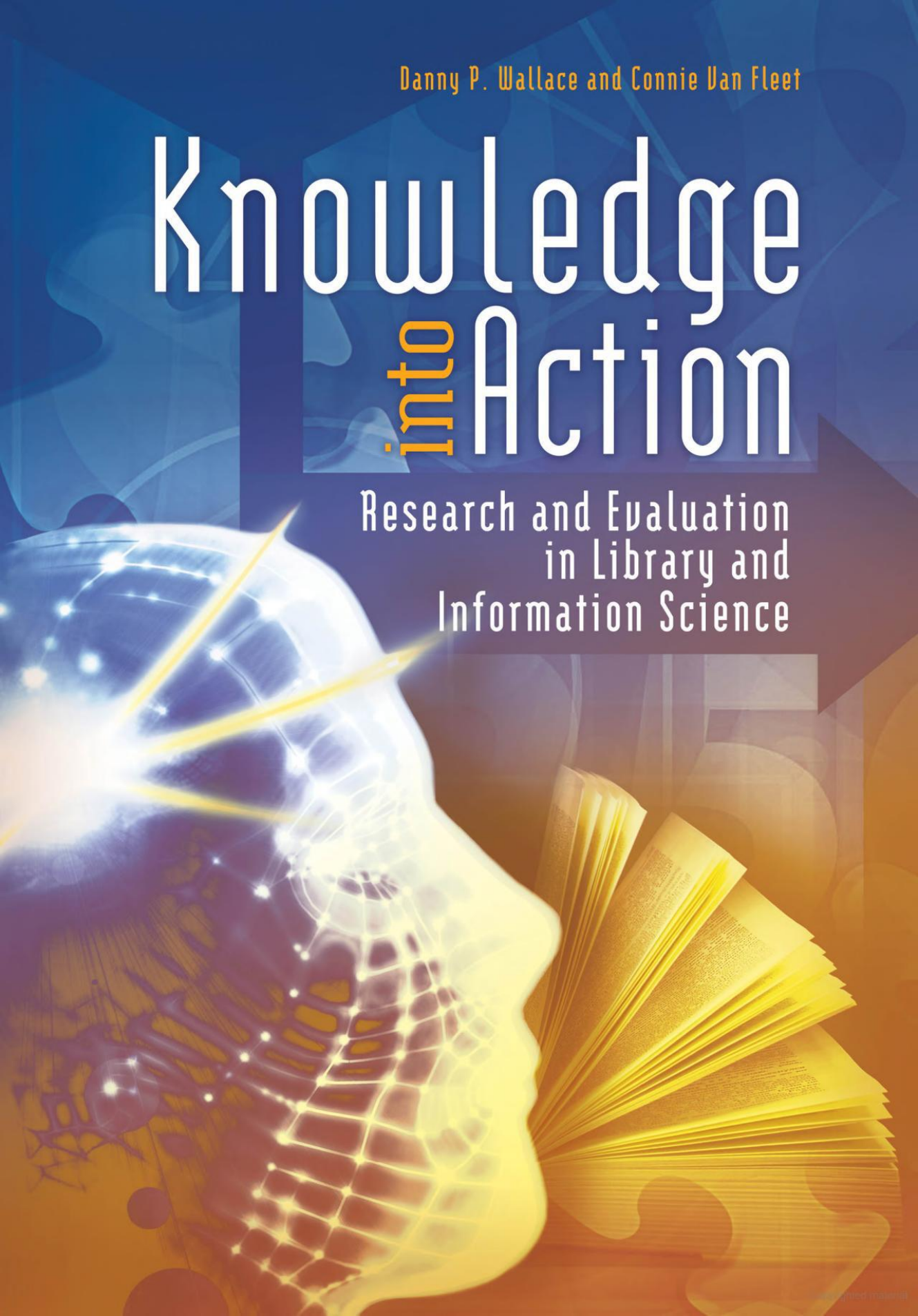
Danny P. Wallace and Connie Van Fleet

Knowledge into Action

Research and Evaluation in Library and Information Science



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INTRODUCTION

The unexamined life is not worth living.

—*Socrates, Apology 36a*

WHY THIS BOOK?

The focus of *Knowledge Into Action: Research and Evaluation in Library and Information Science* is the application of research principles and methods to the understanding of library and information science processes and the solution of problems related to library and information science. Although the book is designed for use in graduate programs in schools of library and information science, any student of the profession, whether enrolled in a formal course of study or learning independently, can benefit from learning about research and evaluation.

Knowledge Into Action is an introduction to library and information science research and evaluation, not a research manual or statistics textbook. It is a practical guide for practitioners in library and information science who have specific research interests or institutional evaluation needs. Research and evaluation are the foundation of evidence-based practice. Every library and information professional will at some time in his or her career be called upon or will elect to engage in evaluation activities. Understanding the nature and methods of evaluation and the close linkage between research and evaluation will inevitably strengthen the evaluation of library services and processes and thereby strengthen the good that libraries provide to the publics they serve. It is the authors' hope and expectation that this book will also inspire professionals who might otherwise not have attempted broad-based research to take a step beyond the solution of local problems and venture into the arena of benefiting the profession as a whole.

Recognition that research and evaluation are closely related is the guiding principle for this book. Research and evaluation are interwoven throughout the text. Although the distinctions between research and evaluation are addressed and explained, the premise of this

book is that research and evaluation are two sides of a single coin. Although a coin with only one side may be of value to a collector, only the coin with both sides is valid as currency. Research and evaluation are at their best when they constitute a cyclical process. The relationship between research and evaluation is itself cyclical. Research informs the selection of methods and tools for evaluation, while effective evaluation serves as an inspiration for research.

Even library and information science practitioners who have no responsibility for evaluation and are not actively involved in research have a need to understand the nature and benefits of research and evaluation. A goal of this book is to educate practitioners in the basics of being effective consumers of the research and evaluation literature. A critical consumer is better positioned than a casual or uninformed consumer to make use of the published literature and to benefit from conference experiences.

This is not a book about research for purely academic purposes, although it has value for students working on thesis, dissertation, or other individualized research projects. For such students, this book will not serve as a substitute for the requirements and guidelines of individual universities.

ASSUMPTIONS OF THE BOOK

Knowledge Into Action is built on a number of core assumptions. For most readers, this is a first book in the systematic application of research and evaluation as an approach to problem solving. Students who have completed an introductory research course as part of a program of study at the bachelor's or graduate level in a different discipline may need a complete refresher experience and may additionally need an opportunity to overcome and even unlearn content that is more applicable to that other program than to library and information science.

Most students enrolled in professional programs in library and information studies will pursue careers primarily or exclusively as practitioners rather than as researchers; students who enter careers that explicitly include a research role will fulfill that role as part of a broader range of responsibilities that are mostly non-research-related. All library and information professionals are at some time in their careers involved in evaluation activities and decisions that will be strengthened by an understanding of research methods and systematic approaches to evaluation. An ability to understand and apply research results in an evaluation context is useful for all library and information professionals and essential for most.

ORGANIZATION OF THE BOOK

Knowledge Into Action is designed to be a textbook and a guide for independent learning. Examples drawn from the literature are used liberally, both in the narrative and as From the Professional Literature boxes that summarize specific research or evaluation publications. Research and Evaluation Checknotes call attention to areas of concern or interest for further exploration. Each chapter concludes with a Think About It! section that raises questions for reflection and a Do It! section that presents targets for independent investigation. The Think About It! and Do It! features are not intended as study guides for quizzes or exams. Their purpose is to encourage individual thought and action. How to Lie features expose

the potential dark side of research and evaluation and serve as guidelines for how to avoid unintentional dishonesty or misconduct. The book includes a Glossary and a Bibliography.

Knowledge Into Action comprises 15 chapters. Chapter 1 explores the nature of knowing, research, and evaluation, grounding research and evaluation in approaches to learning and knowing, and introduces key research and evaluation concepts, including the quantitative and qualitative paradigms for research and evaluation, the nature of validity and reliability, and the major families of research and evaluation methods.

Chapter 2 is built around nine flowcharts that encapsulate the essential steps of the research and evaluation process, including the origin of a project, preplanning, planning, methodology definition, data gathering, data analysis, processing results, reporting, decision making, and action.

Chapter 3 examines ethics and politics in library and information science research and evaluation. Ethics and practical ethics are defined, major ethical dilemmas are explored, policy and legal documents are summarized, and tools for addressing ethical threats are presented. The chapter concludes with a discussion of the roles and challenges of politics in research and evaluation in library and information science.

Chapter 4 is a practical guide to published reports and the professional as consumer. The nature of publication in library and information science and the roles of differing kinds of publications are discussed, the essential elements of published reports are outlined, and a set of pragmatic criteria for evaluation of published reports are presented.

The project plan or proposal is the focus of Chapter 5. Project planning is presented as a requisite for project success. The purposes of research and evaluation project plans and proposals are discussed and the elements of project plans and proposals are detailed. The chapter concludes with guidance on writing plans and proposals.

Chapter 6 defines and explains measurement, explores the nature of measurement, and explores populations, samples, and sampling. Population definition, the role of samples in research and evaluation, selection of an appropriate sample size, and approaches to selecting a sample are explored in detail.

Chapters 7 through 11 explore specific families of research methods. Quantitative and qualitative methods are integrated to emphasize the interlocking roles of the two investigative paradigms. Historical methods are the focus of Chapter 7. Chapters 8 and 9 address descriptive methods, with Chapter 8 concentrating on interviews and questionnaires and Chapter 9 addressing observation. Chapter 10 presents the nature of experimental methods and models for experimental design. Chapter 11 covers the nature and applications of bibliometrics and citation analysis, two areas of particular interest in library and information science research and evaluation.

Data analysis is the focus of Chapter 12, which explores the purposes of data analysis and data analysis concerns. The data matrix model is presented as a tool for visualizing relationships among quantitatively measured phenomena. Quantitative and qualitative tools for analysis are presented, along with basic guidance and rules for presenting data visually in tables, graphs, and charts.

Chapter 13 is a gentle guide to the nature and functions of descriptive and inferential statistics. The distinction between descriptive and inferential statistics is explored. The chapter concludes with hypothesis testing and examples of inferential statistics procedures.

Funding for research and evaluation is the topic of Chapter 14. Internal and external sources of funding are explained. The chapter focuses on targets for external funding,

including governmental and quasi-governmental agencies, foundations, professional associations, and corporate sources.

Knowledge Into Action concludes with a chapter on research, evaluation, and change, which returns to the purpose of research and evaluation explored in Chapter 1 and provides a different take on research, evaluation, and the informed consumer. The characteristics that make research and evaluation useful are explored. The core value of creating a personal or institutional culture of research and evaluation is presented in the context of research, evaluation, and managing change. The book concludes with the relationships among research, evaluation, and the reflective practitioner.

CAVEATS

A single book can provide a useful introduction to research and evaluation but cannot be comprehensive. The emphasis of this book is on gaining familiarity with a broad range of research concepts and methods and their application to evaluation activities and decisions, not on building skill in specific research methods or research tools. Although quantitative methods and statistics are introduced, *Knowledge Into Action* is not designed as a quantitative methods book and is not intended to build expertise in statistical methods. Some readers may feel intimidated by this book, particularly by the discussion of the research and evaluation processes in Chapter 2. Readers should remember that it isn't necessary to know and understand everything from the beginning: the purpose of the book is to build understanding.

1

KNOWING, RESEARCH, AND EVALUATION

The outcome of any serious research can only be to make two questions grow where only one question grew before.

—*Thorstein Veblen, "Evolution of the Scientific Point of View,"* University of California Chronicle, *1908*

Evaluation is creation. . . . Valuating is itself the value and jewel of all valued things. Only through evaluation is there value: and without evaluation the nut of existence would be hollow.

—*Friedrich Nietzsche,* Thus Spake Zarathustra, *1883*

In This Chapter

- The nature of research and evaluation
- Facts and proof
- Approaches to learning
- Validity and reliability
- Definitions of research and evaluation
- Characteristics of research and evaluation
- Levels of research and evaluation
- The traditional research dichotomy
- Major research and evaluation paradigms
- Families of research and evaluation methods
- Benefits of research and evaluation
- Divergence and convergence in research and evaluation

THE NATURE OF RESEARCH AND EVALUATION

The Problem of Truth

Research and evaluation are methods for asking questions in a systematic way and developing an analytical approach to deriving and assessing answers. It is very tempting to equate this with a search for *truth*. Unfortunately, *truth* is a very ambiguous and situational concept. The very long history of the study of epistemology—the study of knowledge—and ontology—the study of the nature of being—as subdisciplines within philosophy indicates that the notion that truth can be observed, captured, and verified cannot itself be ascertained to be a genuine representation of the nature of truth. Truth can vary in a variety of ways including the following examples.

Chronological Influences

Truth changes over time. Most learned Europeans in the early 16th century accepted as fundamental truth the principle that the Universe revolved around the Earth. Nicolaus Copernicus's theory of a heliocentric Universe with the Sun at the center, first formulated in 1513, was a direct challenge to prevailing assumptions of truth. Scholars and scientists did not begin to give general acceptance to the truth of the Copernican theory until the middle of the 17th century. The theoretical base necessary for widespread acceptance of the Copernican theory wasn't in place until Newton formulated the theory of universal gravity in 1687. Even though most educated people at the beginning of the 21st century probably reject the notion that the Earth is the center of the Universe, however, few would actually accept Copernicus's notion that the Sun is the center of the Universe. In the initial era of public libraries in the United States, there was a shared understanding among library professionals that the purpose of a public library was to support education for adults. Children were not viewed as being a legitimate component in the clientele of a public library. In the late 19th century, public libraries began to accept children as being a part of their clienteles. By the mid-20th century, children and young adults were a primary focus of public libraries.

It is tempting to assign values of right and wrong to changes in truth over time: the old way of thinking is quaint, misguided, and *wrong* while the new way is accurate, informed, and *right*. To do so is to fall into the trap of *historicism:* interpreting and judging the past using the assumptions and values of the present.

Societal Influences

Truth is in large part a social, human phenomenon rather than a physical or biological phenomenon. What is true for one culture or societal niche is not necessarily true for another. An obvious example of social variation in ascribing truth is that of religion. Religions are complex social systems that to a considerable extent revolve around structures for determining truth. Governments also establish systems, both formal and accidental, for determining and establishing official truth. Aesthetics is another area in which there are significant societal differences. Keats' *Ode on a Grecian Urn* contends that beauty is truth, but beauty is defined in a vast number of ways by various societal groups. Berger and Luckmann's *The Social Construction of Reality* was a pioneering work in the field of the sociology of knowledge that attempted to differentiate between the objective and subjective aspects of knowledge, broadly defined, and worked to establish a model of societal structure that embraced both

objective and subjective viewpoints while making it clear that reality is largely a societal rather than a physical phenomenon.[1]

Library and information professionals share a conviction that libraries of all types are a fundamental public good. That belief is not immune to challenge as communities and institutions today have many sources of information readily available to them, competition for resources is fierce, and administrations are demanding evidence of the value and contribution of library services.

Personal Influences

Truth can be a very personal matter, especially when human emotions are attached to understanding what is or is not true. Every individual ascribes validity to truths that cannot be verified through external examination and may defy explanation to others. The acceptability of given assertions as true varies not only among individuals but may vary within a given individual over time. It is, for instance, not unusual for a child to view the role of Santa Claus in delivering holiday gifts as undeniable truth, but it is normally expected that the child's view of this particular truth will be altered with maturity.

Library and information professionals typically subscribe to the tenet that more information is better than less information and that all views should be available to all members of the library's public. That tenet is not necessarily shared by members of the public, members of the staff, or government officials. Differing personal views of access to information frequently lead to disagreement and conflict. As a profession, library and information science has at least a loosely defined worldview and mental models that shape the profession's collective outlook and differentiate the profession from other professions and from the general public.

While some personal truths cannot be externally verified, some individual perceptions of truth may be so internally convincing that they defy overwhelming external verification. Phobias are sometimes so deeply ingrained that they constitute absolute truth even though the individual affected by the phobia knows it to be unreasonable.

"We Hold These Truths to Be Self-Evident . . ."

Ultimately, what is true or not true can be adequately perceived and understood only within the context of one or more value systems. Truth is not an absolute and is never truly self-evident. The evidence for truth lies in some combination of the value systems at work and the tools for understanding truth that pertain to those value systems. Truth, then, can only be understood in context. To the extent that research is a search for truth, the success of the search can be assessed only within the constraints of the context within which the search is conducted.

IS THAT A FACT?

The concept of truth is frequently conflated with the concept of a *fact.* The *Oxford English Dictionary* provides several definitions of *fact,* the most pertinent of which is

> Something that has really occurred or is actually the case . . . as opposed to what is merely inferred, or to a conjecture or fiction; a datum of experience, as distinguished from the conclusions that may be based upon it.

In the research and evaluation contexts, a fact is an item of evidence that has been verified and replicated, and that can therefore be generalized. There is an element of objectivity inherent in the concept of a fact—it implies alignment with the physical reality of the universe rather than with a subjective value system. An important element of the *Oxford English Dictionary* definition is the distinction between the objective fact and the conclusions that may be associated with that fact. A fact is generally considered to be a matter of observation and confirmation rather than interpretation, but a conclusion is fundamentally an interpretation of one or more facts. Many investigators consciously avoid the use of the word fact because it tends to imply a definitive and immutable interpretation of truth.

PROVE IT!

Many people who are new to research and evaluation associate the search for meaning or the identification of facts as being a matter of *proof*. Proof as a concept is closely associated with *truth*. If something has in some sense been proven, it takes on the status of being definitively, immutably, and irrefutably true. Proof as a concept and process is essential in mathematics and in civil or criminal law. The notion of proof has very limited applicability in research and evaluation. The problem with proof in the research and evaluation context is that a search for proof, unlike a search for facts or meanings, implies that the investigator knows the answer from the outset. A research or evaluation project that has as its mission an attempt to prove something to be true is extremely susceptible to bias, deceit, and dishonesty, whether intentional or unconscious. Most professionals experienced in research and evaluation very consciously and rigorously avoid the use of the term proof, preferring to speak in terms of evidence.

APPROACHES TO LEARNING

Research and evaluation are about learning. The motive for conducting a research project or implementing an evaluation program is a desire to *know*. That desire for new knowledge may be a matter of curiosity, may be a response to an imposed need such as the requirement to complete a thesis for a master's degree, or may be driven by an immediate, pragmatic problem in need of a solution. The processes of research and evaluation are essentially the same regardless of the specific motivation.

The search for knowledge—the process of *learning*—can take many forms. Some of the most prominent are experience, belief, deduction, and induction. In many cases, the perception of knowledge is derived not from one of these approaches to learning but from some combination of approaches. Such combinations may be formally designed and implemented or may be essentially accidental and mostly unconscious. The major approaches to learning are summarized in Figure 1.1.

Experience

Personal Experience

Experience is a very important avenue for pursuing and assessing new knowledge. Every individual relies on personal experience as an approach to learning. The actual number of experiences necessary to acquire and integrate knowledge is variable. An extremely pleasant or intensely unpleasant experience may result in a very quick and perhaps unreliable

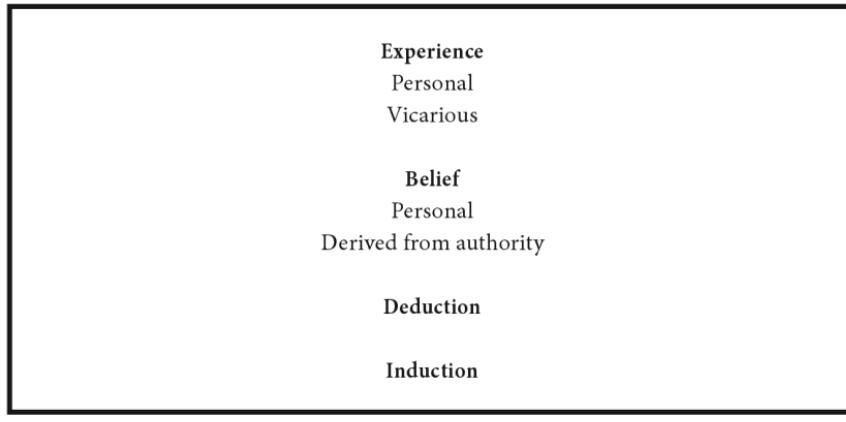

Figure 1.1 Major approaches to learning.

assignment of personal understanding. A child whose experimental curiosity leads him or her to extend a finger into a flame may immediately conclude that the tendency of fire to burn and cause pain is essential knowledge. Less dramatic, less traumatic experiences may involve a longer transformation from experience into knowledge. A child who does not learn from experimental curiosity may lead a very traumatic life and require protections from parental guidance or societal interventions that are unnecessary for most children. Lifelong patterns of failure to learn from personal experience are associated with psychopathic or sociopathic personalities.

A librarian may find that his or her behavior during an interaction with patrons—smiling, asking welcoming questions, engaging in active listening—results in positive and productive experiences. That librarian may find that not only are the reactions of patrons more positive in response to such behavior, but that his or her professional experiences are enhanced. A librarian who does not learn from such experiences may develop a pattern of behavior that is counter to both successful interaction with patrons and to norms of professional behavior.

Vicarious Experience

A second form of experience is vicarious experience—knowledge derived from the experiences of others. No individual can experience everything, nor is it desirable for everyone to experience everything. Every society throughout history has generated and perpetuated some means of imparting knowledge through vicarious experience. Even those societies that emphasize a potentially traumatic rite of passage build readiness through sharing collective experiences with those individuals who must undergo the rite. Both the news media and the entertainment media play significant roles in building knowledge through vicarious experience. The professional library and information science literature provides vicarious experience by providing access to the programs, philosophies, and activities of parallel institutions. Orientation and training for new professionals is another prominent source of vicarious experience, as are professional conferences and meetings, continuing education activities, and the formal education provided by schools of library and information science.

One of the potential negative outcomes of vicarious experience as an approach to acquiring knowledge is that the division between reality and fiction is not always adequately clear. On October 30, 1938, thousands of listeners panicked in response to a radio broadcast

describing an invasion of New Jersey by Martians. Many people did not realize until much later that they had been listening to a very convincing radio play of H. G. Wells's *War of the Worlds*.

The "we have always done it this way" syndrome and the "we tried that and it didn't work" argument in professional service are also negative outcomes of vicarious experience. In both cases, the listener is being invited to accept the message without question or argument. Methodical exploration and critical analysis, however, frequently reveal that neither message is accurate.

Belief

Personal Belief

Belief is experience augmented by additional contextual information. Belief is frequently very closely related to experience—the dividing line between knowledge derived from experience and knowledge derived from belief is not always readily apparent.

Belief can be directly derived from personal experience. The child who has burned a finger by touching a flame will very probably conclude that other parts of his or her body are also susceptible to pain from the same source; only a very unusual child would repeat the same experiment with another finger to determine whether the principle of pain associated with heat is a general one, although such an experiment would facilitate the transition from belief based on limited experience to empirical knowledge based on a systematic series of experiences. Furthermore, the burnt child may reasonably conclude that all human beings are subject to pain, even though he or she cannot directly experience the pain felt by others.

Belief derived from experience may extend further as well—the child who has been burned may conclude that pain will also be felt when inanimate objects such as toys or stuffed animals come in contact with fire. At a greater extreme, the child may conclude that fire is inherently and without exception a *bad* thing that should be eradicated. This could turn into a lasting phobic fear of fire or a pathological belief that could shape the child's approach to adult life.

A professional who finds that welcoming behaviors are productive and rewarding in interactions with patrons may develop the positive belief that such behaviors are similarly productive when interacting with colleagues, administrators, and the public in general. These behaviors may not only be effective in professional life, but may extend to situations outside the workplace. A professional whose experience leads to a belief that the best solution to every encounter is to engage in behaviors that please others may develop patterns of behavior that are counterproductive to the professional endeavor. A librarian who responds to all challenges to library materials by acquiescing, for instance, may be acting on a belief that avoiding any semblance of conflict is always desirable.

Belief Derived from Authority

In addition to belief derived from personal experience, belief derived from authority plays an important role in assessing knowledge. A responsible parent may engage in appropriate efforts to limit a child's direct personal experiences by introducing beliefs that are backed by parental authority. Although some experience of pain is perhaps an essential learning experience, teaching a child to avoid some painful experiences is critical. Belief derived from authority also pervades systems of religion, education, government, and professions. The imprimatur of the Library of Congress, the American Library Association, or

another institution to which professional status has been conferred may cause professionals to believe—in some cases unquestioningly—that the practices and views of that institution are necessarily representative of truth.

Professional standards and guidelines are encapsulations of belief derived from a combination of experience, authority, and sometimes research and evaluation. The American Library Association's *Code of Ethics* represents a set of beliefs derived from the collective experiences of library and information professionals issue under the authority of the Association.[2] The Reference & User Service Association's *Guidelines for Behavioral Performance of Reference and Information Service Providers* explicitly identify the importance of approachability, interest, and listening/inquiring in conducting a reference interview.[3]

Formal Logic

Experience and belief are natural, primarily informal processes that are a deeply ingrained part of human life. Two additional major approaches to determining knowledge are more formal and systematic. Although they cannot be entirely separated from experience and belief, they provide structured frameworks within which experience and belief can be positioned and examined.

Deduction

Deduction is the systematic application of general principles to specific cases. If it is true that fire burns human beings, then it can be assumed that fire will burn any individual human being. If welcoming behaviors work effectively for most library and information professionals, they can be assumed to work for all such professionals. The traditional logical structure of deduction is the syllogism, an argument with two premises and a conclusion:

Premise:	All human beings are mortal.
Premise:	Melvil Dewey was a human being.
Conclusion:	Melvil Dewey was mortal.

In any syllogism the truth of the conclusion is a dependent function of the truth of the premises and of the logic of the syllogistic structure. The premises of the preceding example are both true, therefore the conclusion is reasonable and acceptable.

If one or more of the premises is false, the conclusion is necessarily false as well. In the following example, the second premise is false; as a result the conclusion, although it is an appropriate logical extension of the premises, is false as well.

Premise:	All gods are immortal.
Premise:	Melvil Dewey was a god.
Conclusion:	Melvil Dewey is immortal.

Although Melvil Dewey may to many people in the library world be a figurative god, and his works may indeed possess a substantial element of immortality, this syllogism cannot be taken as literally true because the second premise is not literally true.

Truth in the premises is not a guarantee of truth in the conclusion. The following syllogism contains true premises. The conclusion is true as well, but fails to follow logically from the premises.

Premise:	All human beings are mortal.
Premise:	Melvil Dewey is dead.
Conclusion:	Melvil Dewey was a human being.

Deductive logic is an important formal structure that has played a long history in the development of scientific and scholarly thought. Deduction is the basis for most of Aristotelian logic, which was the fundamental principle of scholarly reasoning up until the Scientific Revolution. In the deductive reasoning process, general principles or theories are applied to specific situations. The literature review and analysis that is an appropriate first action for both research and evaluation plays a deductive role by identifying relevant general principles and theories that may apply to a specific situation. Deduction in modern research and evaluation is used primarily for generating questions and hypotheses and for testing established theories or principles. It is generally not used in research as an approach to gathering or analyzing data.

Many approaches to evaluation are fundamentally deductive in nature. Comparing local library performance to standards published by professional associations or governmental agencies is a deductive process in which a general principle—a *standard*—is used to draw conclusions about a specific case—a particular library. List checking to assess the quality or comprehensiveness of a collection is also a deductive process. A library may routinely compare its collection to sources such as the *Fiction Catalog* or *Reference Sources for Small and Medium-Sized Libraries*. List checking of this sort relies largely on acceptance of the authority and competence of the publisher, editors, and contributors who prepared the list.

Induction

Induction is the formulation of general principles based on information about specific cases. In the inductive reasoning process, evidence from specific situations is used to generate a general principle or build a body of theory. Induction is closely associated with the Scientific Revolution in general and with English mathematician and scientist Roger Bacon in particular. Where deduction is primarily logical and qualitative, induction is very closely associated with quantitative methods.

The basic principle of induction is that observation of a suitable subset of some phenomenon of interest—a *sample*—may substitute for observation of the phenomenon in its entirety. Some level of induction occurs naturally and automatically as part of the human experience; individuals categorize and summarize their personal experiences, vicarious experiences, and beliefs, and formulate general principles based on that analysis. The distinctive factor in systematic induction is an attempt to divorce the observational process from personal values and beliefs and to create a dispassionate body of knowledge.

Induction is very closely linked to both experimental and survey research. Effective inductive analysis requires identification of an appropriate and manageable approach to observing the phenomenon of interest, selection of those characteristics of the phenomenon that will be observed, determination of a minimum or optimal number of observations, gathering data related to the selected characteristics for the target number of observations, summarization of the gathered data, and formulation of conclusions that may serve as general principles for understanding the phenomenon. Researching and writing a typical term paper is an inductive process in which a student identifies and gathers pertinent sources, synthesizes the content of the sources, and draws a conclusion or formulates an argument

based on that synthesis. The annual Association of Research Libraries' *ARL Statistics* is a survey that gathers numeric data on the collections, resources, and staffs of all 123 ARL member libraries. In addition to making available data for individual member libraries, the *ARL Statistics* includes calculated statistics such as the mean and mode. The mean number of volumes held by ARL libraries in 2008–2009, for instance, was 4,528,262.[4]

The Induction–Deduction Cycle

Deduction and induction are used together in the research and evaluation process in a cyclical manner. The cyclical nature of the relationship between induction and deduction draws upon the strengths of each logical model and uses the strengths of each to balance the weaknesses of the other. Figure 1.2 provides a graphic representation of the induction–deduction cycle.

The induction–deduction cycle applies both to evaluation and to research, but works a bit differently for evaluation programs and research projects. The induction–deduction cycle is a model, not a rule, and applies in a variable manner depending on the nature of the specific problem or question to be addressed.

The Induction–Deduction Cycle and Evaluation

A fundamental characteristic of evaluation as it is applied in this text is that it focuses on a local environment and is intended to solve a specific problem and add understanding for purposes primarily internal to a single institution. The following is an example of the induction–deduction cycle applied to an evaluation process.

1. The cycle usually begins when a general interest in some phenomenon is derived from informal inductive observation of the phenomenon, frequently through direct contact between a professional and a process or product for which that professional has some

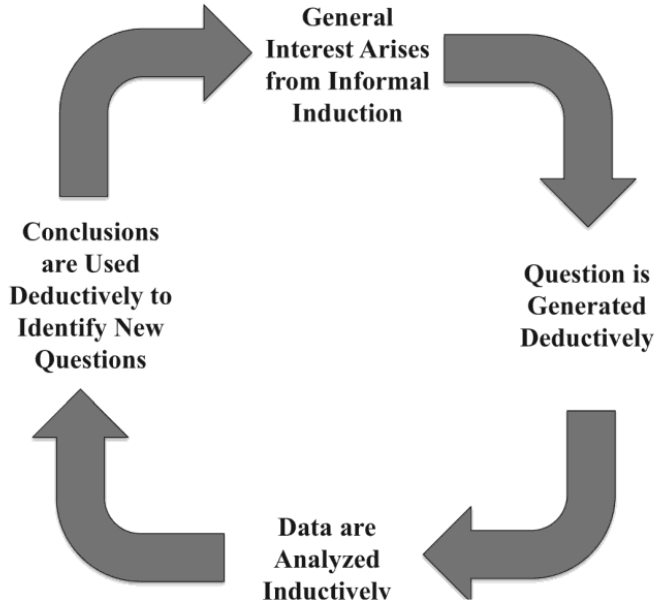

Figure 1.2 Induction and deduction.

assigned or natural sense of responsibility. The motivation for evaluation is frequently an observation of a real-life phenomenon that reveals the existence of a definite or potential problem. A university librarian, for instance, might observe that both the number of questions asked at the reference desk and the number of books circulated in that specific library have been declining in recent years. This informal observation, based on data that may be incomplete, leads to speculation as to the nature of the decline.

2. Working from the inductive, informal observation, and using that observation as a tentative general principle for initial understanding of the phenomenon of interest, a research question or hypothesis (or more than one of either or both) is generated deductively. The research question or hypothesis serves as a general principle for understanding the phenomenon that plays a temporary role pending systematic gathering of data for use in an inductive examination of the nature of the phenomenon. For the example presented in step 1, the informal, inductive observation of data related to declining reference and circulation activity leads to the formulation of a question: are these declines indicators of an overall decline in the use of the library? The broad question serves as a tentative conclusion that may lead directly to deductive speculation regarding subquestions, examples of which might include:
   - Is use of the library's digital resources also declining?
   - Are the library's patrons interacting with reference staff in modes other than face-to-face?
   - Are the indicators in use by the library the most appropriate for effective management and decision making?
   - Are there differences in use among faculty, graduate students, and undergraduate students?
   - Are there differences among users from different colleges in the university?
   - Are there differences between full-time and part-time student use?
   - Are there differences between residential and commuter student use?
3. Using the formulated question as a guide, observational data related to the phenomenon are systematically, formally gathered and then analyzed inductively to formulate conclusions. The question "are these declines indicators of an overall decline in the use of the library?" suggests a need to examine additional sources of data, some of which may be readily available as preexisting routinely gathered figures. It may additionally be necessary to gather new data about use of the library to supplement data already available. The introduction of subquestions in addition to the major question frequently leads to the need to gather additional data.
4. The conclusions are used deductively to assess the performance of the library, to make decisions regarding library policy and practice, and to identify further targets for evaluation. The evaluation process may, for instance, reveal that overall use of the library has not declined, but that numbers of reference transactions and circulation counts are of declining importance and need to be routinely accompanied by other measures.

The Induction–Deduction Cycle and Research

A directly parallel process is typical of research. A primary difference between evaluation and research is that a single library, which is the legitimate and primary focus of evaluation, is at best a limited convenience sample for purposes of research, which is focused on more universal concerns. The cycle, however, is fundamentally the same.

1. Again, the cycle begins with a general interest in some phenomenon derived from informal inductive observation of the phenomenon. To parallel the example used in discussing the induction–deduction cycle and evaluation in the context of research, a university librarian observes that both the number of questions asked at the reference desk and the number of books circulated has been declining in recent years. This informal observation, based on data that may be incomplete, leads to speculation as to the nature of the decline. Unlike the evaluation example, however, in this case the speculation focuses on the possibility of a general decline in the use of academic libraries.
2. A research question or hypothesis is generated deductively from prior understanding of the phenomenon. The observation regarding declines in reference transactions and circulation in the local library leads to the question: Is use of university libraries declining? The act of formulating the question implies the possibility of a general conclusion that use is in decline. This question can easily lead to the same subquestions identified in the evaluation examples, but can also lead to additional subquestions such as
   - Are there differences between Association of Research Libraries members and nonmember libraries?
   - Are there differences between comprehensive universities and liberal arts colleges?
   - Are there differences between state-supported institutions and private institutions?

   Ultimately, addressing these and other questions may lead to the need to address more fundamental questions that have meaningful implications for both research and evaluation, such as
   - Does circulation of print materials accurately reflect use of library resources?
   - Do guidelines and practices designed for face-to-face transactions effectively translate to a digital environment?
3. Observational data related to the phenomenon are gathered and analyzed inductively to formulate conclusions. Some data may be readily available from published sources such as the *ARL Statistics* and the annual surveys conducted by the National Center for Educational Statistics. It may also be necessary to gather additional data to support all aspects of the question and its subquestions; these data will need to be gathered from some appropriately selected sample drawn from the universe of university libraries.
4. The conclusions are used deductively to inform the field and perhaps the broader public and to identify new targets for research. Research results generally do not directly guide local policy, practice, or decision making, but may serve as motivators for specific evaluation programs.

VALIDITY AND RELIABILITY

Validity and reliability are concepts that apply to all kinds of research and evaluation (historical, descriptive, experimental). The terms are most frequently associated with quantitative approaches to research and evaluation, primarily because explicit tools and techniques for assessing validity and reliability in quantitative research and evaluation have been developed and tested. Validity and reliability are frequently discussed in relationship to approaches to measurement or tools used in measurement, although the meaning of the terms is actually broader than that.

Validity

Validity refers to the extent to which conclusions accurately reflect reality. Another way of interpreting this is that validity has to do with the extent to which conclusions are true or accurate.

1. Internal validity has to do with the extent to which relationships among variables are accurately described. A variable is an observable entity of interest to the investigator, the value or nature of which is not known at the outset of the research project. The essential nature of a variable is that its value or nature can vary. Imagine that the hypothesis of a study is "there will be a positive correlation between scores for the analytical portion of the Graduate Record Examination and the number of correct answers to a selected list of known-answer factual reference questions." The implication of this hypothesis is that there is a systematic, predictable relationship between the abilities measured by the analytical GRE score and the ability to answer factual questions. The results of whatever approach is taken to testing the hypothesis are very dependent on the extent to which the two variables (GRE scores and correct answer scores) are truly related and the extent to which the true relationship is revealed by the research and evaluation process. Ensuring internal validity for this hypothesis requires appropriate and careful data gathering, appropriate and accurate measurement, and appropriate analysis. It is very easy to deliberately undermine internal validity. It would be possible, for instance, to manipulate the relationship between GRE scores and question-answering ability by selecting only participants with high analytical GRE scores or by framing the questions such that they deliberately match the abilities assessed by the GRE analytical test.
2. Construct validity refers to the extent to which variables are accurately identified and described. The GRE analytical test certainly measures *something* and has been linked to success in a variety of academic disciplines. It was not, however, designed as a test of reference ability and may be a poor indicator of reference ability even if the hypothesized relationship is supported by the research and evaluation project. The ability to answer factual question is one important component in reference ability but cannot be considered a comprehensive indicator of reference performance. Construct validity is largely a function of the extent to which the investigator is cognizant of and honest about the limitations of operational definitions of variables. A failure to ensure construct validity is always a direct threat to internal validity.
3. External validity is the extent to which conclusions can be generalized and applied to other environments. There are three common approaches to ensuring external validity: (1) carrying out the research and evaluation project in a real-life or realistic setting, (2) gathering data in a manner that constitutes a representative sample, and (3) replication of the research and evaluation project in a different environment.

Reliability

Reliability refers to the extent to which conclusions are repeatable or replicable. A basic principle of reliability is that if the same approach to gathering and analyzing data is repeated with an acceptable level of precision in a directly comparable environment the results will be the same. The definitive test of reliability is direct replication. Although that test is rarely actually applied, the charge to the investigator is to present the results of research and evaluation in a manner that would make it possible for a reader of the research and evaluation report to replicate the study.

Reliability is closely related to measurement, which is addressed in Chapter 6, "Measurement, Populations, Samples, and Sampling." The ability to measure phenomena accurately and consistently is essential to ensuring reliability in research and evaluation. Intercoder reliability, also known as interrater, interobserver, or interjudge reliability, is a concern in any research or evaluation project in which more than one individual is responsible for observing, recording, or describing data. Intercoder reliability is a measure of the extent to which two or more observers agree on what has been observed and how to describe what has been observed. Imagine an evaluation study in which library patrons are asked to provide open-ended answers to the question "Are the library's operating hours adequate?" The most obvious answers are "yes" and "no," but the open-ended nature of the question allows for a wide range of answers, including "most of the time," "I guess so," "I don't know," and others. If multiple research team members are responsible for coding and consolidating those answers, there must be some set of rules for ensuring that they agree in their interpretations of answers. Where one coder may automatically interpret "they're just fine" as being a wholly positive response, another coder may interpret the same expression as meaning barely adequate.

The Relationship between Validity and Reliability

Validity and reliability are very closely related; both are important aspects of quality research and evaluation. There are three possible relationships between validity and reliability:

1. Conclusions are valid and reliable. This is the desired outcome of all research and evaluation. If either the validity or the reliability of the conclusions drawn from a research and evaluation endeavor is in question, then the conclusions themselves are in question and the research and evaluation as a whole cannot be accepted as a useful basis for either understanding or action.
2. Conclusions are reliable but not valid. If an instrument used in measurement is inherently but consistently flawed, it will yield the same results whenever it is applied but those results will always be incorrect. A ruler that is an eighth of an inch short will consistently produce measurements that are incorrect by an eighth of an inch. A question that can be misinterpreted may be consistently misinterpreted. If an operational definition fails to accurately represent the concept being defined, results based on that operational definition will be consistently wrong. Replication of a study that yields invalid conclusions may lead to extensive reproduction of the same invalid conclusions. The situation in which conclusions drawn from research and evaluation are reliable but not valid is one of the most difficult to detect and correct and is one reason that research and evaluation designs tend to focus more on validity than on reliability.
3. Conclusions are neither valid nor reliable. If an instrument is flawed in a manner that produces inconsistent or random results, the conclusions drawn from the use of that instrument will be neither valid nor reliable. Similarly, if an operational definition results in a representation of reality that is overly flexible, results based on that definition will have an unacceptable level of variability. When conclusions cannot be established as being either valid or reliable, they must be rejected and the research and evaluation project as a whole must be rejected as well.

Note that there is a fourth relationship that is not listed (conclusions are valid but not reliable). All valid conclusions are to some extent reliable; if conclusions are not reliable,

however, validity may be difficult to ascertain. Again, the investigator has an obligation to present in the research and evaluation report those details that make it possible for the reader to ascertain validity.

DEFINITIONS OF RESEARCH AND EVALUATION

Research

The *Oxford English Dictionary* provides the following definitions for research:

1. The act of searching carefully for or pursuing a specified thing or person; an instance of this.
2. Systematic investigation or inquiry aimed at contributing to knowledge of a theory, topic, and so on, by careful consideration, observation, or study of a subject. In later use also: original critical or scientific investigation carried out under the auspices of an academic or other institution.
3. Investigation undertaken in order to obtain material for a book, article, thesis, and so on; an instance of this.
4. The product of systematic investigation, presented in written (esp. published) form.

The second definition is most directly related to the focus of this book, but the other three are pertinent as well. Research is properly both a process and a product.

Herbert Goldhor, in *An Introduction to Scientific Research in Librarianship,* which was among the earliest comprehensive attempts to describe the real and potential roles of research in the study of library practice, defined research as "any conscious premeditated inquiry."[5] The fundamental point of Goldhor's definition is in the elements of consciousness and premeditation. Goldhor, who was for many years director of the Library Research Center at the University of Illinois, frequently lamented that librarians are constantly engaged in activities that are almost research—gathering data, compiling statistical reports, searching for new ways to do things more effectively—without adding the elements of "conscious premeditated inquiry" that would turn those activities into research.

Evaluation

The *Oxford English Dictionary* definitions of evaluation are:

1. The action of appraising or valuing (goods, etc.); a calculation or statement of value.
2. The action of evaluating or determining the value of (a mathematical expression, a physical quantity, etc.), or of estimating the force of (probabilities, evidence, etc.).

Evaluation in the context of this book spans both of these definitions. Evaluation has to do with assigning value to things, institutions, processes, or individuals. The central purpose of evaluation is improvement of service in a specific environment or institution, although evaluation may address more than one environment in a comparative manner and may produce results that are of interest beyond the specific institution. Nietzsche's depiction of evaluation as creation in the quote at the beginning of this chapter is appropriate and illustrative: evaluation is a creative activity intended to bring about improvement.

The process of assigning value is perhaps the essential difference between research and evaluation. Research primarily describes what *is* and provides evidence to support general conclusions and to guide understanding and theory development. Evaluation balances factors in a given situation to determine best use of results to achieve desired outcomes.

THE CHARACTERISTICS OF RESEARCH AND EVALUATION

Research and evaluation are characterized by a number of essential factors. The explicit and conspicuous presence of these factors is an indicator of quality and attention to detail in a research project or evaluation program. Their absence signals the potential for flawed research or evaluation and is suggestive of limitations in the extent to which results can be trusted and to which decisions can be made or actions undertaken. The essential characteristics of research and evaluation are summarized in Figure 1.3. These shared characteristics of research and evaluation may assume very different manifestations; the differences in manifestation are summarized further on in Figure 1.5.

1. Research and evaluation are *planned* activities. Research and evaluation are not natural or organic phenomena and do not just occur. The ultimate success and value of any research or evaluation activity are embedded in the planning process. Sloppy planning almost always results in sloppy implementation, sloppy conclusions, and sloppy decisions. Planning for research is generally focused on achieving overall research integrity and ensuring validity, which is a measure of the extent to which conclusions accurately reflect reality, and reliability, which measures the extent to which conclusions are repeatable or replicable. Planning for evaluation, although it should also take into account validity and reliability, is primarily carried out in the interest of ensuring that data are sufficiently accurate to provide a sound basis for decision making and that measures have a pragmatic value.
2. Research and evaluation are *systematic*. There are two meanings of the word *systematic* that apply to research and evaluation. The first has to do with carrying out work in an orderly and methodical manner, which is an essential component in reliable evaluation and research. The second has to do with systems thinking. A fundamental

Figure 1.3 Essential characteristics of research and evaluation.

aspect of planning for research and evaluation is identification of the systems and structures within which the research or evaluation effort will take place. Understanding the systematic context of the phenomenon to be examined is essential to research and evaluation processes. Research generally explores the relationship between the phenomenon of interest and universal or general systems; in this context, the systematic nature of research is a direct tie to building or expanding an appropriate theoretical base. Evaluation is much more focused on establishing, assessing, and improving local systems.

3. Research and evaluation are *controlled.* The extent to which the process is controlled and the ways in which it is controlled vary according to the general and specific methodologies used to carry out research or evaluation. Some forms of research and evaluation, such as those characterized by ethnographic methods, may appear to be less controlled than others, such as those reliant on experimentation. Regardless of the methodological base or the specific purpose of the project, some aspect of control must be exerted for the results of the project to be both valid and reliable. The role of control in research has primarily to do with assuring validity and reliability. The most obvious aspect of control in research is the use of control groups in experimental research as a check on the validity of an experimental treatment. Control in evaluation usually focuses more on assuring that the evaluation effort itself is appropriately cost-effective and that human factors in the institutional environment are appropriately respected and supported.
4. Research and evaluation are *objective.* In traditional thinking, scientific research can basically be reduced to an assessment of physical reality—of what *is*; that which can be observed. The principle of objectivity does not violate the basic principle that truth and values cannot be completely separated. Objectivity in practice has to do with matching the research or evaluation process to the context of the phenomenon being examined. Objectivity in research is primarily a function of minimizing intentional or accidental bias in the research process; random sampling is a prime tool of objectivity in research. Avoidance of bias is also essential in evaluation, but objectivity in local evaluation may also have to do with ensuring that project design, analysis, decision making, and reporting support fairness and equitable treatment for all constituents. Evaluation tends to be more political and value-laden than research, which may make objectivity more difficult to ensure.
5. Research and evaluation are *goal oriented.* As attractive and amusing as the image of the investigator bumbling around until he or she produces some unexpected beneficial result may be, it is not an accurate portrayal of the way in which research and evaluation really happen. Research and evaluation tend to be very highly focused toward the attainment of very explicitly stated, verifiable goals and objectives. This is especially true of evaluation, which is undertaken to solve specific problems or facilitate explicit decision making, but it is also true when the motivation is simply curiosity about some unexplained phenomenon. The central goal of any research project is ensuring that a carefully defined and precisely stated research question and/or hypothesis is explored in a manner that yields valid and reliable results. The fundamental goals of evaluation are ensuring and improving organizational effectiveness.
6. Research and evaluation are aimed at *increasing understanding.* The role of research and evaluation as approaches to learning is essential. Research and evaluation are not idle or casual endeavors. Even if the goal is very specific and local or even essentially personal in nature, the factor of gaining a better understanding of the phenomenon

results produced in one institutional environment can be applied in a parallel institutional environment. Transferability in evaluation means that an evaluation process may not have to be carried out across the entire institutional base; instead, a particular department, division, or branch can serve as a test-bed for evaluation with a reasonable expectation that what is learned in the test-bed setting can be directly applied across the institution. Transferability in evaluation may lend support to the development of best practices—accepted approaches to action that are based on the shared understanding and collective evaluation outcomes of a professional body. Transferability in research is heightened when the results of a research endeavor suggest enhancements to understanding closely related phenomena and particularly when the results of research suggest targets for future research.

4. Research and evaluation results may be *used as a basis for action.* Action and decision making are especially important roles for research and evaluation in library and information science. An obvious focus of research and evaluation in any professional field is the generation of approaches and methods for improving professional practice. Results may also have meaningful policy implications. A series of studies carried out by Lance and others documents a positive correlation between school library media center resources and student reading scores, a finding that has substantial implications for school administrators and community leaders.[6] Research results are sometimes a direct basis for action, but are more frequently a guide to targets for and approaches to local evaluation. The outcomes of research are transformed into action when new questions are generated, targets for theory development and testing are identified, or new methods of exploration are generated. Action based on effective decision making is a fundamental goal of evaluation. Although some concrete change or improvement is frequently an anticipated outcome of evaluation, a positive decision to preserve the status quo is also a form of action.

Characteristic	Manifestation	
	Research	Evaluation
Planned	Assurance of integrity, validity, and reliability	Assurance of accuracy and pragmatic benefit
Systematic	Grounded in universal systems	Grounded in local systems
Controlled	Assurance of validity and reliability	Assurance of economy and human factors
Objective	Avoidance of bias	Assurance of organizational integrity
Goal-oriented	Grounded in research questions and hypotheses	Grounded in improvement of organizational effectiveness
Aimed at increasing understanding	Universal understanding	Knowledge for decision making
Predictive	Focused on future trends and expansion of knowledge	Focused on future decision making and future evaluation needs
Cumulative	Expansion of the field	Expansion of bases for decision making
Transferable	Applicable across institutions and environments	Applicable across a single institution
Used as a basis for action	Indirect, as a guide to local evaluation	Direct, as a basis for local decision making

Figure 1.5 Manifestations of the characteristics of research and evaluation

be directly measured and insubstantive phenomena that can be measured only through indirect means that yield estimates rather than precise measurements. Measurement is addressed in greater detail in Chapter 6.

4. Comparison is the extension of measurement to multiple manifestations of the phenomenon of interest. Comparison combines the elements of classification and measurement. This may involve time series, in which some phenomenon is measured on a recurring basis over time to assess chronological trends. Libraries frequently use time series as a fundamental component in evaluation. Alternatively, the comparison may involve multiple similar cases. Comparing use measures for libraries of a similar size and type, for instance, may yield interesting results about patterns and variations in use.
5. Relationship research focuses on the ways in which different characteristics or manifestations of a phenomenon are related to each other. The search for relationships is a step toward understanding not only the nature of the phenomenon but also exploring the root causes of the nature of the phenomenon. A relationship study of use of library materials might explore whether circulation varies in public libraries of similar sizes as a function of whether they are located in urban, suburban, or rural areas.
6. Cause and effect is a special kind of relationship in which the search is not only for the existence of a relationship but for evidence that one characteristic or factor systematically and consistently influences another. Causation is in practice very difficult to determine except in experimental research. Even if there is a consistent, predictable relationship between the setting (urban, suburban, rural) of a public library of a specific size and the volume of library materials circulated, it is a long step from that observation to a conclusive demonstration that that setting in and of itself causes a particular pattern of circulation.

THE TRADITIONAL RESEARCH DICHOTOMY

Research is often categorized into a dichotomy that distinguishes between basic research and applied research. In this scheme, basic (pure, theoretical) research is aimed at increasing knowledge, with no specific practical application in mind while applied (action oriented, decision making) research is aimed at improving some body of practice. Evaluation is most commonly associated with applied research and applied methods, while research is frequently associated with more academic or theoretical motives.

In reality, the distinction is not that clear-cut. In Pasteur's words, "There are no such things as applied sciences, only applications of science."[8] Although pure research is unquestionably a very real phenomenon and many investigators are employed in the pursuit of increased learning for its own sake, research ideas do not arise in a vacuum but in the tangible environment of the real world. It is difficult to envision an investigator engaged in a project for which there is truly no specific desired outcome that can be applied, especially in professional disciplines such as medicine, law, engineering, and library and information science.

At the same time, effective evaluation that is directly oriented toward decision making, even in the confines of a very specific local environment, must have the outcome of yielding new understanding of some phenomenon that has the potential for being added to the cumulative knowledge base related to that phenomenon. At the very least, good evaluation draws on relevant research. This is the juncture that ties research to evaluation.

Ultimately, the distinction between pure and applied research is not so much in what is done but in the motivation for doing it, and even then the distinction is frequently excessively subtle.

than quantity. Observations are unpredictable and open-ended. The qualitative model is characteristic of much research in the social sciences, particularly in disciplines such as anthropology and ethnography and has in recent years played an increasing role throughout the social sciences. Given has provided a comprehensive, in-depth overview of qualitative research methods.[11]

A qualitative approach to assessing patron satisfaction with library services may take the form of a focus group experience. A focus group brings together representative constituents in a free form, open discussion that centers around a specified service, function, or concern. Very general questions are asked to stimulate discussion, but there are no predefined answer categories. Results are not summarized or tallied, but are presented verbatim.

A substantial emphasis of the literature on qualitative research, particularly in those fields where the quantitative model has historically been dominant, has focused on explicit rejection of quantification. The backlash from the quantitative school has frequently denigrated qualitative methods. This has resulted in a state of tension and conflict that has tended to have a largely negative impact. As approaches to qualitative research have matured and become more widely applied, an increasing number of investigators have begun to combine quantitative and qualitative methods to more fully understand phenomena of interest.

The Qualitative Paradigm

The nature of the quantitative paradigm is relatively easy to understand in that applying numeric values to phenomena is a familiar process that is deeply embedded in education from early childhood through postgraduate experiences. The qualitative paradigm is somewhat more difficult for the uninitiated to understand, in part because it is an emergent way of approaching research and evaluation.

Synonyms and Near Synonyms

The research tradition has its deepest roots in scientific models and modes of inquiry. The emphasis is on objectivity and exploration of the physical environment. Quantitative analysis and statistical tools are applied as means of ensuring objectivity and to provide consistency and comparability in describing what is observed. The emphasis of most reports of quantitative research studies is on summarization of the ways in which manifestations of the phenomenon being studied are alike or different.

Qualitative research comprises a family of methods that deemphasize quantification in favor of studying the fundamental qualities of phenomena. The emphasis of most reports of qualitative research is on explication of specific manifestations of the phenomenon being studied.

Quantitative research and qualitative research are sometimes viewed and treated as being opposites or even as being opposing armed camps. Another point of view is that there is a continuum that extends from entirely qualitative studies through various mixtures of qualitative and quantitative methods to purely quantitative studies. It may be more accurate, however, to view quantitative and qualitative research as being differing perspectives. Just as historical research focuses on the past and descriptive research focuses on the present, quantitative research focuses on examination of the quantifiable aspects of a phenomenon of interest and qualitative research focuses on the nonnumeric qualities of a phenomenon. It is quite reasonable to expect that any given phenomenon can be examined from either a quantitative or a qualitative perspective or from both perspectives simultaneously.

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