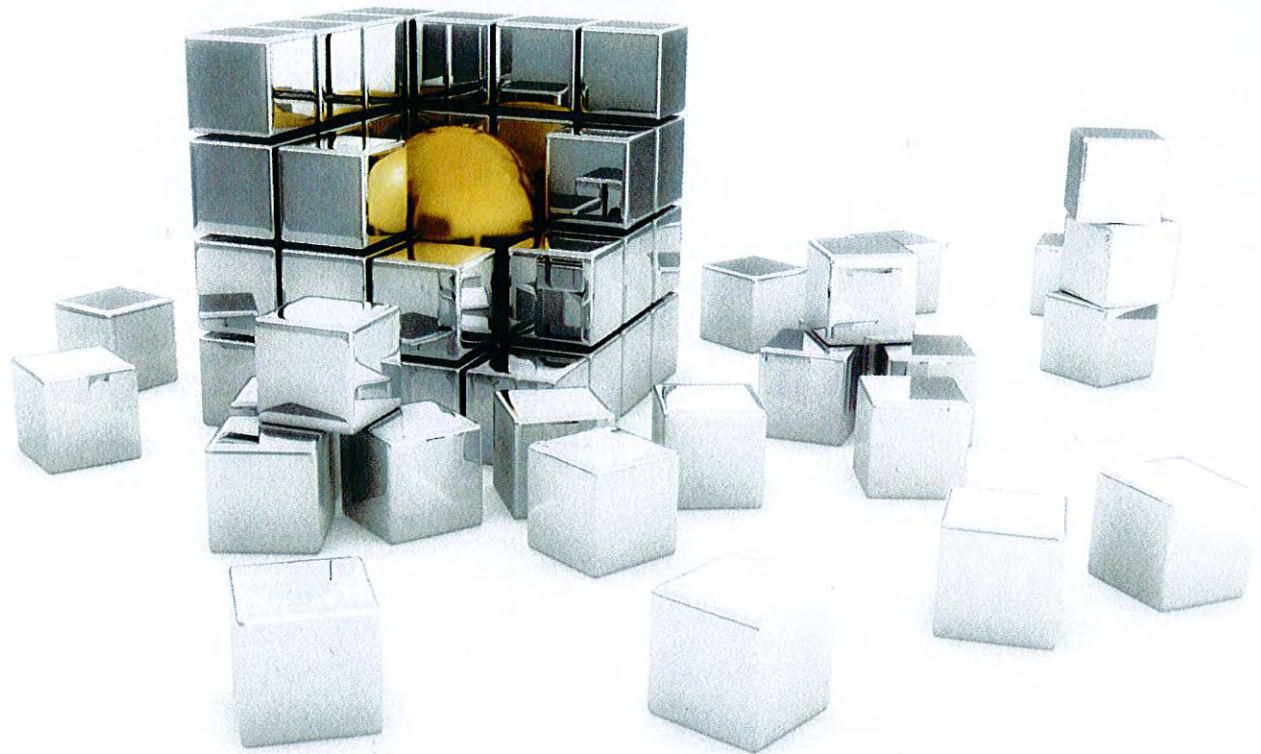


ENCYCLOPEDIA OF
**RESEARCH
DESIGN**

VOLUME 2



EDITED BY
NEIL J. SALKIND

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Table 3 Areas of Lakes in Acres

	Lakes				
	A	B	C	D	E
Area	36.7	48.2	15.3	26.1	79.6

Table 4 Sample Sizes in Each Lake

	Lakes				
	A	B	C	D	E
Area	27	35	11	19	58

denoted from A to E, and the areas of these lakes are summarized in Table 3. If the sample size is determined to be 150, then the sample sizes in each lake are as summarized in Table 4.

For example, the sample size in Lake C can be determined as

$$150 \times \frac{15.3}{250.9} = 11.14619 \cong 11,$$

where

$$250.9 = 36.7 + 48.2 + 15.3 + 26.1 + 79.6$$

is the total area of the study region.

The principle of proportional sampling is widely used in practical sampling survey cases, either to determine the sample sizes of each domain or to evenly spread sampling units over the study region. Numerous researchers recommend proportional sampling because it is relatively more efficient than the uniform sampling or simple random sampling on the whole study region. To name a few, José Schoederer and colleagues described the application of proportional sampling in an ecological survey. Saul Blumenthal discussed proportional sampling on a time interval, in which the study region is a one-dimensional compact space. T. Y. Chen and colleagues studied the performance of proportional sampling on software testing and found it is a better choice than the random testing.

Chang-Tai Chao

See also Random Sampling; Sample Size; Stratified Sampling

Further Readings

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PROPOSAL

A program research plan, or proposal, is a comprehensive description of a potential study that is intended to examine a phenomenon in question. The main purpose of research is the increase of knowledge, either in a specific disciplinary field or in the practice of a professional field. Research is usually associated with a planned, systematic investigation that produces facts and ideas that contribute to human thought, reflection, and action. Because there is no single way in which to approach research, an inquirer must weigh many factors in designing a program research plan.

Throughout the centuries, basic research structures have developed as models for each subsequent generation of knowledge-seekers. One who chooses to research a particular concept or phenomenon within one's field may look to the historic development of research methodology in that particular field to guide him or her in designing an appropriate research protocol. Regardless of the field of study, the potential researcher will find that scholarly investigation is guided by two overarching systems of inquiry—*quantitative* and *qualitative* research methodologies. Both are viable avenues of study that address inquiry in multiple disciplines. However, they are guided by different principles and are, therefore, best applied when matched to the characteristics of the problem that is to be studied.

Generally, postsecondary institutions of education require that a proposal or prospectus be submitted, reviewed, and approved prior to emoverlineking upon a thesis or dissertation study. This requires that the researcher complete a preliminary review of related literature and fomulate a hypothesis or research question that will provide focus for the study. Following these initial steps, the remainder of the program research study is designed and defended as part of the approval process. This plan must also be submitted to the college or university's research department for approval through the institutional review board. The approvals process has many steps, but a fully developed, well-designed plan saves time and effort in the long run; provides structure for the study; and normally produces a higher quality of research.

Although the exact titles, formatting, and subsections may vary based upon the research design and researcher preferences, research plans, whether quantitative or qualitative in nature, have several elements that are commonly included in their designs. Both usually include introductory components that present the phenomenon to be studied, a review of relevant literature, descriptions of the research design and procedures, and discussion of the data analysis methods to be used within the study.

Quantitative Research Versus Qualitative Research

Quantitative research methodologies are most often associated with scientific investigation of quantifiable properties and their relationships. It uses mathematical models, theories, and hypotheses to measure and portray the empirical associations found in natural phenomena. It is frequently the research methodology employed for inquiry in natural science and social science fields such as physics, biology, psychology, and sociology. Characteristically, quantitative methods use large, random samples from which to gather data, and they require that the researcher remain in a neutral, noninteractive role so as to remove any bias that could affect the outcome of the study. Data are often numerical in nature, collected using reliable and valid tools and methods, and analyzed using statistical techniques. Results and findings are methodically presented following statistical data analyses, focusing on deductive, logical reasoning.

Qualitative research methodologies provide a means of gaining deeper understandings of human behaviors and the factors that influence those behaviors. The nature of human interactions is dynamic and may be reshaped by myriad factors. Therefore, qualitative methodology offers multiple means of inquiry that are flexible and adaptable within a more fluid research protocol. In essence, the researcher does not present a typical hypothesis at the onset of the study. Instead, he or she develops the research questions and focus during the study. The questions and focus of the study may change as the researcher investigates and collects data for the project. The broad range of human behaviors dictates that qualitative research use smaller samples in order to limit the scope of a study and allow the inquiry to focus more deeply on the phenomena to be examined. Unlike quantitative research, qualitative research is often subjective in nature, relying on interaction between the researcher and study participants. Qualitative data are characterized by their descriptive qualities, collected through personal accounts and interviews. Instead of using statistical analysis techniques, the qualitative researcher investigates patterns and common themes within the data. Study results are written in narrative form, using inductive reasoning to present findings.

Both research methodologies offer advantages and disadvantages; therefore, the researcher must look to the focus and purpose of his or her inquiry to determine which methodology is the better match for a proposed study. Some of the basic features of qualitative and quantitative research are highlighted in Table 1.

Quantitative Proposed Program

The choice of a quantitative research design requires the researcher to fomulate an initial, specific hypothesis that will serve to guide the study. Thought and planning must be incorporated into the development of instruments and methods for measurement. Variables must be identified and their control and manipulation must be factored into the research design.

Selection of a quantitative research methodology brings with it structure and format that are commonly accepted as the scholarly progression to conduct such a study. Table 2 provides an outline

Table 1 Basic Features of Quantitative and Qualitative Research Methodologies

<i>Qualitative</i>	<i>Quantitative</i>
Generates detailed descriptions portrayed in creative, narrative forms	Generates models, theories, and hypotheses portrayed in mathematical expressions
Role of the researcher is interactive and may include participation in the study	Role of the researcher is a neutral stance in order to eliminate any bias
No hypothesis—the researcher may begin a study with a concept, but without knowing in advance what he or she is specifically looking for	Hypothesis is stated—the researcher clearly knows in advance what he or she is looking for and seeks to prove or disprove the problem
The design may be flexible and aspects may be adapted and changed as the study progresses	All aspects of the design are clearly structured prior to the start of the study and remain intact
Researcher is the main data collection tool—use of interviews, observations, and so on rest with the researcher and require a departure from value neutrality	Researcher uses tools or instruments to collect numerical data—questionnaires, assessments, scales, and so on provide data through a neutral stance
Smaller samples of data are used because of the greater bulk of data generated	Large samples are used to provide maximum insight into numerical data
Data collection and analysis require extensive expenditure of time	Data collection and analysis are more efficient, requiring less time
Data analysis uses both subjective and objective means to determine findings	Data analysis is determined objectively through the use of mathematical calculations
Findings are presented in the form of words, pictures, or other objects	Findings are presented in comparative mathematical expressions
May be more specific rather than generalizable	Generalizable, but has less contextual detail

of the elements that are contained within that academically sanctioned format.

Approaches to a Quantitative Research Plan

Quantitative research is the method of choice for a researcher who seeks to clarify phenomena through specifically designed and controlled data collection and analysis. Within that methodology lies a broad spectrum of approaches.

Experimental Research. Identifies at least one independent variable for interventions and is manipulated, whereas other, related variables are controlled; effects on dependent variables are observed (e.g., measuring student achievement levels by examining and controlling selected variables such as age, grade level, reading level, time,

teacher characteristics, etc.); two subgroups fall within this category: true experimental and quasi-experimental research.

- *True Experimental Research.* Participants are randomly selected and placed into control and experimental groups prior to the intervention; the experimental group receives the intervention and the control group does not; random selection and placement of the participants allows the researcher to control for extraneous variables; this method provides for true causal relationships between independent and dependent variables.
- *Quasi-Experimental Research.* This type of research is used when the researcher cannot or should not randomly assign participants to control and experimental groups; lack of random

Table 2 Organizational Format for a Quantitative Research Study

Preliminary Introductory Pages	
Title Page	
Acknowledgments (optional)	
Abstract—brief, single-page overview of the study	
Table of Contents	
List of Tables	
List of Figures	
Chapter 1—Introduction	
Introductory Paragraph	
Statement of the Problem	
Purpose of the Study	
Significance or Rationale for the Study	
Limitations of the Study	
Delimitations of the Study	
Operational Definitions	
Statement of the Hypotheses or Research Questions	
Summary of Chapter (and overview of the study)	
Chapter 2—Review of Related Literature	
Introductory Paragraph (may include organization of the review)	
Review of the Literature	
Theoretical Framework	
Summary of Chapter (one paragraph)	
Chapter 3—Methodology	
Introductory Paragraph	
Review of Hypotheses and/or Research Questions	
Design of the Study	
Population and Sampling (also include sampling frame)	
Instrumentation (validity and reliability)	
Procedures of the Study	
Pilot Study (if needed)	
Data Analysis	
Summary of Chapter (one paragraph)	

assignment limits the researcher's ability to control for extraneous variables; results should be interpreted cautiously; these types of designs cannot prove cause and effect, although they can show relationships between variables.

Correlational Research. Seeks to examine the degree of relationship that may exist between two or more variables in a single group of participants through collection of relevant data; this type of research cannot definitely identify cause-and-effect relationships because of a lack of

Chapter 4—Findings

Introductory Paragraph
Results of Data Analysis
Findings by Research Questions or Hypotheses
Summary of Chapter (one paragraph)

Chapter 5—Conclusions, Implementations, and Recommendations

Introductory Paragraph
Conclusions of the Study
Generalizability of the Findings
Logistical Aspects of the Study and Some Lessons Learned
Implications for Policy and/or Practice
Recommendations for Future Research
Summary of Chapter (one paragraph)

Appendixes

Time Line for the Study
Consent Form, IRB Approval
Samples of Data Collection
Instruments—Surveys, Questionnaires, etc.

random selection and assignment of participants, and because of a lack of variable manipulation; lack of randomization also limits the generalizability of results.

Causal-Comparative Research. Investigates the causes or consequences of existing differences in groups of individuals; may also be referred to as ex post facto research due to the nature of dealing with groups that have already been established (e.g., whether students whose parents have attended college enter postsecondary education at a higher rate than students whose parents who have not attended college); because the events have already occurred, variable manipulation is impossible; results must be interpreted with caution and generalizability is limited.

Survey Research. Collects descriptive data from a targeted population in order to determine the current status of one or more specific variables (e.g., the status of health care in a given community); questions are not standardized, which may lead to issues with instrument validity and reliability.

Components of a Quantitative Research Plan

For a solid proposal, the researcher needs to write in such a way that the study can be envisioned by the readers. The proposal should be clear and concise, with attention to detail. The following subgroups represent the sections of a written plan for conducting quantitative research. Although the subtitles may not be the same for every proposal, this information serves as an outline for developing the plan of research. The researcher will need to determine the exact subgroups and titles based upon research methods and type of study being conducted.

Introduction and Statement of the Problem

When writing a quantitative research plan, the researcher must first set the scene for the project. The introductory section of the plan allows the researcher to discuss the framework for the project, as well as provide vital background information. The researcher wants to draw in the audience, creating interest and intrigue. In this section, the researcher discusses the topic that is the focus of the research, including its importance to the advancement of knowledge in the particular field of study.

Review of Related Literature

The goal of the literature review section is to link current research and information to the researcher's focus of study, providing a foundation for the project. The literature review should provide adequate background information, current trends in the field of study, and prior research that relates to the project, as well as any gaps in the literature. The literature review will assist the researcher in developing research questions and hypotheses by relating the review findings to the goals of the project. The researcher should aim at including the most current literature and research available, relating it to the study at hand. Ideally, the researcher should demonstrate that his or her research is theoretically based, yet unique in its approach and what it intends to prove.

Statement of the Hypothesis

As mentioned previously, current literature and research trends should help the researcher

determine the basic research questions and goals of the study. The literature review should guide the researcher in formulating the hypothesis or hypotheses for the project. The statement of the hypothesis in a quantitative research proposal should be succinct and include the variables upon which the study will focus. In the proposal stage of the study, it is not always necessary for the researcher to know what type of effect the variables will have on one another. However, it is important that the researcher define clearly and operationally any variables that will be manipulated in the proposed program of study. In addition, if several research questions and/or hypotheses will be examined, all of these should be listed as part of this section. The final statement of the hypothesis or hypotheses must be written in such a way that anyone reviewing the proposal knows exactly what will be studied.

Methodology

The methodology section of the proposed program of a quantitative study describes exactly how the research will be conducted. The researcher needs to include methods involved in selecting participants, any instruments that will be used in the project, and the general research design.

Selecting Participants. When formulating a quantitative research proposal, the researcher needs to include a detailed section on how participants will be selected. The researcher must also describe pertinent demographic information regarding the selected participants and the overall pool from which the participants are being chosen. The researcher must include the type of sampling procedures that will be used to select the participants, as well as how many participants will be included in the project.

Instruments. The researcher should discuss any data collection tools that may be used in the study. Instruments must be described clearly, and the researcher should specify how each will be used. In this section, it is important to indicate which are existing instruments, as well as which instruments will be developed by the researcher. It is also appropriate to discuss validity and reliability of instruments, details of how the instruments will be administered and scored, and why

the specific instruments were selected or developed for the study. Because this is the proposal phase of the study, the researcher may not have all of the data collection tools selected or developed at the time of submission. In such cases, the researcher should, at a minimum, discuss the type of instruments that will be used, such as interview questions, pretests, and so on.

Research Design. The research design outlines the framework for how the study will be conducted, including the research goals and questions that will be answered through the study. The goal of quantitative research is to examine relationships among or between variables. Several designs accomplish this objective as mentioned previously, including experimental and quasi-experimental, correlational, and causal-comparative research. The intention is for the researcher to select the design that best suits the current study's objectives and goals.

Data Collection

Some researchers include the data collection section within the methods section, but it may also be discussed separately. Regardless of how the proposal is organized, it is important for the researcher to effectively share the steps of collecting data for the project. This section should include how the participants will be selected, as well as the details regarding the data collection instruments and any other pertinent information relating to the data. The researcher must specify who will administer each tool, as well as how and to whom the tool will be given for data collection purposes. The researcher may also give an estimated time line for when the data will be collected. If the study claims any assumptions, these should be detailed, as well as any limitations that may influence the data and study outcomes.

Data Analysis

Although the researcher may not yet know the results of data analysis, he or she should be prepared to discuss the methods of how the data will be analyzed. This includes any inferential and descriptive statistical testing and techniques. The types of statistical methods chosen should flow from both the research goals and objectives

and the design of the study. A variety of techniques can be employed in a study, but they depend upon the type of participant sampling methods, research design, independent and dependent variables, and data that are collected. The researcher can strengthen the proposal if he or she determines the specific techniques to analyze the data.

Report of Findings

Once the data have been analyzed, the final step is to report the findings of the study. The researcher conveys whether or not the study provided enough evidence to accept the hypothesis as true, the extent of how the results can be generalized and to what populations, and any other findings that were discovered during the study. This section should also point out any limitations of the study and discuss ways that further research could strengthen the study's hypothesis. Finally, the researcher should note the significance that the study has with regard to furthering knowledge in the field.

Qualitative Proposed Program

Qualitative research explores the *why* and *how* of a phenomenon and provides opportunities for a researcher to go beyond the quantitative questions of *how many* and *to what extent* an experience may occur. According to Norman Denzin and Yvonna Lincoln, a qualitative research project permits the researcher to depart from the value neutrality usually associated with scientific research and delve into the variant factors surrounding a phenomenon—natural settings, characteristics of participants, interactions, thoughts, and discoveries—that are brought to light through interaction with the research participants themselves.

Characteristically, qualitative methodology allows the researcher to collect data through participation, observation, interviews, and analysis of artifacts and documents. With this information, the researcher may then attempt to interpret or make sense of the phenomenon through the meanings that the participants bring to them. Reporting of findings is most frequently done in a more literary form rather than being graphed, charted, or put forth in mathematical terms.

Qualitative methods have their early roots in sociology and anthropology as researchers sought to investigate lived human experiences. Usage expanded to include other social and behavioral sciences. Currently, researchers in multiple fields such as education, health services, clinical research, women's studies, and societal reform movements use qualitative methods to gain greater insight into specific experiences or phenomena. As an example, a researcher studying the importance of mental attitude in the success of chemotherapy for specific cancer patients may, through qualitative methods, explore the various attitudes of the patient, his or her family and friends, and any other factors that produce positive and/or negative feelings regarding the cancer treatments. In educational settings, qualitative methods allow the researcher to take on the role of the researcher/practitioner, thus enabling a teacher to engage in deeper evaluation of instructional techniques, resulting in improvements in both teaching and learning within the classroom.

Qualitative research methodology also lends itself to a *mixed methods* approach that employs both qualitative and quantitative procedures to expand the depth and scope of a research study. This inherent flexibility allows room for human variance and, as such, is a characteristic that has made qualitative research the methodology of choice for a broad range of social, behavioral, and biomedical sciences.

Approaches to a Qualitative Research Plan

Qualitative researchers have an array of approaches that may be used to design a research study. Selection of a specific approach provides a framework that serves to guide the structure and sequence of a qualitative research study. Specific methods of collecting and analyzing data within each approach are determined by the nature of the phenomenon and should be selected to provide consistency between the occurrence and the data derived through that occurrence.

A researcher who elects to pursue a qualitative study faces the task of determining the approach that will fulfill the research goals. Consideration must be given to the research question and the audience for whom the research is targeted. John

Creswell identifies five general models that are usually associated with qualitative research approaches.

1. *Ethnography*. Studies an intact culture in its own setting over a prolonged time period through direct observation.
2. *Grounded theory*. Seeks to establish a generalized theory regarding an experience or process that is grounded in the perspectives of the research participants. Constant comparison of data collected in multiple stages is a primary characteristic of this approach.
3. *Case study*. Explores events, processes, or activities in depth through the perspective of one or more participants over a specified time period. Detailed data collection using a wide range of measures is a hallmark of this approach.
4. *Phenomenological study*. Seeks to gain understanding of the lived experiences of a small number of participants in order to shed light on the phenomenon of such experiences.
5. *Narrative research*. Relies on the stories of individual participants to form the basis of a chronological account that merges the views of the participants with the views of the researcher into a collaborative narrative.

Each of these qualitative approaches carries with it characteristics and procedures that can dictate whether or not that approach will be consistent with the problem or phenomenon to be studied. Matching the approach with the problem will produce the most accurate and informational results for the researcher.

Components of a Qualitative Proposed Program

The researcher's choice of qualitative approach directs the design and development of the research study. Research questions, review of relevant literature, and all aspects of data collection and analysis are formulated relative to the qualitative approach selected for the study. The following information provides the basic structure for writing the qualitative research proposal. However, it is important to keep in mind that the subgroups

may be slightly different from those presented here depending on the researcher, methods used, and type of study.

Statement of the Problem

Qualitative research is often the method of choice for those who seek to examine societal issues, especially those that confront marginalized people, political issues, and issues that affect specific groups of people. An effective statement of the problem sets the stage for the research and provides continual focus as the study progresses.

Table 3 Organizational Format for a Qualitative Research Study

Preliminary Introductory Pages
Title Page
Acknowledgments (optional)
Abstract—brief, single-page overview of the study
Table of Contents
List of Tables
List of Figures
Chapter 1—Introduction of the Study
Introductory Paragraph
Describe the Purpose of the Research Study
Context of the Study—Frame the Study Within the Larger Theoretical, Policy, or Practical Problem
Determine the Purpose of the Study
Initial Research Questions Are Posed
Related Literature Is Presented to Help Frame the Research Questions
Delimitations and Limitations of the Study
Significance of the Study
Summary of Chapter (and overview of the study)
Chapter 2—Research Procedures
Introductory Paragraph
Overall Approach and Rationale of the Study
Site and Sample Selection
Define the Researcher's Role
Determine Data Collection Methods and Data Management Strategies
Design Data Analysis Techniques to Be Used
Consider Trustworthiness Features Such as Triangulation of Data

Observe Ethical Considerations as Related to Human Subjects and Confidentiality of Participants

Summary of Chapter (usually one paragraph)

Chapter 3—Reporting Findings

Introductory Paragraph

Narrative Format Rather Than Mathematical Representations

Contributions of the Research

Limitations of the Study

Provided to All Stakeholders

Summary of Chapter (usually one paragraph)

Appendixes

Time Line for the Study

Consent Form, IRB Approval

Samples of Data Collection Instruments—Surveys, Questionnaires, etc.

Review of Relevant Literature

The literature review defines the importance of a qualitative study. Through this review, a researcher can determine whether there is a gap in knowledge or if there are other relevant studies that could serve as the basis for further examination of a specific problem. A thorough review of relevant literature suggests direction for a potential study and helps the researcher to determine the research questions. Furthermore, it contributes to the formulation of ideas throughout the study and serves to confirm the need for continued exploration of a phenomenon.

There is, however, another option within qualitative research methodology for examining relevant literature. According to Michael Quinn Patton, reviewing the literature prior to the study has the potential to predispose the researcher's thinking, which could diminish openness to developments that occur during the study. Therefore, an alternative approach is to conduct the literature review simultaneously with the study so that emerging data and relevant literature create a collaborative source that informs the researcher's perspective as it continually develops. Regardless of whether the researcher decides to examine the literature in the initial stages of a study or to review it throughout a study, the

literature review is an essential factor to position a qualitative study and provide focus for its merit.

Organizational Format

Academic expectations and standards dictate that any research study be organized in a logical and scholarly fashion. A commonly accepted format for the organizational progression of the "pieces and parts" of a qualitative study includes classic research elements, but also allows expanded creativity because of the flexible nature of qualitative research. For example, emerging data may suggest that an additional data source be added or expanded. In like manner, data analysis may point the researcher to a different body of relevant literature that supports or disputes those themes and categories that emerge throughout the analysis process. However, an overall consistency is provided through use of those elements that are widely accepted as necessary parts of a qualitative study. A summary of the common elements found within the organizational format for a qualitative research study is delineated in Table 3.

Organizational Format for a Qualitative Research Study

Data Collection

Qualitative research studies use small, in-depth samples from which to derive data. The most frequently used data collection strategies include the following:

- *Interviews.* These may be done one-on-one or in a group setting either in person or via telephone; information may be audio- or videotaped for transcription analysis.
- *Observations.* These are direct, firsthand accounts as derived by the researcher in either a concealed or known role; they may also include the participant as an observer.
- *Documents.* These include the researcher's field notes, journals, or other printed materials such as newspapers, minutes of meetings, or other public documents.
- *Audiovisual materials.* Photographs, videotapes, or artwork are among materials used in data collection procedures.

Of these methods, interviews are the primary source of for production of qualitative data. According to Donald Polkinghorne, interviews allow the qualitative researcher to obtain first-person accounts of participants' experiences. John Creswell noted that interviews with participants provide historical information that enhances understanding. The researcher designs the interview protocol so as to elicit the information needed to enlighten the research questions that focus the study. The use of open-ended questions allows participants to respond at greater depth and opens the opportunities for the researcher to ask questions that clarify any comments revealed within the context of the interview.

Data Analysis

Interpretive qualitative research designs have several key characteristics in common. The first is that the researcher strives to understand the meaning that people have constructed about an experience; he or she looks for a depth of understanding not for the future, but for the present situation, the "here and now" of a setting. The second key characteristic is that the researcher serves as the primary instrument to collect and analyze data. Because understanding the human experience is the goal of the research, this human mechanism is the most ideal means of collecting and analyzing data due to the flexibility, adaptiveness, and immediacy brought to the task by the researcher. This brings inherent biases, but another characteristic of such research is to identify and monitor these biases, thus including their influence on data collection and analysis rather than trying to eliminate them. Finally, data analysis in an interpretive qualitative research design is an inductive process. Data are richly descriptive and contribute significantly as the text is used to build concepts and theories rather than to deductively test hypotheses.

It is the task of the researcher to include in the research design the method of data analysis that is to be used. Commonly accepted procedures include phenomenological analysis, hermeneutic analysis, discourse analysis, and a variety of coding procedures. Validity and trustworthiness of findings may be achieved by using multiple data collection methods and triangulating the data gleaned from those processes.

Reporting Findings

Findings derived from a qualitative research study are commonly presented in a narrative style. The flexibility that is the hallmark of qualitative research is also present when the researcher designs the manner for presentation of findings. Sharon Merriam noted that no standard format is required for reporting qualitative research, but that a diversity of styles is allowable with room for creativity. Narratives may be accompanied by commonly accepted methods such as charts and graphs, or may be illustrated by photographs or drawings.

Ernest W. Brewer and Nancy Headlee

See also Experimental Design; Ex Post Facto Study; Nonexperimental Design; Planning Research; Prospective Study; Qualitative Research; Quantitative Research

Further Readings

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PROSPECTIVE STUDY

The term *prospective study* refers to a study design in which the documentation of the presence or absence of an exposure of interest is documented at a time period preceding the onset of the condition being studied. In epidemiology, such designs are often called *cohort studies*. Characteristic features of these designs include initial selection of study subjects at risk for a condition of interest,

but free of disease at the outset. The occurrence/nonoccurrence of the condition is then assessed over a time period following recruitment. The time sequencing of the documentation of the exposure and outcome is an important feature and is related to a commonly cited form of evidence toward drawing causal inference about the relationship between the exposure and the outcome. The terms *prospective study* and *cohort study* also are usually used for observational or nonexperimental designs in which the investigator has not assigned study participants to the levels of exposure or intervention, distinguishing this design from prospectively conducted experiments or trials. In this entry, the distinction between prospective studies and retrospective studies is provided, followed by a discussion of the advantages and analysis of prospective studies and examples of influential studies.

Prospective Versus Retrospective Studies

Prospective studies may be contrasted against retrospective studies, a term that is sometimes applied to case-control studies, in which subjects are selected based on the presence or absence of disease, and exposure history is then documented retrospectively. Prospective studies, however, may use data collected entirely or partially in the past (such as through analysis of existing records for exposure or both the exposure and outcome); in this case, the distinguishing feature remains that the exposure of interest existed, and was documented, prior to the onset of the condition. Across disciplines, there is some overlap in the use of the terms *prospective study*, *cohort study*, and *panel study*. All of these terms imply a prospective design (appropriate time sequence in the assessment of exposure and outcome).

In early publications, many authors used the term *prospective study* synonymously with the term *cohort study*. In essence, *retrospective* and *prospective* can be terms that are used in conjunction with study designs such as case-control and cohort. It is possible to have both prospective and retrospective case-control studies. A case-control study would be considered prospective if the exposure measurements were taken before the outcome is ascertained (often called a nested case-control study). Likewise, it is possible to have both a prospective and retrospective cohort study. A cohort