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M.Lib-02

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UNIT—I

INTRODUCTION TO RESEARCH METHODOLOGY

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STRUCTURE

Learning Objectives

After going through the unit students will be able to :

- understand fundamental concepts and aims of research;
- to identify and formulate research problems;
- to involve various methods of research;

INTRODUCTION

In the broadest sense of the word, the definition of research includes any gathering of data, information and facts for the advancement of knowledge. Reading a factual book of any sort is a kind of research. Surfing the internet or watching the news is also a type of research. Science does not use this word in the same way, preferring to restrict it to certain narrowly defined areas. The word 'review' is more often used to describe the learning process which is one of the underlying tenets of the rigid structures defining research.

The Scientific Definition

The strict definition of research is performing a methodical study in order to prove a hypothesis or answer a specific question. Finding a definitive answer is the central goal of any experimental process.

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Research must be systematic and follow a series of steps and a rigid standard protocol. These rules are broadly similar but may vary slightly between the different fields of science.

Research must be organized and undergo planning, including performing literature reviews of past research and evaluating what questions need to be answered.

Any type of 'real' research, whether scientific, economic or historical, requires some kind of interpretation and an opinion from the researcher. This opinion is the underlying principle, or question, that establishes the nature and type of experiment.

The scientific definition of research generally states that a variable must be manipulated, although case studies and purely observational science do not always comply with this norm.

CONCEPT OF RESEARCH

Research is an often-misused term, its usage in everyday language very different from the strict scientific meaning. In the field of science, it is important to move away from the looser meaning and use it only in its proper context. Scientific research adheres to a set of strict protocols and long established structures.

Often, we will talk about conducting internet research or say that we are researching in the library. In everyday language, it is perfectly correct grammatically, but in science, it gives a misleading impression. The correct and most common term used in science is that we are conducting a literature review.

What is Research? — The Guidelines

For a successful career in science, you must understand the methodology behind any research and be aware of the correct protocols. Science has developed these guidelines over many years as the benchmark for measuring the validity of the results obtained.

Failure to follow the guidelines will prevent your findings from being accepted and taken seriously. These protocols can vary slightly between scientific disciplines, but all follow the same basic structure.

Research is defined as human activity based on intellectual application in the investigation of matter. The primary purpose for applied research is discovering, interpreting, and the development of methods and systems for the advancement of human knowledge on a wide variety of scientific matters of our world and the universe. Research can use the scientific method, but need not do so.

Scientific research relies on the application of the scientific method, a harnessing of curiosity. This research provides scientific information and theories for the explanation of the nature and the properties of the world around us. It makes practical applications possible. Scientific research is funded by public authorities, by charitable organisations and by private groups, including many

companies. Scientific research can be subdivided into different classifications according to their academic and application disciplines.

Historical research is embodied in the historical method.

The term research is also used to describe an entire collection of information about a particular subject.

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Basic Research

Basic research (also called fundamental or pure research) has as its primary objective the advancement of knowledge and the theoretical understanding of the relations among variables. It is exploratory and often driven by the researcher's curiosity, interest, and intuition. Therefore, it is sometimes conducted without any practical end in mind, although it may have confounding variables (unexpected results) pointing to practical applications. The terms "basic" or "fundamental" indicate that, through theory generation, basic research provides the foundation for further, sometimes applied research. As there is no guarantee of short-term practical gain, researchers may find it difficult to obtain funding for basic research.

Examples of questions asked in basic research:

- Does string theory provide physics with a grand unification theory?
- Which aspects of genomes explain organismal complexity?
- Is it possible to prove or disprove Goldbach's conjecture? (i.e., that every even integer greater than 2 can be written as the sum of two, not necessarily distinct primes)

Traditionally, basic research was considered as an activity that preceded applied research, which in turn preceded development into practical applications. Recently, these distinctions have become much less clear-cut, and it is sometimes the case that all stages will intermix. This is particularly the case in fields such as biotechnology and electronics, where fundamental discoveries may be made alongside work intended to develop new products, and in areas where public and private sector partners collaborate in order to develop greater insight into key areas of interest. For this reason, some now prefer the term frontier research.

Research Processes

Scientific Research

Generally, research is understood to follow a certain structural process. Though step order may vary depending on the subject matter and researcher, the following steps are usually part of most formal research, both basic and applied:

- Formation of the topic
- Hypothesis
- Conceptual definitions
- Operational definitions
- Gathering of data
- Analysis of data

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- Test, revising of hypothesis
- Conclusion, iteration if necessary

A common misunderstanding is that by this method a hypothesis can be proven or tested. Generally a hypothesis is used to make predictions that can be tested by observing the outcome of an experiment. If the outcome is inconsistent with the hypothesis, then the hypothesis is rejected. However, if the outcome is consistent with the hypothesis, the experiment is said to support the hypothesis. This careful language is used because researchers recognize that alternative hypotheses may also be consistent with the observations. In this sense, a hypothesis can never be proven, but rather only supported by surviving rounds of scientific testing and, eventually, becoming widely thought of as true (or better, predictive), but this is not the same as it having been proven. A useful hypothesis allows prediction and within the accuracy of observation of the time, the prediction will be verified. As the accuracy of observation improves with time, the hypothesis may no longer provide an accurate prediction. In this case a new hypothesis will arise to challenge the old, and to the extent that the new hypothesis makes more accurate predictions than the old, the new will supplant it.

Historical

The historical method comprises the techniques and guidelines by which historians use historical sources and other evidence to research and then to write history. There are various history guidelines commonly used by historians in their work, under the headings of external criticism, internal criticism, and synthesis. This includes higher criticism and textual criticism. Though items may vary depending on the subject matter and researcher, the following concepts are usually part of most formal historical research:

- Identification of origin date
- Evidence of localization
- Recognition of authorship
- Analysis of data
- Identification of integrity
- Attribution of credibility

Research Methods

The goal of the research process is to produce new knowledge, which takes three main forms (although, as previously discussed, the boundaries between them may be fuzzy):

- Exploratory research, which structures and identifies new problems
- Constructive research, which develops solutions to a problem
- Empirical research, which tests the feasibility of a solution using empirical evidence

Research can also fall into two distinct types:—

- Primary research
- Secondary research

Research is often conducted using the hourglass model Structure of Research. The hourglass model starts with a broad spectrum for research, focusing in on the required information through the methodology of the project (like the neck of the hourglass), then expands the research in the form of discussion and results.

THE AIMS OF RESEARCH

- Observe and Describe
- Predict
- Determination of the Causes
- Explain

The ultimate aims of research are to generate measurable and testable data, gradually adding to the accumulation of human knowledge. Ancient philosophers believed that all answers could be achieved through deduction and reasoning, rather than measurement. Science now uses established research methods and standard protocols to test theories thoroughly.

It is important to remember that science and philosophy are intertwined and essential elements of human advancement, both contributing to the way we view the world. Scientific research, however, allows us to test hypotheses and lay solid foundations for future research and study.

No theory or hypothesis can ever be completely proved or disproved, but research enables us to make valid assumptions about the universe. This gradual accumulation of knowledge dictates the overall direction of science and philosophy.

Observation and Description

The first stage of any research is to observe the world around us and to ask questions about why things are happening. Every phenomenon in the universe has a reason behind it, and the aims of research are to understand and evaluate what is happening.

However simple the phenomenon or however easy it appears to be to generate logical and intuitive answers, scientific research demands rigorous testing for a truth to be accepted. Describing the overall behavior of the subject is the first stage of any research, whether it is a case study or a full-blown 'true experimental design'.

Predict

This stage is where you must make a statement of intent and develop a strong hypothesis. This must be testable, with aims of research being to prove or disprove this statement. At this stage, you may express your personal opinion, favoring one side or the other. You must make a statement predicting what you expect the final answer to be.

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You must, however, keep an open mind and understand that there is a chance that you may be wrong. Research is never about right or wrong, but about arriving at an answer, which improves our knowledge of natural processes.

Determination of the Causes

This is often the 'business end' for many areas of scientific research and is where one of the predictions is tested, usually by manipulating and controlling variables. The idea is to generate numerical data that can determine the cause with one of the many statistical tests.

For example, a small-scale global warming study might study Antarctic ice cores to determine the historical levels of carbon dioxide throughout history. In this experiment, time would be the manipulated variable, showing how levels of the greenhouse gas have changed over time.

Statistical procedures are then utilized to either prove or disprove the hypothesis and prediction. Of course, very little research gives such a black and white answer, but opens up new areas of potential study, focusing on a specific direction.

Explain

After determining the causes, the next layer of the research process is to try to find possible explanations of 'Why?' and 'How?' things are happening. For most areas, this stage involves sifting through and reviewing earlier studies about similar phenomena. Most research is built upon the work of previous researchers, so there should be a wealth of literature resources available.

If we look at a topical example, Global Warming is an area with which most of us are familiar, and has been the subject of thousands of studies. Intuitively, most of us would state that humanity pumping carbon dioxide into the atmosphere is responsible for a worldwide rise in temperatures.

The aims of research may be to establish 'What are the underlying causes and relationships between the different processes fueling this trend?' In most cases, it is necessary to review earlier research and try to separate the better quality sources from the inaccurate or poorly designed studies.

It is equally important to take into account any opposing points of view and accept that they may be equally valid. Explanation is about coming up with viable reasons, and you must try to be as objective and unbiased as possible.

For example, for global warming, there is an opposing view that temperature rises are natural, and that the effect of human society is making little difference. At this stage, personal opinion must be put aside and both sides of the debate must be given equal credence.

New Directions

Whatever the final answer, it can be used to promote a healthy debate and discussion about the validity of the results. The aims of research can then be fine-tuned, or may serve to open up new areas of interest. Either way, the store of human knowledge has been enriched and increased.

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THE PURPOSE OF RESEARCH

The purpose of research can be a complicated issue and varies across different scientific fields and disciplines. At the most basic level, research can be split, loosely, into two types, 'pure research' and 'applied research'.

Both of these types follow the same structures and protocols for propagating and testing hypotheses and predictions, but vary slightly in their ultimate purpose. An excellent example for illustrating the difference is by using pure and applied mathematics.

Pure maths is concerned with understanding underlying abstract principles and describing them with elegant theories. Applied maths, by contrast, uses these equations to explain real life phenomena, such as mechanics, ecology and gravity.

Pure Scientific Research

Some science, often referred to as 'pure science', is about explaining the world around us and trying to understand how the universe operates. It is about finding out what is already there without any greater purpose of research than the explanation itself. It is a direct descendent of philosophy, where philosophers and scientists try to understand the underlying principles of existence.

Whilst offering no direct benefits, pure research often has indirect benefits, which can contribute greatly to the advancement of humanity. For example, pure research into the structure of the atom has led to x-rays, nuclear power and silicon chips.

Applied Scientific Research

Applied scientists might look for answers to specific questions that help humanity, for example medical research or environmental studies. Such research generally takes a specific question and tries to find a definitive and comprehensive answer.

The purpose of research is about testing theories, often generated by pure science, and applying them to real situations, addressing more than just abstract principles. Applied scientific research can be about finding out the answer to a specific problem, such as 'Is global warming avoidable?' or 'Does a new type of medicine really help the patients?'

Generating Testable Data

However, they all involve generating a theory to explain why something is happening and using the full battery of scientific tools and methods to test it rigorously. This process opens up new areas for further study and a continued refinement of the hypotheses.

Observation is not accurate enough, with statistically testable and analyzable data the only results accepted across all scientific disciplines. The exact nature of the experimental process may vary, but they all adhere to the same basic principles.

Scientists can be opinionated, like anybody else, and often will adhere to their own theories, even if the evidence shows otherwise. Research is a tool by

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which they can test their own, and each others' theories, by using this antagonism to find an answer and advance knowledge.

The purpose of research is really an ongoing process of correcting and refining hypotheses, which should lead to the acceptance of certain scientific truths. Whilst no scientific proof can be accepted as ultimate fact, rigorous testing ensures that proofs can become presumptions. Certain basic presumptions are made before embarking on any research project, and build upon this gradual accumulation of knowledge.

IDENTIFICATION OF RESEARCH PROBLEMS

Research forms a cycle. It starts with a problem and ends with a solution to the problem. The problem statement is therefore the axis which the whole research revolves around, beacause it explains in short the aim of the research.

What is a Research Problem?

A research problem is the situation that causes the researcher to feel apprehensive, confused and ill at ease. It is the demarcation of a problem area within a certain context involving the WHO or WHAT, the WHERE, the WHEN and the WHY of the problem situation.

There are many problem situations that may give rise to research. Three sources usually contribute to problem identification. Own experience or the experience of others may be a source of problem supply. A second source could be scientific literature. You may read about certain findings and notice that a certain field was not covered. This could lead to a research problem. Theories could be a third source. Shortcomings in theories could be researched.

Research can thus be aimed at clarifying or substantiating an existing theory, at clarifying contradictory findings, at correcting a faulty methodology, at correcting the inadequate or unsuitable use of statistical techniques, at reconciling conflicting opinions, or at solving existing practical problems.

Identification of the Problem

The prospective researcher should think on what caused the need to do the research (problem identification). The question that he/she should ask is: Are there questions about this problem to which answers have not been found up to the present?

Research originates from a need that arises. A clear distinction between the Problem and the Purpose should be made. The problem is the aspect the researcher worries about, think about, wants to find a solution for. The purpose is to solve the problem, i.e. find answers to the question(s). If there is no clear problem formulation, the purpose and methods are meaningless.

Keep the following in mind:

- Outline the general context of the problem area.
- Highlight key theories, concepts and ideas current in this area.
- What appear to be some of the underlying assumptions of this area?

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- Why are these issues identified important?
- What needs to be solved?
- Read round the area (subject) to get to know the background and to identify unanswered questions or controversies, and/or to identify the the most significant issues for further exploration.

The research problem should be stated in such a way that it would lead to analytical thinking on the part of the researcher with the aim of possible concluding solutions to the stated problem. Research problems can be stated in the form of either questions or statements.

- The research problem should always be formulated grammatically correct and as completely as possible. You should bear in mind the wording (expressions) you use. Avoid meaningless words. There should be no doubt in the mind of the reader what your intentions are.
- Demarcating the research field into manageable parts by dividing the main problem into subproblems is of the utmost importance.

Subproblem(s)

Subproblems are problems related to the main problem identified. Subproblems flow from the main problem and make up the main problem. It is the means to reach the set goal in a manageable way and contribute to solving the problem.

Statement of the Problem

The statement of the problem involves the demarcation and formulation of the problem, i.e., the WHO/WHAT, WHERE, WHEN, WHY. It usually includes the statement of the hypothesis.

FORMULATION OF RESEARCH PROBLEMS

It was previously mentioned that research forms a circle. It starts with a problem and ends with a solution to the problem. Problem statement is therefore the axis which the whole research revolves around, because it explains in short the aim of the research. Prospective researchers can search within their own subject field for suitable problems. What should, however, be mentioned, is that not all identified problems within a scientific field of study is suitable for research.

The prospective researcher should think on what caused the need to do the research (problem identification). The question that he/she should ask him/herself is: Are there questions about this problem to which answers have not been found up to the present? The research problem should be stated in such a way that it would lead to analytical thinking on the part of the researcher with the aim of possibly concluding solutions to the stated problem.

The following aspects are important when formulating a research problem:

- The research problem should always be formulated grammatically correct and as completely as possible. You should bear in mind the wording

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(expressions) you use. Avoid meaningless words. There should be no doubt in the mind of the reader what your intentions are.

- Demarcating the research field into manageable parts by dividing the main problem into subproblems is of the utmost importance.

The following serves as an example:

- Main problem (Aim of the research project should be clearly stated)
- Subproblems (Means to reach the set goal in a manageable way contribute to solving the problem)

The main and subproblems should, however, form a research unit. After you have stated the research problem, you should continue to formulate the relevant hypotheses.

Research problems are questions that indicate gaps in the scope or the certainty of our knowledge. They point either to problematic phenomena, observed events that are puzzling in terms of our currently accepted ideas, or to problematic theories, current ideas that are challenged by new hypotheses. This chapter first looks at the role of such questions in the research process, and especially the ongoing debate among social scientists as to when and how problems should be formulated.

Second, we consider methodology's effect on defining problems, and how the multimethod approach can be used to focus research more sharply upon the substance of research problems. Finally, we consider the role of theory in problem formulation, and how the multimethod approach integrates theory and research more closely in posing these research questions.

The Role of Research Problems in the Research Process

The problems of everyday life are difficulties to be avoided, if possible. Research problems are eagerly sought after. The difference is that research problems represent opportunities as well as trouble spots. Because scientific knowledge is provisional, all empirical findings and theories are in principle problematic and are, therefore, subject to further investigation.

But in addition to seeking more exact confirmations of existing claims to knowledge, research has the equally important goal of generating new claims. Problem formulation is the logical first step toward this goal. As Northrop (1966) writes, "Inquiry starts only when something is unsatisfactory, when traditional beliefs are inadequate or in question, when the facts necessary to resolve one's uncertainties are not known, when the likely relevant hypotheses are not even imagined. What one has at the beginning of inquiry is merely the problem".

The formulation of research problems also has an important social function. As Merton, Broom, and Cottrell (1959) suggest, researchers must justify the demands for attention and other scarce resources that research makes: "In conferring upon the scientist the right to claim that a question deserves the concerted attention of others as well as himself, the social institution of science exacts the obligation that he justify the claim".

Achieving significant research results is perhaps the most powerful justification for such claims, but this type of justification can be offered only after the fact, and only in the event that the research is successful. A compelling research problem, by contrast, must marshal support in advance of research and, if it is sufficiently compelling, can even sustain that support through the sometimes fruitless periods that researchers experience.

However, despite research problems' logical priority in inquiry, and their importance as a priori justifications, a problem's formulation, as John Dewey stresses, is in fact a "progressive" matter. Dewey means that problem formulations are themselves problematic and so require continual attention to assure that the questions being asked will direct research toward the desired end: "If we assume, prematurely, that the problem involved is definite and clear, subsequent inquiry proceeds on the wrong track. Hence the question arises; How is the formation of a genuine problem so controlled that further inquiries will move toward a solution?"

When and How to Formulate Problems: A Debate

It sometimes seems that there is little about which social scientists agree, and the most effective procedure for formulating research problems is no exception. In particular, there has been considerable debate over whether or not it is important to define problems explicitly in advance of research and to show how they are linked to prior work. Many social scientists hold that research problems should be formulated by carefully analyzing as much of the relevant research literature as possible, formally stating the problem and the major hypotheses that the literature suggests, and only then collecting the data. Their intention is to give research a clear and firm justification and to encourage hypothesis testing.

This will ensure that each new study does its utmost to add in an orderly fashion to the sum of knowledge. However, there are many other social scientists who are equally convinced that this style of formulating problems tends to stifle questions and prevent discoveries that a more openended approach might stimulate.

This latter group argues instead for letting problems and hypotheses emerge throughout the research process, pushed forth by new empirical observations that encourage the researcher to ask new questions and build new theories. For example, Schatzman and Strauss (1973) write— "The automatic use of formally stated hypotheses, and of statements of 'the problem' may make it easier to program action, but it will also limit the kinds of experience that he (the researcher) will tolerate and deal with. In original research there is less likely to be a conceptual closure to inquiry, for as the work of discovery continues and new kinds of data are conceptualized, new problems and hypotheses will emerge. Consequently far from putting a closure on his new experience the researcher will modify his problem and hypotheses—if indeed he ever stated them explicitly—arrange to handle new ones simultaneously with the old, or do so in serial order. This is how the relationship between the observer and the observed

object is altered, and how it becomes possible for new questions to be asked and answered through research.

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Stating the problem early and in a highly structured form may indeed lock the researcher into a fixed stance with respect to the situation being observed, and it may also block the emergence of new ideas that might be stimulated by new experience. But open-endedness may have costs as well. For instance, Huber (1973) argues that letting the emergent features of each new research situation continually exert pressure to redefine problems and hypotheses tends to bias the emerging theory in the direction of the status quo.

It gives undue weight to the particular situation being studied at the moment, diverts attention from the problems posed by other theories, and interferes with theory-testing because the same data obviously cannot be used both to form and to test an hypothesis. In this view, prestated problems and hypotheses do much more than make it "easier to program action" (as Schatzman and Strauss [1973] suggest).

They discipline research in the interest of testing theory, accumulating knowledge, and achieving a theoretical standpoint independent of the time and place in which researchers presently find themselves.

Overcoming Methodological

Constraints on Problem Formulation

Both sides in the foregoing debate clearly have merit. However, in practice the decision as to when and how research problems should be defined usually depends less upon the perceived merits of one or the other of these procedures than upon the research style selected. Methods differ in their abilities to predict the kinds, quantities, and quality of the data that may be available in any given instance. For example, survey researchers or experimentalists can usually say with more certainty than fieldworkers whether or not the data pertinent to a particular research problem can be readily collected. Fieldwork offers the possibility of many data sources, but it is usually hard to say in advance which data will actually be obtainable. Similarly, Selltiz, Jahoda, Deutsch, and Cook (1959) note the need to take a "wait-and-see" attitude in the use of nonreactive data sources such as statistical records: "The use of such data demands a capacity to ask many different questions related to a research problem. . . . The guiding principle for the use of available statistics consists in keeping oneself flexible with respect to the form in which the research questions are asked".

An empirical search for problems is considerably less expensive with some methods than others. Exploratory experiments and surveys are certainly feasible, but pilot field studies and searches through archives generally cost less, except perhaps for the researcher whose personal expenditure of time and energy usually "fund" such studies. Moreover, discoveries arise in different ways for different methods. Fieldworkers and nonreactive researchers are more likely to make discoveries as a result of finding new data sources and examining new situations; while survey researchers and experimentalists are more likely to make discoveries

through innovations in techniques of study design, sampling, or data analysis, which can generate unexpected (serendipitous) findings by more precise tests of hypotheses.

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Different research styles thus exert different constraints on formulating problems as as open-ended constraints in response to the immediate research situation for fieldwork and non-reactive research or more programmed constraints for surveys and experiments. The multimethod strategy provides the opportunity to overcome these methodological constraints upon problem formulation and thereby gain the advantages of each approach while compensating for its disadvantages.

Sieber (1973), for example, notes Stinchcombe's (1964) reliance upon about six months of fieldwork among the teachers and administrators in a high school to formulate the hypotheses that guided Stinchcombe's analysis of survey data from the same school. Sieber (1973) concludes that "an optimal schedule for theoretical survey research would include a lengthy period of fieldwork prior to the survey" (p. 1346). He further observes that although he could find in the literature few other examples of this practice of deriving a survey's guiding theory from fieldwork, it may be quite common, since "Often, only passing acknowledgement is made of prior personal familiarity with the situation, a familiarity that has produced rather definite ideas for research (p. 1345). Sieber (1973) cites, for instance, Lipset's (1964) autobiographical account of how the childhood experience of his father's membership in the International Typographical Union, along with the classic works of Robert Michels and Alexis de Tocqueville, influenced the research problem that Lipset and his colleagues formulated and tested in the classic survey study, Union Democracy (1956). If, as Dewey suggested, the correct formulation of research problems is crucial to their solution, then it is critical that no source of potentially valid information—no matter how "unscientific" it may seem—be ignored.

Furthermore, Sieber (1973) demonstrates how despite "an historical antagonism between proponents of qualitative fieldwork and survey research," integration between these two research styles has been achieved in numerous studies (p. 1335). He shows how fieldwork has been employed to define the theoretical structure of problems later studied in surveys, to define and gain greater knowledge of the problem relevant populations for surveys, and to reformulate problems by aiding in the interpretation of surprising survey findings and statistical relationships between variables. He likewise shows how surveys have been used to define and pinpoint relevant cases for fieldwork, to verify and establish the generality of field observations, and to cast new light on "hitherto inexplicable or misinterpreted" observations.

Generating Versus Verifying Theories

The issue of when and how to formulate research problems is closely related to another issue: the relative importance of generating new theories versus the verification of existing theories. Both building and testing theories empirically,

are important research activities, but they serve very different functions in scientific inquiry.

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Since at least the 1960s, the appropriate balance between these two aspects of research has provoked considerable controversy in the social sciences. For example, Glaser and Strauss, writing about sociology in 1967, observe: "Verification is the keynote of current sociology. Some three decades ago, it was felt that we had plenty of theories but few confirmations of them—a position made very feasible by the greatly increased sophistication of quantitative methods. As this shift in emphasis took hold, the discovery of new theories became slighted and, at some universities, virtually neglected".

Glaser and Strauss (1967) argue that the emphasis on verification of existing theories kept researchers from investigating new problem areas; prevented them from acknowledging the necessarily exploratory nature of much of their work, encouraged instead the inappropriate use of verificational logic and rhetoric; and discouraged the development and use of systematic empirical procedures for generating as well as testing theories. To compensate for the overemphasis upon verification, Glaser and Strauss urged that research designed to build empirically "grounded" theories must be recognized as a legitimate social scientific pursuit independent of verification. They saw no necessary logical conflict between empirically building and testing theories. But they felt that the social and the psychological conflicts "reflecting the opposition between a desire to generate theory and a trained need to verify it" were so strong that clear designation of theory building as a proper research goal was essential: "when generating 'theory' is not clearly recognized as the main goal of a given research, it can be quickly killed by the twin critiques of accurate evidence and verified hypotheses".

If we accept that generating theories empirically is not a substitute for empirical verification, then building theories without immediate regard for testing poses no special logical problems. However, it may complicate matters methodologically. One serious complication is that theories are often built empirically using research methods that are different from the methods required to verify them.

Each style of social research can be employed either to generate or to verify theories. But in fact, purely generational studies tend to rely more upon fieldwork or nonreactive data sources than upon experiments or surveys, and often more upon qualitative than upon quantitative observation and analysis. The transition from generational to verificational research may therefore involve a methodological shift as well as a change in the focus of problem formulation. Studying a theory with different research methods provides an opportunity for fuller examination of that theory. However, employing a new or different method also creates difficulties. It may be far from obvious how, for instance, concepts and propositions developed through qualitative field studies may be measured and operationalized in terms suitable for quantitative surveys or experiments—or vice versa, how to design a field study to test a theory deriving from surveys or experiments. There may also be questions about the appropriateness of the new

method to the theory's content, or about whether or not operational hypotheses that can be tested with that method do in fact adequately represent the theory and so provide a fair and full test.

Bernstein, Kelly, and Doyle (1977) encountered these kinds of difficulties in formulating and testing hypotheses derived from symbolic interactionist theories of deviance. These were theories that had been generated largely in qualitative field studies. Bernstein et al.'s strategy was to combine qualitative field observation with quantitative analysis of interviews and court records collected for a larger sample of criminal defenders. This multimethod approach, which is an example of the transition study described allowed them to use the fieldwork data to aid in both the design and the interpretation of the survey and archival segment of their study. The approach also permitted them to be open and sensitive to the kinds of firsthand field observations that had prompted the initial theories. They thereby retained descriptive realism without sacrificing either the quantitative precision required for verification or the generalizability provided by their larger sample.

The Empirical Unfolding of Research Problems

Once a study is published, it is in many ways irrelevant whether the research problem prompted the study or instead emerged from it. With publication, the study's problem enters the public domain and becomes the responsibility not only of the study's author but of all who are professionally interested in that research area. At that point, the key issue is what to do with the problem next. Research into a problem does not end with a single study. Nor is there truly a final formulation of a problem any more than there is a final solution. All research involves some simplification of the problem being investigated. This is unavoidable given the limitations on our resources, theories, and methods.

However, each of a discipline's separate new studies, or each phase of study in an individual's research program, reveals new aspects of the problem by addressing issues that earlier research could not address. The two modes of formulating research problems that we have just discussed differ in that one looks to past studies, while the other looks to ongoing work. But the two are similar in that both rely upon empirical inquiry rather than upon nonempirical procedures, such as speculation or the purely logical analysis of ideas. This means that whether research problems emerge from current research or instead derive from earlier work, research methods are directly implicated in the process. Every empirically based research problem has a methodological as well as a substantive component, and this methodological component may equally influence our perceptions as to which particular phenomena and theories are problematic. One of the central questions to be posed, therefore, is how do the methods employed in research directly affect the formulation of research problems?

The Substantive Importance of Methodology

Deutscher (1966), for example, posed this question of methodological influence by revealing one of the major simplifications of social policy research

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conducted through the early 1960s. He noted the very heavy reliance upon survey research at that time, and suggested that this reliance upon surveys led social scientists to oversimplify research problems by assuming that verbal responses reflect behavioral tendencies.

Deutscher observed that only by making this assumption were researchers, who were studying issues such as racial and ethnic discrimination, able to make causal inferences about behavior solely on the basis of questionnaire and interview data. However, he stressed that this assumption neglected a central problem that had begun to emerge from exploratory field studies as early as the 1930s: People's words and deeds frequently do not agree. To correct this oversimplification, Deutscher urged both that this neglected problem of "attitude versus action" must be formulated more systematically and that a new research technology, a multimethod approach, must be developed to capture both attitudinal and behavioral aspects of policy problems.

The problem of attitude versus action is now a major topic of multimethod research. But when Deutscher addressed this problem in 1966, the topic was relatively unexplored. New areas of inquiry, where little is presumably yet known, promise productive research problems. However, the actual formulation of the problems may be more difficult than in more developed areas in which consistent bodies of empirical generalizations and theories have already been established. This became evident when Deutscher (1966) set about formulating the problem of attitude versus action:

> "We still do not know much about the relationship between what people say and what they do—attitudes and behavior, sentiments and acts, verbalizations and interactions, words and deeds. We know so little that we can't even find an adequate vocabulary to make the distinction! Under what conditions do they say one thing and behave exactly the opposite? In spite of the fact that all of these combinations have been observed and reported few efforts have been made to order these observations."

As research into a problem proceeds with researchers posing it in different ways, the problem ideally (as Dewey implied) unfolds to reveal new dimensions that facilitate the problem's solution. The variety of available research methods is a key element in this process in that it provides researchers with a multifaceted empirical view of the phenomena and of the theories in question. This enables researchers to formulate problems in a manner that does greater justice both to the complexity of social phenomena and to the complex implications of our theories.

However, employing a variety of methods also complicates the process of problem formulation because different types of research methods very often provide conflicting answers to the same research questions. For example, Deutscher (1966) found the problem of attitude versus action to be complicated by the fact that experimental studies generally reported greater consistency between subjects' words and deeds than did observational field studies. When such methodologically linked contradictions appear in the course of a problem's development, the suspicion is that they may derive from theoretically irrelevant

characteristics of the different methods employed rather than from the substantive complexity of the problem.

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Inconsistent findings require reformulations of research problems. When these inconsistencies reflect unanticipated substantive complexity, then concepts and propositions must be recast to take account of that complexity. But although more complicated theories are sometimes necessary to achieve theoretical realism, simplicity is preferable. And if, in fact, contradictory research findings are attributable to methodological influences and can be shown to be consistent with existing theories, once those influences have been taken into account, so much the better.

The substance of social life is certainly diverse enough to generate inconsistent findings, but the methods of social research are also diverse. Only by analyzing the methods employed to obtain research findings can it be determined which source of inconsistency any given set of findings reflects. For example, Hovland (1959) observed that textbooks summarizing the effects of communication on opinion-change in the 1950s often reported substantive contradictions in research findings without regard to differences in methodology, despite the fact that stronger effects were generally found in experiments than in surveys. However, Hovland found that upon closer inspection these apparent contradictions might be explained in terms of the idiosyncrasies of these two different types of methods and might not require new theoretical explanations. In sum, although the exclusive use of a single type of research method can oversimplify research problems, the use of different types of research methods, without systematic comparisons of their results and an understanding of possible methodological influences, can make problems appear to be more complex—or complex in different ways—than they really are.

FORMULATION OF HYPOTHESIS

After you have identified a problem, you may formulate certain answers in the form of hypothesis. These guesses are based on the past experiences or informal observation or information gained from others. A hypothesis is defined as "A tentative proposition suggested as a solution to a problem or as an explanation of some phenomenon."

There are some important aspects to be looked into to judge the worth of a hypothesis in research. A good hypothesis must be:

- consistent with known facts and theories, and might be even expected to predict or anticipate previously unknown data,
- able to explain the data in simpler terms,
- stated in the simplest possible terms, depending upon the complexity of the concepts involved in the research problems, and
- stated in a way that it can be tested for its being probably true or probably false, in order to arrive at conclusions in the form of empirical or operational statements.

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Hypotheses are formulated to explain observed facts, conditions, or behaviour and to serve as a guide in the research process. The statements or tentative generalisations which constitute hypotheses are partly based on facts and explanations, and partly conceptual. Hence there are certain necessary conditions that are conducive to the formulation of hypothesis. These are:

(i) **Deducing a hypothesis inductively:** you may deduce a hypothesis inductively after making observation of behaviour, noticing trends or probable relationships. For example, as a teacher you observe your learners behaviour in classroom. On the basis of your experience in the educational institution, you may attempt to relate your behaviour with that of the learners, to various teaching-learning methods as well as to the change in the institution itself and so on. On the basis of these observations, you may be able to formulate a hypothesis that attempts to explain these behavioural relationship in an educational setting.

(ii) **Limiting the problem:** Here we need to state that the basic understanding of the literature pertaining to the problem under investigation also becomes essential in the view of the fact that the already existing corpus of knowmedge on the particular problem is too detailed to be incorporated in the process of hypothesis formulation. Hence, the researcher must have the ability to comprehend the available evidence in support or against the expected relationship so as to remain within the limits of the problem while formulating the hypothesis.

(iii) **Deriving a hypothesis deductively:** Hypotheses are also derived deductively from the theory. Such types of hypothesis, called "deductive hypothesis" are formulated by studying a particular theory in the area of one's interest and deducting a hypothesis from this theory through logic. This is possible when a researcher has a versatile intellect and can make use of it for restructuring his/her experiences in research. Creative approach to problem solving so badly needed by a researcher, is the product of intellectual adventure, sound attitude and agile intellect. This view is more relevant to the descriptive and historical research in which the abundance of literature with a number of contradictory/supplementary theories may divert the researcher from the right path. Therefore, you have to exercise great restraint and display considerable patience to keep yourself on the right path. You have to develop certain habits and attitudes, besides saturating yourself with all the possible information about the problem and also think open-mindely about it before proceeding further in the conduct of the study.

(iv) **Hypothesis from analogies, conversations, etc.:** Analogies also lead a researcher to clues that may prove to be useful in the formulation of hypothesis and for finding solution to the problems.

Sometimes, especially the inter-disciplinary research conversations and consultations with experts also found to be useful in the formulation of hypothesis. Am 3

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SURVEY OF LITERATURE

A thorough literature study is an indispensable component of all research. It familiarises the researcher with both research which has already been done in his field as well as with current research. A literature study makes the researcher aware of what the current train of thought is, as well as the focus of existing and acceptable thought regarding a specific topic. It also helps him demarcate the boundaries of his research theme. When doing this, he finds ideas for his own research theme and for possibly processing his data.

The researcher also gains personally by his literature review. It fosters a certain attitude and leads to the attainment of certain skills:

- It develops the ability to recognize and select the significant and the relevant, without getting lost in trivialities.
- It helps in gauging the quality of research material and in planning his research accordingly.
- It develops a critical attitude regarding others' research as well as his own efforts.
- It trains him to be an astute observer especially in respect of certain obstacles, making it possible for him to avoid them.
- Knowledge of relevant literature helps the researcher to define the boundaries of his field.

The Role of a Literature Study in Research

The literature study helps the researcher to:

- Select a research problem or theme. Relevant literature enables the researcher to discover where inconsistencies, wrong designs and incorrect statistical conclusions occur.

Often research reports are concluded with recommendations regarding research which still needs to done. The researcher's thinking can be shaped in this way, which in turn will enable him to:

- define the boundaries of his field;
- establish the size and extent of his research;
- consider the procedures and the instruments which he will use in his research. After having considered other researchers' procedures and instruments, the researcher becomes more sophisticated in the choice of his own;
- see his own problem in better perspective through a better understanding of the underlying theory. This enables him to establish whether his research will make a contribution and what the value of his contribution would be;
- avoid unnecessary (non-purposeful) repetition of research already undertaken. A researcher often develops a brilliant insight into how to tackle a problem, only to discover, through a study of relevant literature, that someone else has already done so;

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- better evaluate the significance of his own findings. This applies especially in respect of which techniques were used, and which contributions were made to gaining a better understanding of the problem, etc;
- formulate his hypotheses with sharper insight;
- carry out his research more purposefully. In time he learns to eliminate the unnecessary. He learns from the successes and failures of others.

Types of Literature

In studying works dealing with earlier (and acceptable) research, two types of sources, especially, come to the fore:

- Comprehension literature, ie books and articles by experts in which they state their opinions, experiences, theories and ideas on concepts and constructs within a specific problem area, as well as their opinions on what is good or bad, desirable or undesirable, valuable or worthless regarding insight into specific concepts or constructs. For the young researcher it is very useful because it helps him to understand the validity of correctness of theories (outdated, existing or newly formed) better. It also shows him where there are shortcomings in a specific field (thus requiring research). It also shows its strengths which he may wish to pursue.
- **Research literature:** This includes reporting in respect of research already undertaken in the field (and is currently drawing attention) and gives the researcher a good indication of successes and problems in respect of research procedures, design, hypotheses, techniques and instruments.
- The results of studying these two types of literature are thus a personal frame of reference, i.e. an insight into the body of basic knowledge, possible differences, underlying theories, et cetera.
- It furthermore leads to a greater awareness of those matters within the field which have already sufficiently been demonstrated and proved, as well as those matters still requiring more in-depth research.

Primary and Secondary Sources

Primary sources of a specific type of information are the original works, books, magazine articles, films, sound recordings, et cetera, which reflect the information firsthand. Secondary sources include commentaries, explanations, elucidations et cetera, which other writers have done on the primary sources.

It is desirable (especially in historical research) that, where possible, the primary source should preferably be consulted. There are, however, problems with consulting primary sources.

- The source is out of print, has been destroyed or is unobtainable. Then secondary sources have to be consulted.
- The primary source is in a foreign language, rendering it inaccessible for the researcher. Translations have to be used with the expressed knowledge that such translations are possibly inaccurate or even incorrect. Sometimes it helps to read an expert's comment on the translation.

- The primary source is so complicated and advanced that the researcher cannot understand it. It then helps to read explanations in technical dictionaries, encyclopaedias or elementary handbooks.

This, does not mean, however, that secondary sources are of no value whatsoever. The researcher could possibly encounter many useful references to primary sources in his study of secondary sources.

Survey

To conduct research regarding a topic, by implication means that the researcher has obtained sound knowledge with regard to the research topic. It is therefore imperative that the researcher, at the time of the submission of the research proposal, clearly indicates what theoretical knowledge he possesses about the prospective research. A literature search therefore will entail the literature the prospective researcher has already consulted.

An overview of the literature anticipates the background knowledge of the researcher and a possible classification of the content for the purpose of stating the research problem. This should also reveal the importance of the contemplated research. A literature search therefore simplifies the formulation of hypotheses for the researcher.

The aim of a literature study is to:

- give all-round perspectives on the latest research findings regarding the topic;
- indicate the best method, scale of measurements and statistics that can be used;
- interpret the research findings in a better way; and
- determine the relevancy of the prospective research.

It should further noted that the research design must be accompanied by a preliminary list of references consulted by the researcher during the preparation of the research proposal. The list should include the most recent publications on the research topic.

It must however be emphasized that this reference list by no means is sufficient to complete the research project; it must be augmented during further literature searches as the research process continues.

PROCESS OF RESEARCH

The research process or methodology is the approach to the entire study, it is the master plan. It is the blueprint for achieving your objectives, one of which is the production of the dissertation. Irrespective of the research you are going to conduct, there are several fundamental stages you will have to go through. The diagram below is a simplified, traditional and highly structured view of the research process.

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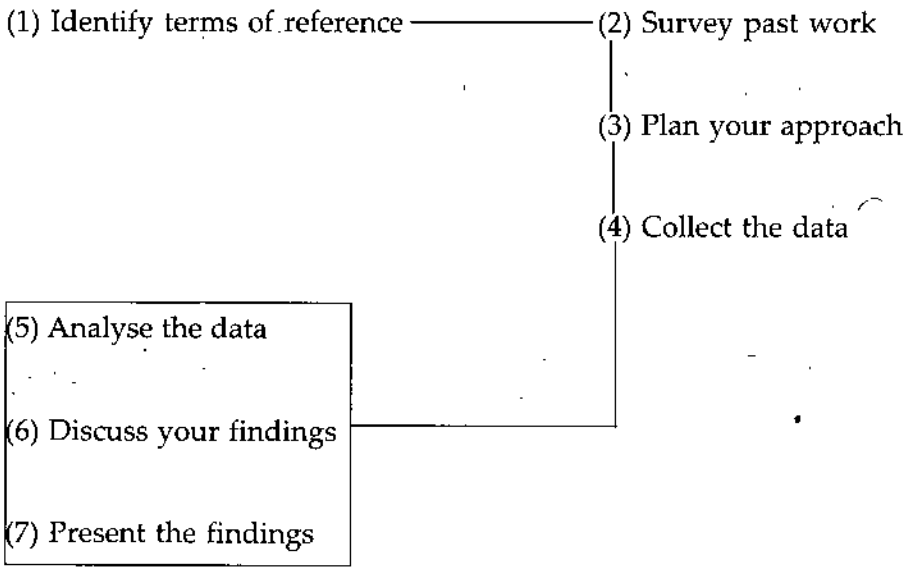

The diagram shows the systematic nature of the research process. Unfortunately it is not quite so straightforward as many of the stages overlap and there is much 'looping back' to previous stages.

This simplified diagram does not show the underpinning theoretical issues and questions that have to be addressed. The following diagram shows the different aspects to be considered under each section.

As you can see each stage in the process has many aspects and issues to be considered. We cover all of these stages in this unit.

Theory of Research

Superficially the research process can appear to be relatively simple if you carry out the basic steps methodically and carefully, then you should arrive at useful conclusions. However, the nature of research can be very complex and when you are reading textbooks on research methodology you will come across many unfamiliar words and terms. We first look at types of research and explain some of the terms.

Types of Research

The main different types of research can be classified by its purpose, its process and its outcome. These can in turn be broken down further:

- The purpose of the research can be classified as:
  - o exploratory
  - o descriptive
  - o analytical
  - o predictive.
- The process of the research can be classified as:
  - o quantitative
  - o qualitative.
- The outcome of the research can be classified as:

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- o applied
- o basic or pure
- o action.

Let us look at these in more detail.

Exploratory Research

This is conducted when there are few or no earlier studies to which references can be made for information. The aim is to look for patterns, ideas or hypotheses rather than testing or confirming a hypothesis. In exploratory research the focus is on gaining insights and familiarity with the subject area for more rigorous investigation later. In an undergraduate dissertation it is likely that you will be drawing on previous studies and so pure exploratory research is not generally appropriate for studies at this level; it is more appropriate for postgraduate research. However, it is possible that you may carry out an initial survey to establish areas of concern (exploratory research) and then research these issues in more depth, perhaps through interviews, to provide a deeper understanding (explanatory research).

Descriptive Research

This describes phenomena as they exist. It is used to identify and obtain information on the characteristics of a particular issue. It may answer such questions as:

- What is the absentee rate amongst a particular group of workers?
- What are the feelings of workers faced with redundancy?

The data collected are often quantitative, and statistical techniques are usually used to summarise the information. Descriptive research goes further than exploratory research in examining a problem since it is undertaken to ascertain and describe the characteristics of the issue.

An undergraduate dissertation may include descriptive research, but it is likely that it will also include one of the following two types (explanatory or predictive) as you are required in your dissertation to go beyond description and to explain or predict.

Analytical or Explanatory Research

This is a continuation of descriptive research. The researcher goes beyond merely describing the characteristics, to analyse and explain why or how something is happening. Thus, analytical research aims to understand phenomena by discovering and measuring causal relations among them. It may answer questions such as:

- How can the number of complaints made by customers be reduced?
- How can the absentee rate among employees be reduced?
- Why is the introduction of empowerment seen as a threat by departmental managers?

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Predictive Research

Predictive research goes further by forecasting the likelihood of a similar situation occurring elsewhere. It aims to generalise from the analysis by predicting certain phenomena on the basis of hypothesised, general relationships. It may attempt to answer questions such as:

- Will the introduction of an employee bonus scheme lead to higher levels of productivity?
- What type of packaging will improve our products?

Predictive research provides 'how', 'why', and 'where' answers to current events as well as to similar events in the future. It is also helpful in situations where 'What if?' questions are being asked.

Process of Research

There is no consensus about how to conceptualise the actual undertaking of research. There are, however, two main traditions of approaching a research topic— quantitative and qualitative. Each approach demands different research methods.

Quantitative Research

The quantitative approach usually starts with a theory or a general statement proposing a general relationship between variables. With this approach it is likely that the researchers will take an objective position and their approach will be to treat phenomena as hard and real. They will favour methods such as surveys and experiments, and will attempt to test hypotheses or statements with a view to generalising from the particular. This approach typically concentrates on measuring or counting and involves collecting and analysing numerical data and applying statistical tests.

Qualitative research

The alternative tradition is the qualitative approach. Here the investigator views the phenomena to be investigated as more personal and softer. He or she will use methods such as personal accounts, unstructured interviews and participant observation to gain an understanding of the underlying reasons and motivations for peoples' attitudes, preferences or behaviours. With this approach, the emphasis is more on generating hypotheses from the data collection rather than testing a hypothesis.

In reading around the subject you will find many alternative names for qualitative and quantitative research. It is good to have an understanding of these and to recognise them when you see them in research methods textbooks.

You should note the following points:

- Qualitative and quantitative research methods are not clear-cut nor mutually exclusive; most research draws on both methods.
- Both approaches can generate quantitative and qualitative data.
- The difference between the two methods is in the overall form and in the emphasis and objectives of the study.

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Outcome of Research

Applied Research

Applied research is problem-oriented as the research is carried out to solve a specific problem that requires a decision, for example, the improvement of safety in the workplace, or market research. For your dissertation it is not usually acceptable to carry out applied research as it is very much limited to one establishment or company and you are required to look at issues of wider significance, perhaps to your industry as a whole or to a sector of it. You may have already carried out a problem-based piece of research related to your placement. It is important to understand that the dissertation requires you to carry out some form of basic research.

Basic Research

Basic research is also called fundamental or pure research, and is conducted primarily to improve our understanding of general issues, without any emphasis on its immediate application. It is regarded as the most academic form of research since the principal aim is to make a contribution to knowledge, usually for the general good, rather than to solve a specific problem for one organisation. This may take the form of the following:

- *Discovery*– where a totally new idea or explanation emerges from empirical research which may revolutionise thinking on that particular topic. An example of this would be the Hawthorne experiments. (Gillespie, 1991)
- *Invention*– where a new technique or method is created. An example of this would be the invention of TQM (total quality management).
- *Reflection*– where an existing theory, technique or group of ideas is re-examined possibly in a different organisational or social context. For example, to what extent can Herzberg's theory of motivation be applied to front-line workers in the contract catering sector?

Action Research

This is a form of research where action is both an outcome and a part of the research. The researcher 'interferes' with or changes – deliberately – what is being researched. The critics of action research argue that since the researcher is changing what is being researched during the process of research, the work cannot be replicated. If it cannot be replicated its findings cannot be tested in other situations.

This prevents general knowledge being developed and thus it cannot contribute to theory. Also, as the researcher is involved in the change process there is a loss of critical, detached objectivity. There are two approaches to action research:

- Classical action research begins with the idea that if you want to understand something you should try changing it.
- New paradigm research is based on a new model or framework for research. It claims that research can never be neutral and that even the most static and conventional research exposes the need for change in what

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is being researched. It involves inquiry into persons and relations between persons, and is based on a close relationship between researcher and those being researched. The research is a mutual activity of a 'co-ownership' involving shared power with respect to the process and the outcomes of the research. Those being researched can, for example, decide how the research will be undertaken, in what form and with what questions being asked. The researcher is a member of a 'community' and brings to it special skills and expertise. The researcher does not dictate what will happen. This type of research is most easily carried out when working with individuals or small groups. It means that the researcher must be highly skilled not only in research methods but also in the interpersonal skills of facilitating others. It is not, therefore, usually appropriate for an undergraduate student who is carrying out a major piece of research for the first time. Action research is often used by educationalists who are trying to improve their own practice by making changes to the delivery of their classes and by observing and asking students which actions work best.

As you can see, there are a number of types of research and not all may be suitable for you in your dissertation. The key points to remember are as follows:

- While the purpose of your dissertation may have some elements of exploratory or descriptive research you should concentrate on research that will mainly fall into the explanatory area, or perhaps predictive research if you are very confident. Explanatory research gives you the opportunity to demonstrate the skills of analysis and evaluation which will help you to score highly in your final marks.
- The process of your research can either be quantitative or qualitative and the different methods that can help you to carry out your research in this way.
- It is likely that you will be carrying out basic or pure research in the reflection mode (rather than applied or action research) as this will give you the best chance of showing that you can test out a theory in a new situation.

Historical

The historical method comprises the techniques and guidelines by which historians use historical sources and other evidence to research and then to write history. There are various history guidelines commonly used by historians in their work, under the headings of external criticism, internal criticism, and synthesis. This includes higher criticism and textual criticism. Though items may vary depending on the subject matter and researcher, the following concepts are usually part of most formal historical research:

- Identification of origin date
- Evidence of localization
- Recognition of authorship

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- Analysis of data
- Identification of integrity
- Attribution of credibility

RESEARCH DESIGN— MEANING, PURPOSE AND PRINCIPLES

A plan for collecting and utilizing data so that desired information can be obtained with sufficient precision or so that an hypothesis can be tested properly is called research design.

Research is any form of systematic and arranged investigation to organize facts or gather data, and is often related to a problem that has to be solved. Research is the study of materials, sources, and data in order to get conclusions. Any research is at the center of the process of learning about the world, and it is important that people understand how "good" research is organized. People depend on the accumulated knowledge and experience of the civilization. Research is the process the civilization uses to construct further on the store of knowledge.

Research is the process of finding out new data based on facts collected in ways that minimize observer prejudice. Research project comprises a great variety of methods that can be used in order to achieve goals. Sometimes, a research project is designed and worked on by a group of investigators, management decision makers. In this situation collaboration plays a great role in achieving understanding and thus, good results. Here, the proposal is used in order to share the gained experience and find the most effective way of research conducting.

A research project starts from an idea, usually in the mind of a researcher who has done other investigations in the field. The idea may have come from a research done by others. The ideas occur to researchers with a bulk of experience in some field by means of a process of intuitive creative intelligence. A good research differs from a research that falls short of professional quality by set of processes closely connected with each other.

Some researchers point out the cognitive processes of generating creative decisions, gathering expert opinions, assessing the probable results of each alternative. Other researchers point out the problems of good decision-making, such as impatience with gathering data, the consequences of feeling inadequate, dependent. In this situation a hypothesis is used as a form of researchable proposal. Hypothesis is an explanation of observable facts or phenomena that may be verifiable via investigations.

A hypothesis is concerned with an explanation of something previously unknown. It needs some form of investigative process. For the research to be acceptable others must be able to apply the same procedure to get similar outcomes. Hypotheses that can be tested are known as 'testable hypotheses'. It is important to point out that not all investigations have to be concerned with testable hypotheses. Nevertheless, testable hypotheses give a research design that can reliably get high assessment. The purpose of proposal is to suspect the research process before it is carried out and the hypothesis plays a significant role in it.

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Research design is a critical part of research. It provides the link between the theory or argument that informed the research, on the one hand, and the empirical material collected on the other. Research design addresses at least three issues. First of all, and most importantly, it must allow the researcher to engage in an on-going debate. Social science proceeds by examining critically the positions in a debate, discover unanswered (or poorly answered) questions, and then engage the debate through an analysis of these weaknesses. Research design therefore has to address the debate, and allow the researcher to make a contribution to that debate. Secondly, and as a result, the design of a research project must aim to include not just the answers that the researcher is trying to give, but also explicitly address the positions in the debate.

Case selection thus becomes an instrument that allows an intervention in the ongoing debate, and therefore needs to be done not just with the researcher's final argument in mind, but also explicitly engaging the most important alternative explanations. Third, the research design must allow the researcher to make the step from argument, over well-specified hypotheses (about the probable outcome of the research) to the actual cases studied. Developing theory or argument, translating them into well-specified hypotheses, and collecting empirical material therefore are steps in the research process that are closely linked to one another. In sum, research design and the selection of cases is an intricate part of building the argument: cases offer analytical leverage.

There are many purposes that research design serve main are as follows:

- Defines, elaborate and explain the research topic.
- Make clear the area of research to other.
- Provide limits and boundaries to a research.
- Give the whole scenario of the research.
- Tell the modes and consequences.
- Ensuring of time and resources is done.

A. SCIENCE, THEORY, AND RESEARCH

Research starts with the researcher, the position where you stand, the world around you, your ethics, etc. The conceptions of the researcher influence the research topic and the methodology with which it is approached. Research is not just a matter of technique or methods.

What is specific to social-science research, as compared to say journalism, is the quest to examine and understand social reality in a systematic way. What is observed is as important as how it is observed.

General outline of a research: theory, conceptualization of theoretical constructs into concepts, formalization of relationships, operationalization, measurement or observation, data analysis or interpretation, report.

1. Science and Reality

Science, as a system of propositions on the world, is a grasp of reality; it is systematic, logical, and empirically founded. Epistemology is the science of

knowledge (what is knowledge?), and methodology is the science of gathering knowledge (how to acquire knowledge?). The inferences from science can be causal or probabilistic, and/or it seeks to offer understanding of social processes. Factors that intervene in the process of scientific inquiry include the available tradition of research and the status of the researcher.

Scientific inquiry should reduce errors in observations (mistakes, incorrect inferences), and avoid over-generalizations (e.g. selective observations, only studying that which conforms to a previously found pattern).

Mistakes include: a) ex-post facto reasoning: a theory is made up after the facts are observed, which is not wrong as such, but the derived hypothesis still needs to be tested before it can be accepted as an hypothesis; b) over-involvement of researcher (researcher bias); c) mystification: findings are attributed to supernatural causes; in social-science research, while we cannot understand everything, everything is potentially knowable.

Basically, the two necessary pillars of science are logics and observation (to retrieve patterns in social life, i.e. at the aggregate level). Note that people are not directly researched: social-science research studies variables and the attributes that compose them.

A variable is a characteristic that is associated with persons, objects or events, and a variable's attributes are the different modalities in which the variable can occur (e.g. the attributes male and female for the variable sex). Theories explain relationships between variables, in terms of causation or understanding. Typically, this leads to identify independent and dependent variables (cause and effect), or situation, actor, and meaning (interpretation).

2. *From Theory to Research*

Different purposes of social-science research can be identified: (1) to test a theoretical hypothesis, usually a causal relationship (e.g. division of labor produces suicide); (2) to explore unstructured interests, which usually involves a breaking through of the empirical cycle, shifting from induction to deduction (e.g. what is so peculiar about drug-abuse among young black females); (3) applied research, for policy purposes (e.g. market research).

The basic model of research is: (1) theory, theoretical proposition, (2) conceptualization of the theoretical constructs, and formalization of a model, the relationships between variables; (3) operationalization of the variables stated in the theory, so they can be measured (indicators) and (4) observation, the actual measurements. The inquiry can be deductive, from theoretical logic to empirical observations (theory-testing), or inductive, from empirical observations to the search for theoretical understanding of the findings of the observations (theory-construction). (Note that, basically, it's always both, cf. Feyerabend, which is more than just an alternation, it's rather an mutual constituency). The wheel of science.

- *Deduction:* the logical derivation of testable hypotheses from a general theory.
- *Induction:* the development of general principles on the basis of specific observations.

B. RESEARCH DESIGN, MEASUREMENT, AND OPERATIONALIZATION

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1. Research Design

Research design concerns the planning of scientific inquiry, the development of a strategy for finding out something. This involves: theory, conceptualization, formalization, operationalization of variables, preparations for observation (choice of methods, selection of units of observation and analysis), observation, data analysis, report (and back to theory).

(a) Purposes of Research

The purposes of research are basically three-fold:

(1) *Exploration:* to investigate something new of which little is known, guided by a general interest, or to prepare a further study, or to develop methods. The disadvantage of most exploratory studies is their lack of representativeness and the fact that their findings are very rudimentary.

(2) *Description:* events or actions are observed and reported (what is going on?). Of course, the quality of the observations is crucial, as well as the issue of generalizability.

(3) *Explanation:* this is research into causation (why is something going on?). This is extremely valuable research of course, but note that most research involves some of all three types.

(b) Units of Analysis

The units of analysis refer to the what or who which is being studied (people, nation-states). Units of analysis can be (and often are) the units of observation, but not necessarily (e.g. we ask questions to individuals about their attitudes towards abortion, but analyze the religious categories they belong to). Units of analysis in social-science research typically include individuals within a certain area at a given period of time; groups (e.g. the family); organizations (e.g. social movements); products of human action (e.g. newspapers in a content-analysis); and so on.

Two common problems are— the ecological fallacy, i.e. making assertions about individuals on the basis of findings about groups or aggregations (e.g. higher crime rates in cities with a high percentage of blacks are attributed to blacks, but could actually be committed by the whites in those areas); and reductionism, i.e. illegitimate inferences from a too limited, narrow (individual-level) conception of the variables that are considered to have caused something broader (societal), (e.g. Durkheim does not explain any individual's suicide, but only the suicide-rates among certain categories of people).

(c) Focus and Time of Research

The focus in a research can be on: (1) characteristics of states of being (e.g. sex of an individual, number of employees in a company); (2) orientations of attitudes (e.g. prejudice of an individual; the political orientation of a group), and

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(3) actions, what was done (e.g. voting behavior of individuals; the riot participation of a group).

Research, considered in its time dimension, can be (1) cross-sectional at any given point in time; (2) longitudinal over a period of time to trace change or stability (e.g. panel study of the same people after two elections to see if and how their voting behavior changed); (3) quasi-longitudinal by investigating certain variables in a cross-sectional study (e.g. a comparison of older and younger people indicates a process over time).

2. *Conceptualization and Measurement*

(a) Conceptualization

Theories are comprised of statements that indicate relationships between constructs, i.e. particular conceptions which are labeled by a term. These constructs should be conceptualized, i.e. the meaning of the constructs must be specified, as a working agreement, into clearly defined concepts (which are still mental images). Then we can operationalize those concepts, i.e. specify indicators that measure the concept in terms of its different dimensions (e.g. the action or the ideas that are referred to by the concept of crime). Note that this process reminds us that terms should not be reified into things.

Concepts, then, should be defined in two steps— first, a nominal definition of the concept gives a more precise meaning to the term, but it cannot yet be observed as such, therefore, second, the operational definition of the concept spells out how it is to be measured or observed, so that the actual measurement can be undertaken. Example: theoretical construct = social control; nominal definition of concept = social control as the individual's bonding to society; operational definition = attachment to primary institutions, which can be high or low; measure = years of education. Note that these specifications are absolutely necessary in explanatory research.

(b) Measurement Quality

Measurements should best be precise, and reliable and valid. Reliability and validity refer to the relationship between measure and concept!!

(1) *Reliability:* does the replication of a measurement technique lead to the same results?

This refers to the consistency of the measurement techniques. Reliability can be achieved through the *test-retest method,* i.e. the replication of a method on a phenomenon that could not, or should not, have changed, or of which the amount of expected change is known (*e.g.*, asking for age, and asking again the next year, should lead to a difference of one year). Another technique for reliability check is the split-half method, *e.g.*, if you have ten indicators for a phenomenon, then use five randomly chosen in one questionnaire, and the other five in the other one, apply to two random-samples, then their should be no differences in the distribution of attributes on the measured variable between the two. Other reliability techniques are the use of established methods, and training of researchers.

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(2) *Validity:* does the method of measurement measure what one wants to measure?

This means different things: first, face validity is based on common-sense knowledge (*e.g.*, the number of children is an invalid measure of religiosity); second, criterion or predictive validity is based on other criteria that are related to the measurement (*e.g.*, racist actions should be related to responses to racist attitude scales); third, construct validity is based on logical relationships between variables (*e.g.*, marital satisfaction measurements should correlate with measurements of marital fidelity); finally, content validity refers to the degree to which a measure covers all the meanings of a concept (*e.g.*, racism as all kinds of racism, against women, ethnic groups, etc.).

Note that reliability is all in all an easier requirement, while on validity we are never sure. Note also the tension between reliability and validity, often there is a trade-off between the two (*e.g.*, compare in-depth interviewing with questionnaire surveys).

3. Operationalization

Operationalization is the specification of specific measures for concepts in a research (the determination of indicators). Some guidelines— be clear about the range of variation you want included (*e.g.*, income, age), the amount of precision you want, and about the dimensions of a concept you see relevant.

In addition, every variable should have two qualities:— (1) exhaustive: all the relevant attributes of a variable must be included (*e.g.*, the magical 'other' category is best not too big), and (2) attributes should be mutually exclusive (*e.g.*, whether a person is unemployed or employed is not exclusive, since some people can be part-time employed and part-time unemployed).

Variables are (1) nominal, when there attributes indicate different, mutually exclusive and fully exhausted qualities (*e.g.*, sex: male or female); (2) ordinal, when the attributes can also be ranked in an order (*e.g.*, type of education); (3) interval, when the distance between attributes in an order is precise and meaningful (*e.g.*, IQ test); and (4) ratio, when, in addition, these attributes have a true zero-point (*e.g.*, age). Note that variables do usually not in and by themselves indicate whether they are nominal, ordinal, etc., or that you can convert them from one type to another (*e.g.*, dummy-variables, from nominal to metric).

Finally, note that you can use one or multiple indicators for a variable; sometimes even, a composite measurement is necessary. (note: see questionnaire design for an application of operationalization).

4. Indexes, Scales and Typologies

There are commonalities between indexes and scales; they both typically involve ordinal variables, and they are both composite measures of variables.

An index is constructed by accumulating scores assigned to individual attributes. The requirements of scales are— face validity (each item should measure the same attribute), unidimensionality (only one dimension should be represented by the composite measure). Then you consider all the bivariate relationships between the items in the scale, the relationship should be high, but not perfect.

A scale is constructed by accumulating scores assigned to patterns of attributes. The advantage is that it gives an indication of the ordinal nature of the different items, one item is in a sense included in the other (higher ranked).

A typology is a break-down of a variable into two or more. As dependent variables this is a difficult thing, since any one cell in the typology can be under-represented (it's best then to undertake a new analysis, making sure each cell is well represented).

C. CAUSAL MODELLING

1. Assumptions of Causal Inquiry

The first step in causal modelling involves conceptualization: what are the relevant concepts, and, second, how to operationalize these concepts. The next step is formalization, i.e. specification of the relationships between the variables. This seems to destroy the richness of the theory, but it helps to achieve comprehensibility and avoids logical inconsistencies. Note that this model is ideally based on a deductive approach, but it does not exclude a more dynamic approach which moves back and forth (from theory to data).

The causal model itself specifies not only the direction (from X to Y) but also the sign of the relationship (positive or negative). A positive relationship means that when X goes up, Y goes up; a negative relationship between X and Y means that as X goes up why goes down. between different paths, the signs should be multiplied to determine the net-effect. A causal system is consistent when all the causal chains push the relationship in the same direction (indicated by the fact that all the signs are the same). When some signs are positive, others negative, the system is inconsistent (suppressors).

Please note that the causality is not in reality (perhaps it is), but it is above *all put into the model by virtue of the theory. This involves a notion of determinism* (for the sake of the model), and that we stop some place in looking for any more causes or effects. Also note that the variables in a causal model are all at the same level of abstraction (ideally).

Causal explanations can be idiographic or nomothetic— (1) idiographic explanations seek to explain a particular events in terms of all its caused (deterministic model); (2) nomothetic explanations seek to explain general classes of actions or events in terms of the most important causes (probabilistic model).

2. Causal Order: Definitions and Logic

Prior (unknown or not considered) variables precede the independent variable. Intervening variables are located in between the independent and dependent variable. Consequent variables are all variables coming after the dependent variable (unknown or not considered). Note that the identification of prior, independent, intervening, dependent, and consequent variables is relative to the model at hand.

The causal order between a number of variables is determined by assumptions that determine the causal system that determines the relationship

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between those variables. (note that variables in a loop have no order, i.e. when the path from X away to other variables returns from those variables back to X).

The following possibilities can be distinguished:

- *X causes Y*

- *X and Y influence eachother*

- *X and Y correlate*

Variable X causes variable Y, when change in X lead to change in Y, or when fixed attributes of X are associated with certain attributes of Y. This implies, of course, that we talk about certain tendencies: X is a (and not the) cause. And this implies correlation as a minimum, necessary condition (the causation itself is theoretical).

3. *Minimum-Criteria for Causality*

Rule 1: Covariation

Two variables must be empirically correlated with one another, they must co-vary, or one of them cannot have caused the other. This leads to distinguish direct from indirect effects.

Rule 2: Time-order

When Y appears after X, Y cannot have caused X, or in other words, the cause must have preceded the effect in time. Derivative from this is the rule that when X is relatively stable, hard to change, and fertile (it produces many other effects), it is likely to be the independent variable.

Rule 3: Non-Spuriousness

When the observed correlation between two variables is the result of a third variable that influences both of those two separately, then the correlation between the two is spurious. This is indicated by a variable having a causal path to the two variables that correlate.

Basic to causality is the control of variables. Most ideally, this is done by randomization in experiments, then the attributes of any prior variables are randomly distributed over the control and the experimental group. We can also purposely control for prior variables when we select the ones we consider relevant. In bivariate relationships, no variables are controlled, while in partial relationships, one or more of the prior and intervening variables, that might interfere, are controlled. It is better still to identify the necessary and sufficient causes of certain effects but usually we are pleased with either one.

Some common errors are— biased selection of variables to be included in the model, unwarranted interpretation, suppression of evidence, and so on. It is interesting to see the different steps involved in a typical causality-type research and what can go wrong at each step. First, from theory to conceptualization, this

step is rarely clear-cut. Second, the step into operationalization is in a way always arbitrary (since the concept indicates more than any measurement). Third, the empirical associations found between measured variables is rarely, if ever, perfect. Finally, any measurement therefore requires additional studies, and any conclusion is in principle falsifiable (variables are shown to be associated, but then the question is how they are associated).

Strategies for causal analysis— When a bivariate non-zero relationship between X and Y is reduced to zero under control of a third variable, then the third variable explains the bivariate relationship, or the relationship is spurious (causality can never be proven by data analysis); Check out for the effect of prior variables; Path analysis.

D. SAMPLING PROCEDURES

Sampling refers to the systematic selection of a limited number of elements (persons, objects or events) out of a theoretically specified population of elements, from which information will be collected. This selection is systematic so that bias can be avoided. Observations are made on observation units, which can be elements (individuals) or aggregations of elements (families). A population is theoretically constructed and is often not directly accessible for research. Therefore, the study population, the set of elements from which the sample is actually selected, can (insignificantly) differ from the population. In multi-stage samples, the sampling units refer to elements or sets of elements considered for selection at a sampling stage. The sampling frame is the actual list of sampling units from which the samples are selected.

The sampling procedures are designed to best suit the collection of data, i.e. to measure the attributes of the observation units with regard to certain variables. Depending on theoretical concerns and choice of method, probability or non-probability sampling designs are appropriate in research.

1. Probability Sampling

Probability sampling is based on principles of probability theory which state that increasing the sample size will lead the distribution of a statistic (the summary description of a variable in the sample) to more closely approximate the distribution of the parameter (the summary description of that variable in the population). The standard error, inversely related to sample size, indicates how closely a sample statistic approximates the population parameter. These conditions are only met when samples are randomly selected out of a population, i.e. when every element in the population has an equal chance of being selected in the sample.

A randomly selected sample of sufficiently large size (absolute size, not size proportionate to the population) is assumed to be more representative for the population because the relevant statistics will more closely approximate the parameters, or the findings in the sample are more generalizable to the population. Representativeness of samples, or generalizability of sample findings, both matters

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of degree, are the main advantages of probability sampling designs. The accuracy of a sample statistic is described in terms of a level of confidence with which the statistic falls within a specified interval from the parameter (the broader the interval, the higher the confidence). The main disadvantage of probability sampling is that the theoretical assumptions (of infinity) never "really" apply.

(a) Simple Random Sampling

In simple random sampling, each element is randomly selected from the sampling frame. Example: in an alphabetical list of all students enrolled at CU-Boulder, each student is given a number ascending from 1, and 400 students are selected using a table of random numbers.

(b) Systematic Sampling

In systematic sampling, every kth element in a list is selected in the sample, the distance k indicating the sampling interval. The systematic sample has a random start when the first element is randomly chosen (out of numbers between 1 and k). Systematic sampling has the advantage of being more practical but about as (sometimes more) efficient than simple random sampling. A disadvantage is the danger of an arrangement of elements forming a pattern that coincides with the sampling interval. Example: in a list of all students enrolled at CU-Boulder, each 100th student, starting with the randomly chosen 205th, is selected. Later it turned out that every other student in the list was female (and the entire sample female), since the composer of the list though "perfect randomness" would lead to perfect probability samples.

(c) Stratified Sampling

Stratified sampling is a modification to the use of simple random and systematic sampling. It is based on the principle that samples are more representative when the population out of which they are selected is homogeneous. To ensure samples to be more representative, strata of elements are created that are homogeneous with respect to the (stratification) variables which are considered to correlate with other variables relevant for research (the standard error for the stratification variable equals zero). Example (stratified & systematic): luckily we know how stupid composers of student lists are, so we stratify students by sex (taking every other student in our "perfectly randomized" list); we thus get two strata of students based on sex, and select every 40th student in each stratum.

(d) Cluster Sampling

In cluster sampling, clusters of groups of elements are created, and out of each group, elements are selected. This method is advantageous since often complete lists of the population are unavailable. Cluster sampling is multi-stage when first clusters are selected, then clusters within clusters (on the basis of simple random or systematic sampling, stratified or not), and so on, up until elements within clusters. While cluster sampling is more efficient, the disadvantage is that there are sampling errors (of representativeness) involved at each stage of sampling, a problem which is not only repeated at each stage, but also intensified since sample size grows smaller at each stage. However, since elements in clusters are

often found to be homogeneous, this problem can be overcome by selecting relatively more clusters and less elements in each cluster (at the expense of administrative efficiency).

When information is available on the size of clusters (the number of elements it contains), we can decide to give each cluster a different chance of selection proportionate to its size (then selecting a fixed number within each cluster). This method has the advantage of being more efficient: since elements in clusters are typically more homogeneous, only a limited number of elements for each cluster has to be selected. Finally, disproportionate sampling can be useful to focus on any one sample separately, or for the comparison of several samples. In this case, generalizability of sample findings to the entire population should not and cannot be considered.

Example (multi-stage cluster, proportionate to size, stratified): for research on political attitudes of students in the USA, no list of all students are available, but we have a list of all US states; we select a number of states (clusters); they are given a chance of selection proportionate to the "size" of (number of universities in) each state, because, for instance, there are more universities in the north-eastern states (probability proportionate to size); out of the selected states, we select cities (again proportionate to size, since metropolitan areas have more universities), select universities out of each selected city, take the student lists of each selected university, and select a relatively small number of students (assuming homogeneity among them since we know all students in Harvard are conservative and everybody at CU-Boulder is a liberal).

2. *Non-Probability Sampling*

The choice between probability or non-probability design is dependent on theoretical premises and choice of method. While probability sampling can avoid biases in the selection of elements and increase generalizability of findings (these are the two big advantages), it is methodologically sometimes not feasible or theoretically inappropriate to undertake them. Then non-probability samplings can be used.

(a) Quota Sampling

In quota sampling, a matrix is created consisting of cells of the same attributes of different variables known to be distributed in the population in a particular way. Elements are selected having all attributes in a cell relative to their proportion in the population (e.g. take 90% white and 10% black because based on census data that is the racial composition of the entire population). Although the information on which the proportionate distribution of elements is based can be inaccurate, quota sampling does strive for representativeness (but it is not based on probability theory).

(b) Purposive Sampling

Purposive or judgmental sampling can be useful in explorative studies or as a test of research instruments. In explorative studies, elements can purposively be selected to disclose data on an unknown issue, which can later be studied in a

probability sample. Questionnaires and other research instruments can be tested (on their applicability) by purposively selecting "extreme" elements (after which a probability sample is selected for the actual research).

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(c) Sampling by Availability

When samples are being selected simply by the availability of elements, issues of representativeness about the population cannot justifiably be addressed. A researcher may decide to just pick any element that she/he bumps in to. As such, there is nothing wrong with this method, as long as it is remembered that the selection of samples may be influenced by dozens of biases and cannot be assumed to represent anything more than the selected elements.

(d) Theoretical Reasons for Non-Probability Sampling

The previous non-probability sampling designs are related to methodological concerns. In fact, the issue of representativeness does matter in the background of these designs but is conceived not feasible or, worse, purported as feasible but not founded on probability theory. However, more interesting and scientifically valuable are the non-probability sampling designs based on theoretical insight. In some theoretical models, it is unwise to conceive the world in terms of probability, sometimes even not as something to be sampled. (this is a kind of purposive sampling, but now because of theoretical concerns).

First, in field research, the researcher may be interested in acquiring a total, holistic understanding of a natural setting. As such, there is no real sampling of anything at all. However, since observations on "everything" or "everybody" can in effect never be achieved, it is best to study only those elements relevant from a particular research perspective (sometimes called "theoretical sampling" or "creative sampling").

Second, when the elements in a natural setting clearly appear in different categories, quota sampling "in the field" can be used. This is the same as regular quota sampling, but the decisions on relevant cells and proportions of elements in cells are based on field observations.

Snowball sampling is used when access to the population is impossible (methodological concern) or theoretically irrelevant. The selection of one element leads to the identification and selection of others and these in turn to others, and so on. (The principle of saturation, indicating the point when no more new data are revealed, determines when the snowball stops). Example (cluster and snowball): in a study of drug-users in the USA, a number of cities (clusters) is randomly selected, a drug-user is selected in each city (e.g. through clinics), is interviewed and asked for friends that use drugs too, and so on. Example (snowball): a researcher is interested in African-American HIV infected males in Hyde Park, Chicago; the research aims at in-depth understanding of this setting, and inferences about other HIV infected males are trivial (apart from being impossible).

Third, the sampling of deviant cases can be interesting to learn more about a general pattern by selecting those elements that do not conform to the pattern.

Example: 99% of the students at CU voted for Clinton, so I select those that did not, to find out why they are "deviant".

These samples are purposive samples with a theoretically founded purpose. As long as that is the case, their use may be perfectly justified and, according to some theories, even the only applicable ones. The main disadvantage of non-probability sampling designs is the lack of representativeness for a wider population. But again, based on some theories, these difficulties can precisely be advantages (as long as the methodological and theoretical positions are clearly stated, both probability and non-probability sampling designs can be equally "scientific").

METHODS OF OBSERVATION

A full research design is not just a matter of determining the right methods of observation, there is always (or there better be) theory first. The following procedure can be suggested:

- *First*, there should be a theory that states what is to be researched, and how this connects to the already available body of literature (to ensure, or strive towards, cumulative knowledge). There is no "naked" or mind-less observation.
- *Second*, the theory has to be conceptualized, so that the different variables of the theory are clearly defined and identified. This may also involve acknowledgment of the limitations of the approach.
- *Third*, the research topic and methodology is formalized into observable phenomena. This involves specification of the research topic (where, when) and the methods of observation (how) as well as the way in which the data are to be analyzed, and what the anticipated findings are.
- *Finally*, after the research is conducted, a report is drawn up, indicating theory, methodology, as well as findings.

A. EXPERIMENTAL DESIGNS

The most important issue in an experiment is randomization (as a matter of internal validity). There are issues of internal and external validity, and the problems and solutions of external validity. Note the strength and limitations with regard to the control of variables, i.e. all the variables we know might interfere.

1. The Structure of Experiments

A classical experiment involves four basic components:

(1) An experiment examines the effect of an independent variable on a dependent variable. Typically, a stimulus is either absent or present. In this way, a hypothesis on the causal influence between two variables can be tested (see logic of causal modelling). Both variables are, of course, operationalized.

(2) An experiment involves pretesting and posttesting, i.e. the attributes of a dependent variable are measured, first before manipulation of the

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independent variable, and second after the manipulation. Of course, applied to one group, this may affect the validity of the results, since the group is aware of what is being measured (research affects what is being researched).

(3) Therefore, it is better to work with experimental groups and control groups. We select two groups for study, then apply the pretesting-posttesting, and thus conclude that any effect of the tests themselves must occur in both groups. There can indeed be a Hawthorne effect, i.e. the attention given to the group by the researchers affects the group's behavior. Note that there can also be an experimenter bias, which calls for accurate observation techniques of the expected change in the dependent variable.

(4) Selecting Subjects—

Note that there can always be some bias because often students are selected (problem of generalizability). Also, note that samples of 100 or not very representative, and that experiments often have fewer than 100 subjects.

Randomization refers to the fact that the subjects (which are often non-randomly selected from a population) should be randomly assigned to either the experimental or the control group. This does not ensure that the subjects are representative of the wider population from which they were drawn (which they usually are not), but it does ensure that the experimental and the control group are alike, i.e. the variables that might interfere with the results of the experiment will, based on the logic of probability, be equally distributed over the two groups. Note that randomization is related to random-sampling only in the sense that it is based on principles of probability (the two groups together are a "population", and the split into two separate groups is a random-sampling into two samples that mirror eachother and together constitute this "population").

Matching refers to the fact that subjects are purposely assigned by the researcher to either the control or the experimental group on the basis of knowledge of the variables that might interfere with the experiments. This is based on the same logic as quota sampling. Matching has the disadvantage that the relevant variables for matching decisions are often not all known, and that data analysis techniques assume randomness (therefore, randomization is better).

Finally, the experiments should be conducted in such a way that the only difference between the experimental and the control group is the manipulation of a variable during the experiment. Taken together, randomization or matching, and the fact that the manipulation during experimentation is the only difference between the two groups, these techniques allow for the control of all variables, other than the manipulated one, to interfere in the outcome of the experiment (internal validity!).

Note on the One-Shot Case Study:

A single group is manipulated on an independent variable, and then measured on a dependent variable. This method must involved pretest and posttest to be of any significance (otherwise there is nothing to compare), i.e. the one-group pretest-posttest design, but then we are not sure if it was the manipulated

variable that caused the observed difference.

2. Internal Validity and External Validity

(a) Internal Validity: did the experimental treatment cause the observed difference?

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The problem of internal validity refers to the logic of design, the fact whether other variables that may intervene were controlled, i.e. the integrity of the study. The problem can be that the conclusions of an experiment are not warranted based on what happened during the experiment. This can come about because of: (a) accident: historical events can have occurred during the experiment and affected its outcome; (b) time: people change, mature, during the period of experimentation; (c) testing: the groups are aware of what is being researched; (d) instrumentation: the techniques to measure pretest and posttest results are not identical (reliability); (e) statistical regression: results are biased because the subjects started with extreme values on a variable; and (f) other problems include, that the relationships are temporal but not causal, and that the control group may be frustrated or stuff.

Randomization of subjects into an experimental and a control group (to ensure that only the experimental manipulation intervened, while other variables are controlled), and reliable measurements in pretest and posttest are guards against problems of internal validity.

(b) External Validity: are the results of the experiment generalizable?

The problem of external validity refers to the issue of generalizability: what does the experiment, even when it is internally valid, tell us about the real, i.e. non-manipulated, world?

A good solution is a four-group experimental design, i.e. first an experimental and a control group with pretest and posttest, and second, an experimental and a control group with posttest only. And better than anything else is a two-group design with posttest only when there is good randomization, since randomization ensures that all variables are evenly distributed between experimental and control group so that we do not have to do a pretest.

An experimental manipulation as close as possible to the natural conditions, without destroying internal validity, are the best methods to ensure external validity.

(c) Note on Ex-Post Facto Experiment

This is not a true experiment since there is (was) no control group. The manipulation of the independent variable has naturally occurred (e.g. earthquake). We are of course not sure, say when we compare with a group were the natural "manipulation" did not take place, that there are (or are not) other variables involved (very bad on the control of variables).

3. Advantages and Disadvantages of Experiments

The isolation of the one crucial variable, when all others are controlled, is the main advantage of experiments (it can lead to hypothesis falsification). Experiments are well-suited for projects with clearly defined concepts and

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hypotheses, thus it is the ideal model for causality testing. It can also be used in the study of small-group interaction, possibly in a field research, i.e. as a natural experiment. Experiments can also be repeated.

The big disadvantage is the artificial character of the research, and, in the social sciences, they often involve ethical difficulties, or can simply not be executed.

B. SURVEY RESEARCH

Note on quantification, which is quite essential in survey research, that numbers are representations of..., they are created, they represent something, so do not reify them (e.g. they are limited to the sample, and therefore to the sampling procedure - typically a probability sample design). You have to know the process that created the numbers or you cannot make any inferences. The powers of the analytical tools (quantitative data analysis) should not be abused. Note that quantitative methods are generally better on matters of reliability, while qualitative methods are better on validity.

The main advantage of survey research is of course the generalizability of its findings because of the representativeness of the sample (see sampling - as a matter of external validity). Note that a pre-test of the questionnaire is always necessary (as a matter of validity).

1. The Questionnaire

Survey research typically involves administering a questionnaire to a sample of respondents to draw conclusions on the population from which the sample is drawn. The questionnaire is standardized to ensure that the same observation method is used on all respondents. This involves considerations of questionnaire construction, question wording, and the way in which the questionnaire is administered to the respondents.

(a) Questionnaire Construction

In the construction of the questionnaire, attention is devoted to increase the respondents' cooperation and avoid misunderstanding of the questions. First, the questionnaire format should be presentable, not too densely packed, and clear. This involves using intelligible contingency ("if no/yes go to...") questions, or matrix questions that contain al the items or response options to a question. Second, the effects of question order have to be considered, and this can be pre-tested with different questionnaires, and by being sensitive to the research problem. Third, clear instructions on how to answer the questions should be given, and it is best to divide the questionnaire into different sections that are each preceded with instructions.

(b) Question Wording

The question wording should equally enhance the unambiguous nature of the questionnaire. Several options are available depending on the research perspective: attitudes, for instance, can be measured with Likert scale questions

(variation from strongly disagree to strongly agree). Questions can also be open-ended (and coded by the researcher for analysis) or closed-ended (an exhaustive list of mutually exclusive alternatives).

Note that open-ended questions may pose problems for analysis (too many responses), while closed-ended questions may impose too rigid a framework on the respondents. Also, each statement should not be too long, not negatively phrased, and posed in neutral, unambiguous terms to avoid social desirability effects and bias in any one (pro/con) direction. Also avoid double-barreled questions, and make sure to ask comprehensible and relevant questions.

2. *The Administration of a Questionnaire*

Questionnaires can be administered in a variety of ways.

(a) Self-Administered Questionnaire

In this type of survey, respondents fill out a questionnaire delivered to them by mail, taking precautions to ensure a sufficiently high response rate, or they can be delivered "on the spot", e.g. in a factory or school. The basic problem is the monitoring of returns, which have to be identified, i.e. you have to make up a return graph to indicate the response rate (over 50%), and you have to send follow-up mailings to non-respondents.

(b) Interview Survey

In a (more time-consuming and expensive) interview survey, sensitive and complicated issues can be explored face-to-face. This method also ensures a higher response rate, and a reduction of "don't know" answers. The interviewer has more control over the data collection process (note that observations can be made during the interview) and can clarify, in a standardized way, unclear questions. Since the questionnaire is the main measurement instrument, the interviewer must make sure that the questions have identical meaning to all respondents: interviewers should (and are trained to) be familiar with the questionnaire, dress like the respondents, behave in a neutral way during the interview, follow the given question wording and order, record the answers exactly, and probe for answers. Interview surveys typically have a higher response rate (affecting generalizability).

(c) Telephone Survey

A questionnaire conducted by telephone is a cheaper and less time-consuming method, one moreover in which the researcher can keep an eye on the interviewers, but one on which the respondents can also hang up.

3. *Advantages and Disadvantages of Survey Research*

Survey research generally has the advantage that, depending on the research objective, it can serve descriptive, explanatory, as well as exploratory purposes. But more important than anything else, depending on sampling techniques, it can generalize findings to large populations, while the standardization of the questionnaire (and the way it is administered) ensures reliability of the

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measurement instrument. In addition, many respondents can be researched, relatively many topics can be asked about them (flexibility), and statistical techniques allow for accurate analysis. Note that pre-collected data can also be analyzed for a different purpose (secondary data-analysis).

The main weakness of survey research is its rather superficial approach to social life because all subjects are treated in a unified way, the particularities of each cannot be explored in any great detail, and no knowledge is acquired of the social context of the respondents' answers. Also, surveys measure only answers, and not what this actually refers to (you know whether a person has responded to be "conservative" but not whether s/he is). Next, surveys are not so good in measuring action, but rather thoughts about action. This raises questions of validity: perhaps the questionnaire does not reveal anything "real", that is, anything of genuine concern for the respondents themselves.

C. FIELD RESEARCH

While surveys typically produce quantitative data, field research yields qualitative data. Also notice how field-research often not only produces data but also theory (alternation of deduction and induction).

1. Entering the Field

Depending on sampling procedure, a research site is selected and observations will be made and questions asked within the natural setting.

(a) The Role of the Field Researcher

(1) complete participant: the researcher is covertly present in the field and fully participates as if he is a member of the community under investigation; the problems are ethical, your mere presence might affect what goes on, and there are practical problems (e.g. when and how to leave the field?); 2) participant-as-observer: the researcher participates yet his identity is known; 3) observer-as-participant: the researcher observes and his identity is known; the latter two, since identity is known, may affect what's going on in the field, and it could cause the researcher to be expelled from the field; 4) complete observer: the researcher merely observes and his identity is not known.

(b) Preparing for the Field and Sampling in the Field

Start with a literature review (as always), then research yourself, why are you interested?, what will you bring to the field?, etc. Then search for informants, gate-keepers, and make a good impression (or simply join the group you want to study).

Establishing rapport is very important, and if your identity is known, it is important to tell them what you are there for (although you may choose to lie). Then sample in the field (see above). Remember that the overall goal of field research is to acquire the richest possible data.

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2. *In-Depth Interviewing*

(a) In-Depth Interviewing versus Questionnaire

While standardized questionnaires are typically, though not necessarily, employed in quantitative research, in-depth or unstructured interviewing is closely associated with qualitative field research. Like any interview, an in-depth interview can be defined as a "conversation with a purpose": an interview involves a talk between at least two people, in which the interviewer always has some control since s/he wants to elicit information. In survey interviews, the purpose of the conversation is dominant, especially when it involves the testing of hypotheses (a relationship between two or more variables). In-depth interviewing, in comparison, takes the "human element" more into account, particularly to explore a research problem which is not well defined in advance of the observation process. *In-depth interviewing does not use a questionnaire, but the interviewer* has a list of topics (an interview-guide) which are freely explored during the interview, allowing the respondent to bring up new issues that may prove relevant to the interviewer. The in-depth interviewer is the central instrument of investigation rather than the interview guide.

(b) Procedure of In-Depth Interviewing

The procedure of in-depth interviewing first involves establishing a relationship with the respondent: even more than is the case with questionnaires, it is crucial that the interviewer gains the trust of the respondent, otherwise the interview will hardly reveal in-depth insight into the respondent's knowledge of, and attitudes towards, events and circumstances. Since the kind of information elicited in the interview is not pre-determined in a questionnaire, tape-recording (and negotiation to get permission) is appropriate. The role of the in-depth interviewer involves a delicate balance between being active and passive: active because she/he guides the respondent tactfully to reveal more information on an issue considered relevant, passive because the interviewer leaves the respondent free to bring up issues that were unforeseen but nevertheless turn out to be relevant. Since the interviewer should talk, listen, and think during the interview, his/her experience and skill greatly contributes to the quality of the research findings. Note that in a field research, the interview can be formal or informal: in formal in-depth interviewing the researcher's identity is known and the respondent knows that an interview is going on, while an informal in-depth interview appears to be (to the respondent) just a conversation with someone (who is actually a covert researcher).

(c) Characteristics of In-depth Interviewing

In-depth interviewing has the advantage of being able to acquire a hermeneutic understanding of the knowledge and attitudes specific to the respondent (without an "alien", super-imposed questionnaire). It is often called a more valid research method. However, this assertion needs qualification: both in-depth and survey interviews approach human subjects with a perspective in mind, but only in in-depth interviewing is this perspective amenable to change

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(given the quest for what is unique to the person being interviewed), while in surveys it is not allowed to change (given the quest for generalizability of the findings).

During a research process involving several in-depth interviews, the "big wheel of science" can freely rotate between induction and deduction (finding new things and asking about them, cf. grounded theory). In addition, the method is beneficial for explorative research on a (sociologically) new issue. The main weakness of in-depth interviewing is its lack of reliability without a fixed questionnaire, the interviewer's flexibility, while allowing for new information, may affect the research findings, not because of respondents' characteristics, but because of the different ways in which they were interviewed.

Since in-depth interviewing often does not rely on random sampling of respondents, issues of generalizability cannot (but often do not have to) be addressed. Finally, the results of in-depth interviews are harder to analyze than survey questionnaire findings, since they cannot easily be transferred into numbers (allowing for statistical analysis) but have to be brought together comprehensively in meaningful categories that do not destroy the uniqueness of the findings (the recent use of computerized techniques of qualitative data-analysis is helpful in this regard).

3. Making Observations

In your observations, be sure to see as much as you can and to remain open-minded on what you see; you want to understand, not to condemn or approve. Once you have taken up your role, do not get over-involved, nor completely disengaged.

Very important is to record what you observe accurately, and best as soon as possible after the event occurred. Therefore, you should keep a field journal (or tape). Field notes include what is observed and interpretations of what is observed. Also, keep notes in stages, first rather sketchy and then more in detail. Finally, keep as many notes as you can (anything can turn out to be important). Apart from that, a separate file can be kept on theoretical and methodological concerns, as well as reports of the researcher's own personal experiences and feelings.

As an initial step for analysis, the notes must be kept in files (with multiple entries), to discover patterns of behavior or practices, instances of attitudes and meanings of events for the observed, encounters of people in interaction, episodes of behavior (in which a sudden event can be crucial), and roles, lifestyles and hierarchies. These analytically conceived files should keep the chaos of observation together. Be flexible about your files.

The analysis itself can then proceed to discover similarities and differences: what re-appears in the field, which events seem to indicate the same pattern of behavior or thought, as well as what is "deviant" in the research site, and so on. Note, of course, that it is typical for field research that observing, formulating theory, evaluating theory, and analyzing data, can all occur throughout the research process.

Important tools to avoid problems of mis-interpretation or biased observations include: add quantitative findings to your field observations (triangulation), keep in touch with a supervisor, and ensure your self-awareness (introspection).

In writing up the report, an account of the method of observation and/or participation, as well as reflections of the researcher's experiences and motives are inevitable.

4. Advantages and Disadvantages of Field Research

Field research is especially appropriate if you want to research a social phenomenon as completely as possible (comprehensiveness), within its natural setting, and over some period of time. Also, the method is flexible and can move freely from induction to deduction, it is relatively inexpensive.

With regard to validity, field research is generally stronger than survey research. But as a matter of reliability, the method may be too much tied up to the person that did the research (which is why their methods and experiences have to be reported and evaluated).

Finally, field research lacks generalizability, because of the uniqueness of the researcher's investigative qualities, because the comprehensiveness of research essentially excludes generalizability, and because of selectivity in observations and question asking. Therefore, the findings of field research are suggestive (not definitive).

D. UNOBTRUSIVE RESEARCH

Survey research and in-depth interviewing affect their object of study in at least (and hopefully only) one way: people are confronted with social-science research! Unobtrusive methods of inquiry, on the other hand, have no impact on what is being studied. There are three methods of unobtrusive research— content analysis, analysis of statistics, and historical analysis.

1. Content and Document Analysis

Content analysis refers to the quantitative study of written and oral documents. This requires sampling of the units of analysis in a source (best probability sampling), codification of the units, and finally classification of the units to reveal their manifest and latent content.

Document analysis refers to the qualitative study of traces of the past: it involves the in-depth investigation of sources and aims at hermeneutic understanding.

2. Historical Analysis

Historical research refers to the study of the past through an examination of the traces the past has left behind (written documents, oral histories, and artefacts). The procedure of historical research typically involves— (1) selection of sources relevant for research; (2) identification and registration of sources

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according to formal and substantial criteria; (3) confrontation and (internal/external) critique of sources; (4) interpretation and analysis of sources to determine who said what to whom, why, how, and with what effect.

Three methods of data collection can be used in historical research (note that these methods do not have to be, but can be historical): content analysis, document analysis, and historical study of statistics. The historical investigation of statistics can trace a pattern over time (e.g. crime reports). Of course, you are again stuck to what you found (validity!).

3. *Advantages and Disadvantages of Unobtrusive Research*

The unobtrusive nature of research is the main advantage of the method: the researcher cannot affect what has happened. Several topics can be studied from this perspective, particularly forms of communication (who says what to whom, why and with what effect). Note that the techniques can be very rigidly applied (good on reliability).

Also, it has the advantage that it saves time and money, and you can study long periods of time. Moreover, unobtrusive historical research can fulfill several purposes: 1) the parallel testing of theories, to apply a theory to several historical cases; 2) the interpretation of contrasting contexts, to reveal the particularities of historical events; and 3) analyzing causalities, to explain why historical events took place.

The main weakness of historical research is the historical fact that it is probably the least developed method of social-science research. Although many reputed sociologists used historical research methods (e.g. Durkheim on the division of labor, Marx and Weber on capitalism, Merton on science and technology), the idea that a study of the past can be meaningful in and by itself, or to grasp the present, only rarely inspires research.

In addition, historical research can only reveal the past inasmuch as it is still present today: important documents, for instance, may be lost or destroyed (bad on validity). Finally, because of the often less rigid nature of this method of inquiry, the researcher can (invalidly) affect his/her picture of what has happened. Therefore, corroboration, the cross-checking of various sources, is helpful.

E. EVALUATION RESEARCH

Evaluation research is intended to evaluate the impact of social interventions, as an instance of applied research, it intends to have a real-world effect.

Just about any topic related to occurred or planned social intervention can be researched. Basically, it intends to research whether the intended result of an intervention strategy was produced.

1. *Measurement in Evaluation Research*

The basic question is coming to grips with the intended result: how can it be measured, so the goal of an intervention program has to be operationalized for it to be assessed in terms of success (or failure).

The outcome of a program has to be measured, best by specifying the different aspects of the desired outcome. The context within which an outcome occurred has to be analyzed. The intervention, as an experimental manipulation, has to be measured too. Other variables that can be researched include the population of subjects that are involved in the program. Measurement is crucial and therefore new techniques can be produced (validity), or older ones adopted (reliability).

The outcome can be measured in terms of whether an intended effect occurred or not, or whether the benefits of an intervention outweighed the costs thereof (cost/benefit analysis). The criteria of success and failure ultimately rest on an agreement.

The evaluation can occur by experiment, or by quasi-experiment. Time-series analysis, for instance, can analyze what happened for a longer period before and after an intervention, and with the use of multiple time-series designs, we can also compare with a pseudo control group.

2. *The Context in Evaluation Research*

There are a number of problems to be overcome in evaluation research. First, Logistical problems refer to getting the subjects to do what they are supposed to do. This includes getting them motivated, and ensuring a proper administration. Second, ethical problems include concerns over the control group (which is not manipulated, and whose members may experience deprivation).

It is hard to overlook what is done with the findings of an evaluation research, for instance, because the findings are not comprehensible to the subjects, because they contradict 'intuitive' beliefs, or because they run against vested interests.

Note social indicators research as a special type of evaluation research. This is the analysis of social indicators over time (pattern of evolution) and/or across societies (comparison). These indicators are aggregated statistics that reflect the condition of a society or a grouping.

3. *Advantages and Disadvantages of Evaluation Research*

The main advantage is that evaluation research can reveal whether policies work, or at least identify when they do not work (pragmatism), right away (when we use experiments) or over a long period of time and across societies (indicators). (different research instruments can be used in evaluation research)

The disadvantages include the special logistic and administrative problems, as well as the ethical considerations. Also, it can usually only measure the means, given certain program goals, but cannot go into questioning those goals themselves.

Summary

1. Research includes any gathering of data, information and facts for the advancement of knowledge.
2. Research must be organized and undergo planning, including performing

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literature reviews of past research and evaluating what questions need to be answered.

3. Basic research (also called fundamental or pure research) has as its primary objective the advancement of knowledge and the theoretical understanding of the relations among variables.
4. The ultimate aims of research are to generate measurable and testable data, gradually adding to the accumulation of human knowledge. Ancient philosophers believed that all answers could be achieved through deduction and reasoning, rather than measurement.
5. A research problem is the situation that causes the researcher to feel apprehensive, confused and ill at ease. It is the demarcation of a problem area within a certain context involving the WHO or WHAT, the WHERE, the WHEN and the WHY of the problem situation.
6. A thorough literature study is an indispensable component of all research. It familiarises the researcher with both research which has already been done in his field as well as with current research.
7. A hypothesis is defined as "A tentative proposition suggested as a solution to a problem or as an explanation of some phenomenon."

Review Questions

1. What are the fundamental aims of research? Discuss.
2. Discuss the essential steps of the method of research.
3. How is hypothesis formulated?
4. How is research problems identified?
5. How is research problems formulated?
6. What are the most valuable importance of literature survey in research?
7. Discuss the research process in detail.
8. How is research designed, measured and operationalized?
9. Discuss the method of observation in research methodology.

Further Readings

- Bhanwar Lal garg, Renu Kavdia, Sulochana Agrawal and Umesh Kumar Agarwal; ***An Introduction to Research Methodology***, RBSA Publcation.
- K. Chandrakandan and Karthikeyan; ***Behavioural Research Methodology***, Classical.
- Ary, D., Lucy, C. Jacobs and Razavich, A., ***Introduction to Research in Education***, Third Edition, New york: Holt, Rinehart and Winston Inc., 1972.
- Campbell, D.T. & Stanley, J.C. (1966). ***Experimental and quasi-experimental designs for research.*** Chicago: RandMcNally.
- Drew, C.J. & Hardman, M.L. (1985). ***Designing and conducting behavioral research***. New York: Pergamon Press. (Part II, "Basic Design Considerations").

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UNIT – II

RESEARCH METHODS

STRUCTURE

Learning Objectives

After going through the unit students will be able to :

- to classify the research methods;
- to know case study and evaluation research;
- understand the uses and process of content analysis;

INTRODUCTION

Research is defined as human activity based on intellectual application in the investigation of matter as we have already discussed in the previous unit. The primary purpose for applied research is discovering, interpreting, and the development of methods and systems for the advancement of human knowledge on a wide variety of scientific matters of our world and the universe. Research can use the scientific method, but need not do so.

Scientific research relies on the application of the scientific method, a harnessing of curiosity. This research provides scientific information and theories for the explanation of the nature and the properties of the world around us. It makes practical applications possible. Scientific research is funded by public authorities, by charitable organisations and by private groups, including many companies. Scientific research can be subdivided into different classifications according to their academic and application disciplines.

Historical research is embodied in the historical method.

The term research is also used to describe an entire collection of information about a particular subject.

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TYPES OF RESEARCH METHODS

The goal of the research process is to produce new knowledge, which takes three main forms (although, as previously discussed, the boundaries between them may be fuzzy):

- *Exploratory research,* which structures and identifies new problems
- *Constructive research,* which develops solutions to a problem
- *Empirical research,* which tests the feasibility of a solution using empirical evidence

Research can also fall into two distinct types:

- Primary research
- Secondary research

Research is often conducted using the hourglass model Structure of Research. The hourglass model starts with a broad spectrum for research, focusing in on the required information through the methodology of the project (like the neck of the hourglass), then expands the research in the form of discussion and results.

Exploratory Research

Exploratory research is a type of research conducted because a problem has not been clearly defined. Exploratory research helps determine the best research design, data collection method and selection of subjects. Given its fundamental nature, exploratory research often concludes that a perceived problem does not actually exist.

Exploratory research often relies on secondary research such as reviewing available literature and/or data, or qualitative approaches such as informal discussions with consumers, employees, management or competitors, and more formal approaches through in-depth interviews, focus groups, projective methods, case studies or pilot studies.

The results of exploratory research are not usually useful for decision-making by themselves, but they can provide significant insight into a given situation. Although the results of qualitative research can give some indication as to the "why", "how" and "when" something occurs, it cannot tell us "how often" or "how many."

Exploratory research is not typically generalizable to the population at large.

A defining characteristic of causal research is the random assignment of participants to the conditions of the experiment; e.g., an Experimental and a Control Condition.. Such assignment results in the groups being comparable at the beginning of the experiment.

Any difference between the groups at the end of the experiment is attributable to the manipulated variable. Observational research typically looks for difference among "in-tact" defined groups. A common example compares smokers and non-smokers with regard to health problems. Causal conclusions can't be drawn from such a study because of other possible differences between the groups; e.g.,smokers may drink more alcohol than non-smokers. Other unknown differences could exist as well. Hence, we may see a relation between smoking and health but a conclusion that smoking is a cause would not be warranted in this situation.

Social Science

In many social science circles, exploratory research "seeks to find out how people get along in the setting under question, what meanings they give to their actions, and what issues concern them.

The goal is to learn 'what is going on here?' and to investigate social phenomena without explicit expectations." This methodology can is also at times referred to as a 'grounded theory' approach to 'qualitative research' or 'interpretive research', and is an attempt to 'unearth' a theory from the data itself rather than from a pre-disposed hypothesis.

There are three types of objective in a marketing research project.

- Exploratory Research
- Descriptive research
- Causal research

Exploratory Research: 'The objective of exploratory research is to gather preliminary information that will help define problems and suggest hypotheses.'

Descriptive Research: 'The objective of descriptive research is to describe things, such as the market potential for a product or the demographics and attitudes of consumers who buy the product.'

Causal Research: 'The objective of causal Research is to test hypotheses about cause-and-effect relationships.

Constructive Research

Constructive research is perhaps the most common computer science research method. This type of approach demands a form of validation that doesn't need to be quite as empirically based as in other types of research like exploratory research.

Nevertheless the conclusions have to be objectively argued and defined. This may involve evaluating the "construct" being developed analytically against some predefined criteria or performing some benchmark tests with the prototype.

The term "construct" is often used in this context to refer to the new contribution being developed. Construct can be a new theory, algorithm, model, software, or a framework.

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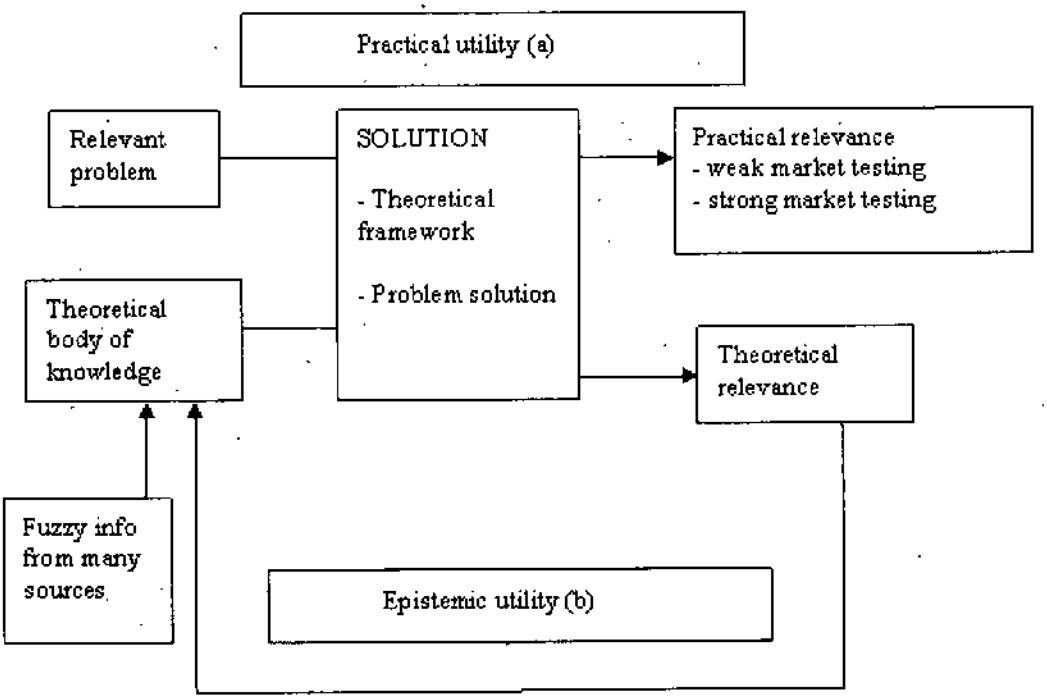

The following phrases explain the above figure:

— The "fuzzy info from many sources" tab refers to different info sources like training materials, processes, literature, articles, working experience etc.

— In the "solution" tab, "theoretical framework" represents a tool to be used in the problem solving.

— The "practical relevance" tab it refers to empirical knowledge creation that offers final benefits.

— The "theoretical relevance" tab it gives the new theoretical knowledge that needs scientific acceptance: the back arrow to "theoretical body of knowledge" tab.

Steps to be followed in "practical utility" tab (a):

- set objectives and tasks
- identify process model
- select case execution
- interview case organization
- prepare simulation
- run simulation
- interpret simulation results
- give feedback

Steps to be followed in "epistemic utility" tab (b):

- constructive research
- case research
- surveys

- qualitative and quantitative methods
- theory creating
- theory testing

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Empirical Research

Empirical research is any research that bases its findings on direct or indirect observation as its test of reality. Such research may also be conducted according to hypothetico-deductive procedures, such as those developed from the work of R. A. Fisher.

The researcher attempts to describe accurately the interaction between the instrument (or the human senses) and the entity being observed. If instrumentation is involved, the researcher is expected to calibrate her/his instrument by applying it to known standard objects and documenting the results before applying it to unknown objects.

In practice, the accumulation of evidence for or against any particular theory involves planned research designs for the collection of empirical data, and academic rigor plays a large part of judging the merits of research design. Several typographies for such designs have been suggested, one of the most popular of which comes from Campbell and Stanley (1963). They are responsible for popularizing the widely cited distinction among pre-experimental, experimental, and quasi-experimental designs and are staunch advocates of the central role of randomized experiments in educational research.

Empirical Cycle

A.D. de Groot's empirical cycle:

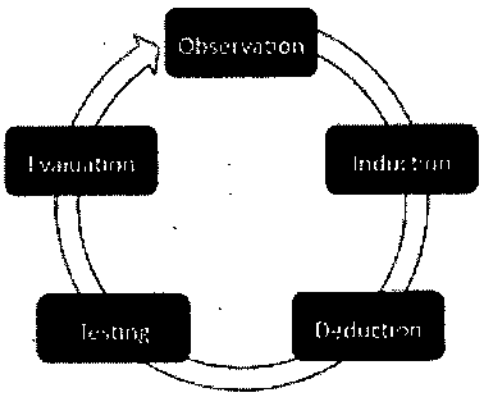
Observation: The collecting and organisation of empirical facts; Forming hypotheses.

Induction: Formulating hypotheses.

Deduction: Deducting consequenses of hypotheses as testable predictions.

Testing: Testing the hypotheses with new empirical material.

Evaluation: Evaluating the outcome of testing.



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Primary Research

Primary research (also called field research) involves the collection of data that does not already exist. This can be through numerous forms, including questionnaires and telephone interviews amongst others. This information may be collected in things like questionnaires, magazines, and Interviews

The term is widely used in market research and competitive intelligence.

- May be very expensive because many people need to be confronted.
- By the time the research is complete it may be out of date.
- People may have to be employed or avoid their primary duties for the duration of the research.
- People may not reply if emails or letters are used.

Secondary Research

Secondary research (also known as desk research) involves the summary, collation and/or synthesis of existing research rather than primary research, where data is collected from, for example, research subjects or experiments.

The term is widely used in market research and in medical research. The principal methodology in medical secondary research is the systematic review, commonly using meta-analytic statistical techniques, although other methods of synthesis, like realist reviews and meta-narrative reviews, have been developed in recent years.

HISTORICAL AND EXPERIMENTAL RESEARCH METHODS

The historical method comprises the techniques and guidelines by which historians use primary sources and other evidence to research and then to write histories in form of accounts of the past. The question of the nature, and indeed the possibility, of sound historical method is raised in the philosophy of history, as a question of epistemology.

Source Criticism

Core Principles

The following core principles of source criticism were formulated by two Scandinavian historians, Olden-Jorgensen (1998) and Thurén (1997):

- Human sources may be relics (e.g. a fingerprint) or narratives (e.g. a statement or a letter). Relics are more credible sources than narratives.
- A given source may be forged or corrupted; strong indications of the originality of the source increases its reliability.
- The closer a source is to the event which it purports to describe, the more one can trust it to give an accurate description of what really happened.
- A primary source is more reliable than a secondary source, that is more reliable than a tertiary source and so on.

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- If a number of independent sources contain the same message, the credibility of the message is strongly increased.
- The tendency of a source is its motivation for providing some kind of bias. Tendencies should be minimized or supplemented with opposite motivations.
- If it can be demonstrated that the witness (or source) has no direct interest in creating bias, the credibility of the message is increased.

Procedures

Bernheim (1889) and Langlois & Seignobos (1898) proposed a seven-step procedure for source criticism in history:

1. If the sources all agree about an event, historians can consider the event proved.
2. However, majority does not rule; even if most sources relate events in one way, that version will not prevail unless it passes the test of critical textual analysis.
3. The source whose account can be confirmed by reference to outside authorities in some of its parts can be trusted in its entirety if it is impossible similarly to confirm the entire text.
4. When two sources disagree on a particular point, the historian will prefer the source with most "authority" i.e., the source created by the expert or by the eyewitness.
5. Eyewitnesses are, in general, to be preferred, especially in circumstances where the ordinary observer could have accurately reported what transpired and, more specifically, when they deal with facts known by most contemporaries.
6. If two independently created sources agree on a matter, the reliability of each is measureably enhanced.
7. When two sources disagree (and there is no other means of evaluation), then historians take the source which seems to accord best with common sense.

The process of learning and understanding the background and growth of a chosen field of study or profession can offer insight into organizational culture, current trends, and future possibilities. The historical method of research applies to all fields of study because it encompasses their: origins, growth, theories, personalities, crisis, etc. Both quantitative and qualitative variables can be used in the collection of historical information. Once the decision is made to conduct historical research, there are steps that should be followed to achieve a reliable result. Charles Busha and Stephen Harter detail six steps for conducting historical research:

1. the recognition of a historical problem or the identification of a need for certain historical knowledge.
2. the gathering of as much relevant information about the problem or topic as possible.

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3. if appropriate, the forming of hypothesis that tentatively explain relationships between historical factors.
4. The rigorous collection and organization of evidence, and the verification of the authenticity and veracity of information and its sources.
5. The selection, organization, and analysis of the most pertinent collected evidence, and the drawing of conclusions; and
6. the recording of conclusions in a meaningful narrative.

In the field of library and information science, there are a vast array of topics that may be considered for conducting historical research. For example, a researcher may chose to answer questions about the development of school, academic or public libraries, the rise of technology and the benefits/ problems it brings, the development of preservation methods, famous personalities in the field, library statistics, or geographical demographics and how they effect library distribution. Harter and Busha define library history as "the systematic recounting of past events pertaining to the establishment, maintenance, and utilization of systematically arranged collections of recorded information or knowledge....A biography of a person who has in some way affected the development of libraries, library science, or librarianship is also considered to be library history."

There are a variety of places to obtain historical information. Primary Sources are the most sought after in historical research. Primary resources are first hand accounts of information. "Finding and assessing primary historical data is an exercise in detective work. It involves logic, intuition, persistence, and common sense...(Tuchman, Gaye in Strategies of Qualitative Inquiry, 252). Some examples of primary documents are: personal diaries, eyewitness accounts of events, and oral histories. "Secondary sources of information are records or accounts prepared by someone other than the person, or persons, who participated in or observed an event." Secondary resources can be very useful in giving a researcher a grasp on a subject and may provided extensive bibliographic information for delving further into a research topic.

In any type of historical research, there are issues to consider. Harter and Busha list three principles to consider when conducting historical research:

1. Consider the slant or biases of the information you are working with and the ones possessed by the historians themselves.
   a. This is particularly true of qualitative research. Consider an example provided by Gaye Tuchman:

> Let us assume that women's letters and diaries are pertinent to ones research question and that one can locate pertinent examples. One cannot simply read them....one must read enough examples to infer the norms of what could be written and how it could be expressed. For instance, in the early nineteenth century, some (primarily female) schoolteachers instructed girls in journal writing and read their journals to do so. How would such instruction have influenced the journals kept by these girls as adults?...it is useful to view the nineteenth-century journal writer as an informant. Just as one tries

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to understand how a contemporary informant speaks from specific social location, so too one would want to establish the social location of the historical figure. One might ask of these and other diaries: What is the characteristic of middle-class female diary writers? What is the characteristic of this informant? How should one view what this informant writes?

b. Quantitative facts may also be biased in the types of statistical data collected or in how that information was interpreted by the researcher.

2. There are many factors that can contribute to "historical episodes".
3. Evidence should not be examined from a singular point of view.

The resources that follow this brief introduction to the historical method in research provide resources for further in-depth explanations about this research method in various fields of study, and abstracts of studies conducted using this method.

Experimental Research Methods

Experimental research designs are used for the controlled testing of causal processes. The general procedure is one or more independent variables are manipulated to determine their effect on a dependent variable. These designs can be used where: (1) There is time priority in a causal relationship (cause precedes effect), (2) There is consistency in a causal relationship (a cause will always lead to the same effect), and (3) The magnitude of the correlation is great. The most common applications of these designs in marketing research and experimental economics are test markets and purchase labs. The techniques are commonly used in other social sciences including sociology, psychology and social work.

Experimental Research Designs

In an attempt to control for extraneous factors, several experimental research designs have been developed, including:

- **Classical pretest-post test** - The total population of participants is randomly divided into two samples; the control sample, and the experimental sample. Only the experimental sample is exposed to the manipulated variable. The researcher compares the pretest results with the post test results for both samples. Any divergence between the two samples is assumed to be a result of the experiment.
- **Solomon four group design** - The population is randomly divided into four samples. Two of the groups are experimental samples. Two groups experience no experimental manipulation of variables. Two groups receive a pretest and a post test. Two groups receive only a post test. This is an improvement over the classical design because it controls for the effect of the pretest.
- **Factorial design** - this is similar to a classical design except additional samples are used. Each group is exposed to a different experimental manipulation.

CASE-STUDY RESEARCH

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Case study research excels at bringing us to an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research. Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships. Researchers have used the case study research method for many years across a variety of disciplines. Social scientists, in particular, have made wide use of this qualitative research method to examine contemporary real-life situations and provide the basis for the application of ideas and extension of methods. Researcher Robert K. Yin defines the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used.

Critics of the case study method believe that the study of a small number of cases can offer no grounds for establishing reliability or generality of findings. Others feel that the intense exposure to study of the case biases the findings. Some dismiss case study research as useful only as an exploratory tool. Yet researchers continue to use the case study research method with success in carefully planned and crafted studies of real-life situations, issues, and problems. Reports on case studies from many disciplines are widely available in the literature.

This unit explains how to use the case study method and then applies the method to an example case study project designed to examine how one set of users, non-profit organizations, make use of an electronic community network. The study examines the issue of whether or not the electronic community network is beneficial in some way to non-profit organizations and what those benefits might be.

Many well-known case study researchers such as Robert E. Stake, Helen Simons, and Robert K. Yin have written about case study research and suggested techniques for organizing and conducting the research successfully. This introduction to case study research draws upon their work and proposes six steps that should be used:

- Determine and define the research questions
- Select the cases and determine data gathering and analysis techniques
- Prepare to collect the data
- Collect data in the field
- Evaluate and analyze the data
- Prepare the report

Step 1. Determine and Define the Research Questions

The first step in case study research is to establish a firm research focus to which the researcher can refer over the course of study of a complex phenomenon or object. The researcher establishes the focus of the study by forming questions about the situation or problem to be studied and determining a purpose for the study. The research object in a case study is often a program, an entity, a person, or a group of people. Each object is likely to be intricately connected to political,

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social, historical, and personal issues, providing wide ranging possibilities for questions and adding complexity to the case study. The researcher investigates the object of the case study in depth using a variety of data gathering methods to produce evidence that leads to understanding of the case and answers the research questions.

Case study research generally answers one or more questions which begin with "how" or "why." The questions are targeted to a limited number of events or conditions and their inter-relationships. To assist in targeting and formulating the questions, researchers conduct a literature review. This review establishes *what research has been previously conducted and leads to refined, insightful* questions about the problem. Careful definition of the questions at the start pinpoints where to look for evidence and helps determine the methods of analysis to be used in the study. The literature review, definition of the purpose of the case study, and early determination of the potential audience for the final report guide how the study will be designed, conducted, and publicly reported.

Step 2. Select the Cases and Determine Data Gathering and Analysis Techniques

During the design phase of case study research, the researcher determines what approaches to use in selecting single or multiple real-life cases to examine in depth and which instruments and data gathering approaches to use. When using multiple cases, each case is treated as a single case. Each case?s conclusions can then be used as information contributing to the whole study, but each case remains a single case. Exemplary case studies carefully select cases and carefully examine the choices available from among many research tools available in order to increase the validity of the study. Careful discrimination at the point of selection also helps erect boundaries around the case.

The researcher must determine whether to study cases which are unique in some way or cases which are considered typical and may also select cases to represent a variety of geographic regions, a variety of size parameters, or other parameters. A useful step in the selection process is to repeatedly refer back to the purpose of the study in order to focus attention on where to look for cases and evidence that will satisfy the purpose of the study and answer the research questions posed. Selecting multiple or single cases is a key element, but a case study can include more than one unit of embedded analysis. For example, a case study may involve study of a single industry and a firm participating in that industry. This type of case study involves two levels of analysis and increases the complexity and amount of data to be gathered and analyzed.

A key strength of the case study method involves using multiple sources and techniques in the data gathering process. The researcher determines in advance what evidence to gather and what analysis techniques to use with the data to answer the research questions. Data gathered is normally largely qualitative, but it may also be quantitative. Tools to collect data can include surveys, interviews, documentation review, observation, and even the collection of physical artifacts.

The researcher must use the designated data gathering tools systematically and properly in collecting the evidence. Throughout the design phase, researchers

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must ensure that the study is well constructed to ensure construct validity, internal validity, external validity, and reliability. Construct validity requires the researcher to use the correct measures for the concepts being studied. Internal validity (especially important with explanatory or causal studies) demonstrates that certain conditions lead to other conditions and requires the use of multiple pieces of evidence from multiple sources to uncover convergent lines of inquiry. The researcher strives to establish a chain of evidence forward and backward. External validity reflects whether or not findings are generalizable beyond the immediate case or cases; the more variations in places, people, and procedures a case study can withstand and still yield the same findings, the more external validity. Techniques such as cross-case examination and within-case examination along with literature review helps ensure external validity. Reliability refers to the stability, accuracy, and precision of measurement. Exemplary case study design ensures that the procedures used are well documented and can be repeated with the same results over and over again.

Step 3. Prepare to Collect the Data

Because case study research generates a large amount of data from multiple sources, systematic organization of the data is important to prevent the researcher from becoming overwhelmed by the amount of data and to prevent the researcher from losing sight of the original research purpose and questions. Advance preparation assists in handling large amounts of data in a documented and systematic fashion. Researchers prepare databases to assist with categorizing, sorting, storing, and retrieving data for analysis.

Exemplary case studies prepare good training programs for investigators, establish clear protocols and procedures in advance of investigator field work, and conduct a pilot study in advance of moving into the field in order to remove obvious barriers and problems. The investigator training program covers the basic concepts of the study, terminology, processes, and methods, and teaches investigators how to properly apply the techniques being used in the study. The program also trains investigators to understand how the gathering of data using multiple techniques strengthens the study by providing opportunities for triangulation during the analysis phase of the study. The program covers protocols for case study research, including time deadlines, formats for narrative reporting and field notes, guidelines for collection of documents, and guidelines for field procedures to be used. Investigators need to be good listeners who can hear exactly the words being used by those interviewed. Qualifications for investigators also include being able to ask good questions and interpret answers. Good investigators review documents looking for facts, but also read between the lines and pursue collaborative evidence elsewhere when that seems appropriate. Investigators need to be flexible in real-life situations and not feel threatened by unexpected change, missed appointments, or lack of office space. Investigators need to understand the purpose of the study and grasp the issues and must be open to contrary findings. Investigators must also be aware that they are going into the world of real human beings who may be threatened or unsure of what the case study will bring.

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After investigators are trained, the final advance preparation step is to select a pilot site and conduct a pilot test using each data gathering method so that problematic areas can be uncovered and corrected. Researchers need to anticipate key problems and events, identify key people, prepare letters of introduction, establish rules for confidentiality, and actively seek opportunities to revisit and revise the research design in order to address and add to the original set of research questions.

4. Collect Data in the Field

The researcher must collect and store multiple sources of evidence comprehensively and systematically, in formats that can be referenced and sorted so that converging lines of inquiry and patterns can be uncovered. Researchers carefully observe the object of the case study and identify causal factors associated with the observed phenomenon. Renegotiation of arrangements with the objects of the study or addition of questions to interviews may be necessary as the study progresses. Case study research is flexible, but when changes are made, they are documented systematically.

Exemplary case studies use field notes and databases to categorize and reference data so that it is readily available for subsequent reinterpretation. They record testimonies, stories, and illustrations which can be used in later reports. They may warn of impending bias because of the detailed exposure of the client to special attention, or give an early signal that a pattern is emerging. They assist in determining whether or not the inquiry needs to be reformulated or redefined based on what is being observed. Field notes should be kept separate from the data being collected and stored for analysis.

Maintaining the relationship between the issue and the evidence is mandatory. The researcher may enter some data into a database and physically store other data, but the researcher documents, classifies, and cross-references all evidence so that it can be efficiently recalled for sorting and examination over the course of the study.

Step 5. Evaluate and Analyze the Data

The researcher examines raw data using many interpretations in order to find linkages between the research object and the outcomes with reference to the original research questions. Throughout the evaluation and analysis process, the researcher remains open to new opportunities and insights. The case study method, with its use of multiple data collection methods and analysis techniques, provides researchers with opportunities to triangulate data in order to strengthen the research findings and conclusions.

The tactics used in analysis force researchers to move beyond initial impressions to improve the likelihood of accurate and reliable findings. Exemplary case studies will deliberately sort the data in many different ways to expose or create new insights and will deliberately look for conflicting data to disconfirm the analysis. Researchers categorize, tabulate, and recombine data to address the initial propositions or purpose of the study, and conduct cross-checks of facts and discrepancies in accounts. Focused, short, repeat interviews may be necessary to gather additional data to verify key observations or check a fact.

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Specific techniques include placing information into arrays, creating matrices of categories, creating flow charts or other displays, and tabulating frequency of events. Researchers use the quantitative data that has been collected to corroborate and support the qualitative data which is most useful for understanding the rationale or theory underlying relationships. Another technique is to use multiple investigators to gain the advantage provided when a variety of perspectives and insights examine the data and the patterns. When the multiple observations converge, confidence in the findings increases. Conflicting perceptions, on the other hand, cause the researchers to pry more deeply.

Another technique, the cross-case search for patterns, keeps investigators from reaching premature conclusions by requiring that investigators look at the data in many different ways. Cross-case analysis divides the data by type across all cases investigated. One researcher then examines the data of that type thoroughly. When a pattern from one data type is corroborated by the evidence from another, the finding is stronger. When evidence conflicts, deeper probing of the differences is necessary to identify the cause or source of conflict. In all cases, the researcher treats the evidence fairly to produce analytic conclusions answering the original "how" and "why" research questions.

Step 6. Prepare the report

Exemplary case studies report the data in a way that transforms a complex issue into one that can be understood, allowing the reader to question and examine the study and reach an understanding independent of the researcher. The goal of the written report is to portray a complex problem in a way that conveys a vicarious experience to the reader. Case studies present data in very publicly accessible ways and may lead the reader to apply the experience in his or her own real-life situation. Researchers pay particular attention to displaying sufficient evidence to gain the reader's confidence that all avenues have been explored, clearly communicating the boundaries of the case, and giving special attention to conflicting propositions.

Techniques for composing the report can include handling each case as a separate chapter or treating the case as a chronological recounting. Some researchers report the case study as a story. During the report preparation process, researchers critically examine the document looking for ways the report is incomplete. The researcher uses representative audience groups to review and comment on the draft document. Based on the comments, the researcher rewrites and makes revisions. Some case study researchers suggest that the document review audience include a journalist and some suggest that the documents should be reviewed by the participants in the study.

Applying the Case Study Method to an Electronic Community Network

By way of example, we apply these six steps to an example study of multiple participants in an electronic community network. All participants are non-profit organizations which have chosen an electronic community network on the World Wide Web as a method of delivering information to the public. The case study method is applicable to this set of users because it can be used to examine the issue of whether or not the electronic community network is beneficial in some way to the organization and what those benefits might be.

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Step 1. Determine and Define the Research Questions

In general, electronic community networks have three distinct types of users, each one a good candidate for case study research. The three groups of users include people around the world who use the electronic community network, the non-profit organizations using the electronic community network to provide information to potential users of their services, and the "community" that forms as the result of interacting with other participants on the electronic community network.

In this case, the researcher is primarily interested in determining whether or not the electronic community network is beneficial in some way to non-profit organization participants. The researcher begins with a review of the literature to determine what prior studies have determined about this issue and uses the literature to define the following questions for the study of the non-profit organizations providing information to the electronic community network:

- Why do non-profit organization participants use the network?
- How do non-profit organization participants determine what to place on the electronic community network?
- Do the non-profit organization participants believe the community network serves a useful purpose in furthering their mission? How?

Step 2. Select the Cases and Determine Data Gathering and Analysis Techniques

Many communities have constructed electronic community networks on the World Wide Web. At the outset of the design phase, the researcher determines that only one of these networks will be studied and further sets the study boundaries to include only some of the non-profit organizations represented on that one network. The researcher contacts the Board of Directors of the community network, who are open to the idea of the case study. The researcher also gathers computer generated log data from the network and, using this data, determines that an in-depth study of representative organizations from four categories — health care, environmental, education, and religious — is feasible. The investigator applies additional selection criteria so that an urban-based and a rural-based non-profit are represented in the study in order to examine whether urban non-profits perceive more benefits from community networks than rural organizations.

The researcher considers multiple sources of data for this study and selects document examination, the gathering and study of organizational documents such as administrative reports, agendas, letters, minutes, and news clippings for each of the organizations. In this case, the investigator decides to also conduct open-ended interviews with key members of each organization using a check-list to guide interviewers during the interview process so that uniformity and consistency can be assured in the data, which could include facts, opinions, and unexpected insights.

In this case study, the researcher cannot employ direct observation as a tool because some of the organizations involved have no office and meet infrequently to conduct business directly related to the electronic community network. The researcher instead decides to survey all Board members of the selected

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organizations using a questionnaire as a third data gathering tool. Within-case and cross-case analysis of data are selected as analysis techniques.

Step 3. Prepare to Collect the Data

The researcher prepares to collect data by first contacting each organization to be studied to gain their cooperation, explain the purpose of the study, and assemble key contact information. Since data to be collected and examined includes organizational documents, the researcher states his intent to request copies of these documents, and plans for storage, classification, and retrieval of these items, as well as the interview and survey data. The researcher develops a formal investigator training program to include seminar topics on non-profit organizations and their structures in each of the four categories selected for this study. The training program also includes practice sessions in conducting open-ended interviews and documenting sources, suggested field notes formats, and a detailed explanation of the purpose of the case study. The researcher selects a fifth case as a pilot case, and the investigators apply the data gathering tools to the pilot case to determine whether the planned timeline is feasible and whether or not the interview and survey questions are appropriate and effective. Based on the results of the pilot, the researcher makes adjustments and assigns investigators particular cases which become their area of expertise in the evaluation and analysis of the data.

Step 4. Collect Data in the Field

Investigators first arrange to visit with the Board of Directors of each non-profit organization as a group and ask for copies of the organization's mission, news clippings, brochures, and any other written material describing the organization and its purpose. The investigator reviews the purpose of the study with the entire Board, schedules individual interview times with as many Board members as can cooperate, confirms key contact data, and requests that all Board members respond to the written survey which will be mailed later.

Investigators take written notes during the interview and record field notes after the interview is completed. The interviews, although open-ended, are structured around the research questions defined at the start of the case study.

Research Question: Why do non-profit organization participants use the network?

Interview Question: How did the organization make the decision to place data on the World Wide Web community network? What need was the organization hoping to fulfil?

Research Question: How do non-profit organization participants determine what to place on the electronic community network?

Interview Questions: What process was used to select the information that would be used on the network? How is the information kept up to date?

Research Question: Do the non-profit organization participants believe the community network serves a useful purpose in furthering their mission? How?

Interview Question: How does the organization know if the electronic community network is beneficial to the organization? How does the electronic

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community network further the mission of the organization? What systematic tracking mechanisms exist to determine how many or what types of users are accessing the organization information?

The investigator's field notes record impressions and questions that might assist with the interpretation of the interview data. The investigator makes note of stories told during open-ended interviews and flags them for potential use in the final report. Data is entered into the database.

The researcher mails written surveys to all Board members with a requested return date and a stamped return envelope. Once the surveys are returned, the researcher codes and enters the data into the database so that it can be used independently as well as integrated when the case study progresses to the point of cross-case examination of data for all four cases.

Step 5. Evaluate and Analyze the Data

Within-case analysis is the first analysis technique used with each non-profit organization under study. The assigned investigator studies each organization?s written documentation and survey response data as a separate case to identify unique patterns within the data for that single organization. Individual investigators prepare detailed case study write-ups for each organization, categorizing interview questions and answers and examining the data for within-group similarities and differences.

Cross-case analysis follows. Investigators examine pairs of cases, categorizing the similarities and differences in each pair. Investigators then examine similar pairs for differences, and dissimilar pairs for similarities. As patterns begin to emerge, certain evidence may stand out as being in conflict with the patterns. In those cases, the investigator conducts follow-up focused interviews to confirm or correct the initial data in order to tie the evidence to the findings and to state relationships in answer to the research questions.

Step 6 Prepare the Report

The outline of the report includes thanking all of the participants, stating the problem, listing the research questions, describing the methods used to conduct the research and any potential flaws in the method used, explaining the data gathering and analysis techniques used, and concluding with the answers to the questions and suggestions for further research. Key features of the report include a retelling of specific stories related to the successes or disappointments experienced by the organizations that were conveyed during data collection, and answers or comments illuminating issues directly related to the research questions.

The researcher develops each issue using quotations or other details from the data collected, and points out the triangulation of data where applicable. The report also includes confirming and conflicting findings from literature reviews. The report conclusion makes assertions and suggestions for further research activity, so that another researcher may apply these techniques to another electronic community network and its participants to determine whether similar findings are identifiable in other communities. Final report distribution includes all participants.

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Applicability to Library and Information Science

Case study research, with its applicability across many disciplines, is an appropriate methodology to use in library studies. In Library and Information Science, case study research has been used to study reasons why library school programs close (Paris, 1988), to examine reference service practices in university library settings (Lawson, 1971), and to examine how questions are negotiated between customers and librarians (Taylor, 1967). Much of the research is focused exclusively on the librarian as the object or the customer as the object. Researchers could use the case study method to further study the role of the librarian in implementing specific models of service. For example, case study research could examine how information-seeking behavior in public libraries compares with information-seeking behavior in places other than libraries, to conduct in-depth studies of non-library community based information services to compare with library based community information services, and to study community networks based in libraries.

Conclusion

Case studies are complex because they generally involve multiple sources of data, may include multiple cases within a study, and produce large amounts of data for analysis. Researchers from many disciplines use the case study method to build upon theory, to produce new theory, to dispute or challenge theory, to explain a situation, to provide a basis to apply solutions to situations, to explore, or to describe an object or phenomenon. The advantages of the case study method are its applicability to real-life, contemporary, human situations and its public accessibility through written reports. Case study results relate directly to the common reader?s everyday experience and facilitate an understanding of complex real-life situations.

EVALUATION RESEARCH

Evaluation is systematic determination of merit, worth, and significance of something or someone using criteria against a set of standards. Evaluation often is used to characterize and appraise subjects of interest in a wide range of human enterprises, including the arts, criminal justice, foundations and non-profit organizations, government, health care, and other human services.

Evaluation Standards and Meta-Evaluation

Depending on the topic of interest, there are professional groups which look to the quality and rigor of the evaluation process.

The Joint Committee on Standards for Educational Evaluation has developed standards for educational programmes, personnel, and student evaluation. The Joint Committee standards are broken into four sections: Utility, Feasibility, Propriety, and Accuracy. Various European institutions have also prepared their own standards, more or less related to those produced by the Joint Committee. They provide guidelines about basing value judgments on systematic inquiry,

evaluator competence and integrity, respect for people, and regard for the general and public welfare.

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The American Evaluation Association has created a set of Guiding Principles for evaluators. The order of these principles does not imply priority among them; priority will vary by situation and evaluator role. The principles run as follows:

- *Systematic Inquiry:* Evaluators conduct systematic, data-based inquiries about whatever is being evaluated.
- *Competence:* Evaluators provide competent performance to stakeholders.
- *Integrity / Honesty:* Evaluators ensure the honesty and integrity of the entire evaluation process.
- *Respect for People:* Evaluators respect the security, dignity and self-worth of the respondents, program participants, clients, and other stakeholders with whom they interact.
- *Responsibilities for General and Public Welfare:* Evaluators articulate and take into account the diversity of interests and values that may be related to the general and public welfare.

Furthermore, the international organizations such as the I.M.F. and the World Bank have independent evaluation functions. The various funds, programmes, and agencies of the United Nations has a mix of independent, semi-independent and self-evaluation functions, which have organized themselves as a system-wide UN Evaluation Group (UNEG), that works together to strengthen the function, and to establish UN norms and standards for evaluation. There is also an evaluation group within the OECD-DAC, which endeavors to improve development evaluation standards.

Evaluation Approaches

Evaluation approaches are conceptually distinct ways of thinking about, designing and conducting evaluation efforts. Many of the evaluation approaches in use today make truly unique contributions to solving important problems, while others refine existing approaches in some way.

Classification of Approaches

Two classifications of evaluation approaches by House and Stufflebeam & Webster can be combined into a manageable number of approaches in terms of their unique and important underlying principles.

House considers all major evaluation approaches to be based on a common ideology, liberal democracy. Important principles of this ideology include freedom of choice, the uniqueness of the individual, and empirical inquiry grounded in objectivity. He also contends they are all based on subjectivist ethics, in which ethical conduct is based on the subjective or intuitive experience of an individual or group. One form of subjectivist ethics is utilitarian, in which "the good" is determined by what maximizes some single, explicit interpretation of happiness for society as a whole. Another form of subjectivist ethics is intuitionist / pluralist, in which no single interpretation of "the good" is assumed and these interpretations need not be explicitly stated nor justified.

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These ethical positions have corresponding epistemologies—philosophies of obtaining knowledge. The objectivist epistemology is associated with the utilitarian ethic. In general, it is used to acquire knowledge capable of external verification (intersubjective agreement) through publicly inspectable methods and data. The subjectivist epistemology is associated with the intuitionist/pluralist ethic. It is used to acquire new knowledge based on existing personal knowledge and experiences that are (explicit) or are not (tacit) available for public inspection.

House further divides each epistemological approach by two main political perspectives. Approaches can take an elite perspective, focusing on the interests of managers and professionals. They also can take a mass perspective, focusing on consumers and participatory approaches.

Stufflebeam and Webster place approaches into one of three groups according to their orientation toward the role of values, an ethical consideration. The political orientation promotes a positive or negative view of an object regardless of what its value actually might be. They call this pseudo-evaluation. The questions orientation includes approaches that might or might not provide answers specifically related to the value of an object. They call this quasi-evaluation. The values orientation includes approaches primarily intended to determine the value of some object. They call this true evaluation.

When the above concepts are considered simultaneously, fifteen evaluation approaches can be identified in terms of epistemology, major perspective (from House), and orientation (from Stufflebeam & Webster). Two pseudo-evaluation approaches, politically controlled and public relations studies, are represented. They are based on an objectivist epistemology from an elite perspective. Six quasi-evaluation approaches use an objectivist epistemology. Five of them—experimental research, management information systems, testing programs, objectives-based studies, and content analysis—take an elite perspective. Accountability takes a mass perspective. Seven true evaluation approaches are included. Two approaches, decision-oriented and policy studies, are based on an objectivist epistemology from an elite perspective. Consumer-oriented studies are based on an objectivist epistemology from a mass perspective. Two approaches—accreditation/certification and connoisseur studies—are based on a subjectivist epistemology from an elite perspective. Finally, adversary and client-centered studies are based on a subjectivist epistemology from a mass perspective.

Summary of Approaches

Pseudo-evaluation

Politically controlled and public relations studies are based on an objectivist epistemology from an elite perspective. Although both of these approaches seek to misrepresent value interpretations about some object, they go about it a bit differently. Information obtained through politically controlled studies is released or withheld to meet the special interests of the holder.

Public relations information is used to paint a positive image of an object regardless of the actual situation. Neither of these approaches is acceptable

evaluation practice, although the seasoned reader can surely think of a few examples where they have been used.

Objectivist, elite, quasi-evaluation

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As a group, these approaches represent a highly respected collection of disciplined inquiry approaches. They are considered quasi-evaluation approaches because particular studies legitimately can focus only on questions of knowledge without addressing any questions of value. Such studies are, by definition, not evaluations. These approaches can produce characterizations without producing appraisals, although specific studies can produce both. Each of these approaches serves its intended purpose well. They are discussed roughly in order of the extent to which they approach the objectivist ideal.

Experimental research is the best approach for determining causal relationships between variables. The potential problem with using this as an evaluation approach is that its highly controlled and stylized methodology may not be sufficiently responsive to the dynamically changing needs of most human service programs.

Management information systems (MISs) can give detailed information about the dynamic operations of complex programs. However, this information is restricted to readily quantifiable data usually available at regular intervals.

Testing programs are familiar to just about anyone who has attended school, served in the military, or worked for a large company. These programs are good at comparing individuals or groups to selected norms in a number of subject areas or to a set of standards of performance. However, they only focus on testee performance and they might not adequately sample what is taught or expected.

Objectives-based approaches relate outcomes to prespecified objectives, allowing judgements to be made about their level of attainment. Unfortunately, the objectives are often not proven to be important or they focus on outcomes too narrow to provide the basis for determining the value of an object.

Content analysis is a quasi-evaluation approach because content analysis judgements need not be based on value statements. Instead, they can be based on knowledge. Such content analyses are not evaluations. On the other hand, when content analysis judgements are based on values, such studies are evaluations.

Objectivist, mass, quasi-evaluation

Accountability is popular with constituents because it is intended to provide an accurate accounting of results that can improve the quality of products and services. However, this approach quickly can turn practitioners and consumers into adversaries when implemented in a heavy-handed fashion.

Objectivist, elite, true evaluation

Decision-oriented studies are designed to provide a knowledge base for making and defending decisions. This approach usually requires the close collaboration between an evaluator and decision-maker, allowing it to be susceptible to corruption and bias.

Policy studies provide general guidance and direction on broad issues by identifying and assessing potential costs and benefits of competing policies. The

drawback is these studies can be corrupted or subverted by the politically motivated actions of the participants.

Objectivist, mass, true evaluation

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Consumer-oriented studies are used to judge the relative merits of goods and services based on generalized needs and values, along with a comprehensive range of effects. However, this approach does not necessarily help practitioners improve their work, and it requires a very good and credible evaluator to do it well.

Subjectivist, elite, true evaluation

Accreditation / certification programs are based on self-study and peer review of organizations, programs, and personnel. They draw on the insights, experience, and expertise of qualified individuals who use established guidelines to determine if the applicant should be approved to perform specified functions. However, unless performance-based standards are used, attributes of applicants and the processes they perform often are overemphasized in relation to measures of outcomes or effects.

Connoisseur studies use the highly refined skills of individuals intimately familiar with the subject of the evaluation to critically characterize and appraise it. This approach can help others see programs in a new light, but it is difficult to find a qualified and unbiased connoisseur.

Subjectivist, mass, true evaluation

The adversary approach focuses on drawing out the pros and cons of controversial issues through quasi-legal proceedings. This helps ensure a balanced presentation of different perspectives on the issues, but it is also likely to discourage later cooperation and heighten animosities between contesting parties if "winners" and "losers" emerge.

Client-centered studies address specific concerns and issues of practitioners and other clients of the study in a particular setting. These studies help people understand the activities and values involved from a variety of perspectives. However, this responsive approach can lead to low external credibility and a favorable bias toward those who participated in the study.

CONTENT ANALYSIS

Content analysis is a methodology in the social sciences for studying the content of communication. Earl Babbie defines it as "the study of recorded human communications, such as books, websites, paintings and laws." It is most commonly used by researchers in the social sciences to analyze recorded transcripts of interviews with participants.

Content analysis is also considered a scholarly methodology in the humanities by which texts are studied as to authorship, authenticity, of meaning. This latter subject include philology, hermeneutics, and semiotics.

Harold Lasswell formulated the core questions of content analysis: "Who says what, to whom, why, to what extent and with what effect?." Ole Holsti (1969) offers a broad definition of content analysis as "any technique for making inferences

by objectively and systematically identifying specified characteristics of messages." Kimberly A. Neuendorf (2002) offers a six-part definition of content analysis:

> "Content analysis is an indepth analysis using quantitative or qualitative techniques of messages using a scientific method (including attention to objectivity-intersubjectivity, a priori design, reliability, validity, generalizability, replicability, and hypothesis testing) and is not limited as to the types of variables that may be measured or the context in which the messages are created or presented."

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Description

In the 1931s, Alfred R Lindesmith developed a methodology to refute existing hypotheses, which became known as a content analysis technique, and it gained popularity in the 1960s by Glaser and is referred to as the "The Constant Comparative Method of Qualitative Analysis" in an article published in 1964-65. Glaser and Strauss (1967) referred to their adaptation of it as "Grounded Theory." The method of content analysis enables the researcher to include large amounts of textual information and systematically identify its properties, e.g. the frequencies of most used keywords (KWIC meaning "Key Word in Context") by detecting the more important structures of its communi—cation content. Yet such amounts of textual information must be categorised analysis, providing at the end a meaningful reading of content under—scrutiny. David Robertson (1976:73-75) for example created a coding frame for a comparison of modes of party competition between British and American parties. It was developed further in 1979 by the Manifesto Research Group aiming at a comparative content-analytic approach on the policy positions of political parties. This classification scheme was also used to accomplish a comparative analysis between the 1989 and 1994 Brazilian party broadcasts and manifestos by F. Carvalho (2000).

Since the 1980s, content analysis has become an increasingly important tool in the measurement of success in public relations (notably media relations) programs and the assessment of media profiles. In these circumstances, content analysis is an element of media evaluation or media analysis. In analyses of this type, data from content analysis is usually combined with media data (circulation, readership, number of viewers and listeners, frequency of publication). It has also been used by futurists to identify trends. In 1982, John Naisbitt published his popular Megatrends, based on content analysis in the US media.

The creation of coding frames is intrinsically related to a creative approach to variables that exert an influence over textual content. In political analysis, these variables could be political scandals, the impact of public opinion polls, sudden events in external politics, inflation etc. Mimetic Convergence, created by F. Lampreia Carvalho for the comparative analysis of electoral proclamations on free-to-air television is an example of creative articulation of variables in content analysis. The methodology describes the construction of party identities during long-term party competitions on TV, from a dynamic perspective, governed by the logic of the contingent. This method aims to capture the contingent logic observed in electoral campaigns by focusing on the repetition and innovation of themes sustained in party broadcasts. According to such post-structuralist

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perspective from which electoral competition is analysed, the party identities, 'the real' cannot speak without mediations because there is not a natural centre fixing the meaning of a party structure, it rather depends on ad-hoc articulations. There is no empirical reality outside articulations of meaning. Reality is an outcome of power struggles that unify ideas of social structure as a result of contingent interventions. In Brazil, these contingent interventions have proven to be mimetic and convergent rather than divergent and polarised, being integral to the repetition of dichotomised worldviews.

Mimetic Convergence thus aims to show the process of fixation of meaning through discursive articulations that repeat, alter and subvert political issues that come into play. For this reason, parties are not taken as the pure expression of conflicts for the representation of interests but attempts to recompose and re-articulate ideas of an absent totality around signifiers gaining positivity.

Every content analysis should depart from a hypothesis. The hypothesis of Mimetic Convergence supports the Downsian interpretation that in general, rational voters converge in the direction of uniform positions in most thematic dimensions. The hypothesis guiding the analysis of Mimetic Convergence between political parties' broadcasts is: 'public opinion polls on vote intention, published throughout campaigns on TV will contribute to successive revisions of candidates' discourses.

Candidates re-orient their arguments and thematic selections in part by the signals sent by voters. One must also consider the interference of other kinds of input on electoral propaganda such as internal and external political crises and the arbitrary interference of private interests on the dispute. Moments of internal crisis in disputes between candidates might result from the exhaustion of a certain strategy. The moments of exhaustion might consequently precipitate an inversion in the thematic flux.

As an evaluation approach, content analysis is considered by some to be quasi-evaluation because content analysis judgments need not be based on value statements if the research objective is aimed at presenting subjective experiences. Thus, they can be based on knowledge of everyday lived experiences. Such content analyses are not evaluations. On the other hand, when content analysis judgements are based on values, such studies are evaluations.

As demonstrated above, only a good scientific hypothesis can lead to the development of a methodology that will allow the empirical description, be it dynamic or static.

USES AND PROCESS OF CONTENT ANALYSIS

Ole Holsti (1969) groups 15 uses of content analysis into three basic categories:

- make inferences about the antecedents of a communication
- describe and make inferences about characteristics of a communication

- make inferences about the effects of a communication.

He also places these uses into the context of the basic communication paradigm.

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The following table shows fifteen uses of content analysis in terms of their general purpose, element of the communication paradigm to which they apply, and the general question they are intended to answer.

Uses of Content Analysis by Purpose, Communication Element, and Question

Purpose	Element	Question	Use
Make inferences about the antecedents of communications	Source	Who?	• Answer questions of disputed authorship (authorship analysis)
	Encoding process	Why?	• Secure political & military intelligence • Analyze traits of individuals • Infer cultural aspects & change • Provide legal & evaluative evidence
Describe & make inferences about the characteristics of communications	Channel	How?	• Analyze techniques of persuasion • Analyze style
	Message	What?	• Describe trends in communication content • Relate known characteristics of sources to messages they produce • Compare communication content to standards
	Recipient	To whom?	• Relate known characteristics of audiences to messages produced for them • Describe patterns of communication
Make inferences about the consequences of communications	Decoding process	With what effect?	• Measure readability • Analyze the flow of information • Assess responses to communications

Note:— Purpose, communication element, & question from Holsti (1969). Uses primarily from Berelson (1952) as adapted by Holsti (1969).

The Process of a Content Analysis

According to Dr. Klaus Krippendorff (1980 and 2004), six questions must be addressed in every content analysis:

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1. Which data are analyzed?
2. How are they defined?
3. What is the population from which they are drawn?
4. What is the context relative to which the data are analyzed?
5. What are the boundaries of the analysis?
6. What is the target of the inferences?

The assumption is that words and phrases mentioned most often are those reflecting important concerns in every communication. Therefore, quantitative content analysis starts with word frequencies, space measurements (column centimeters/inches in the case of newspapers), time counts (for radio and television time) and keyword frequencies. However, content analysis extends far beyond plain word counts, e.g. with Keyword In Context routines words can be analysed in their specific context to be disambiguated. Synonyms and homonyms can be isolated in accordance to linguistic properties of a language.

Qualitatively, content analysis can involve any kind of analysis where communication content (speech, written text, interviews, images ...) is categorized and classified. In its beginnings, using the first newspapers at the end of 19th century, analysis was done manually by measuring the number of lines and amount of space given a subject. With the rise of common computing facilities like PCs, computer-based methods of analysis are growing in popularity. Answers to open ended questions, newspaper articles, political party manifestoes, medical records or systematic observations in experiments can all be subject to systematic analysis of textual data. By having contents of communication available in form of machine readable texts, the input is analysed for frequencies and coded into categories for building up inferences. Robert Philip Weber (1990) notes: "To make valid inferences from the text, it is important that the classification procedure be reliable in the sense of being consistent: Different people should code the same text in the same way". The validity, inter-coder reliability and intra-coder reliability are subject to intense methodological research efforts over long years.

One more distinction is between the manifest contents (of communication) and its latent meaning. "Manifest" describes what (an author or speaker) definitely has written, while latent meaning describes what an author intended to say/write. Normally, content analysis can only be applied on manifest content; that is, the words, sentences, or texts themselves, rather than their meanings.

Dermot McKeone (1995) has highlighted the difference between prescriptive analysis and open analysis. In prescriptive analysis, the context is a closely-defined set of communication parameters (e.g. specific messages, subject matter); open analysis identifies the dominant messages and subject matter within the text.

A further step in analysis is the distinction between dictionary-based (quantitative) approaches and qualitative approaches. Dictionary-based approaches set up a list of categories derived from the frequency list of words and control the distribution of words and their respective categories over the texts. While methods in quantitative content analysis in this way transform

observations of found categories into quantitative statistical data, the qualitative content analysis focuses more on the intentionality and its implications.

COMPARATIVE STUDY

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The comparative method is often used in the early stages of the development of a branch of science. It can help the researcher to ascend from the initial level of exploratory case studies to a more advanced level of general theoretical models, invariances, such as causality or evolution.

The design of comparative research is simple. Your objects are specimens or cases which are similar in some respects (otherwise, it would not be meaningful to compare them) but they differ in some respects. These differences become the focus of examination. The goal is to find out why the cases are different: to reveal the general underlying structure which generates or allows such a variation.

Comparation is one of the most efficient methods for explicating or utilizing tacit knowledge or tacit attitudes. This can be done, for example, by showing in parallel two slides of two slightly different objects or situations and by asking people to explain verbally their differences.

The method is also versatile: you can use it in detail work as a complement to other methods, or the entire structure of a research project can consist of the comparison of just a few cases.

	Observed state of things	
	Case 1	***Case 2***
Aspect A	A_1	A_2
Aspect B	B_1	B_2
Aspect C	C_1	C_2

In comparative study, you are examining two (or more) cases, specimens or events, often in the form of a table such as can be seen on the right where a column is reserved for each case, here called "Case 1" and "Case 2". On the basis of the target of your study you have to decide which are the interesting aspects, properties or attributes that you will have to note and record for each of the cases. In the table on the right, these aspects are called A, B and C. During the process of analysis, you then can add new aspects or drop out fruitless ones. Those aspects that are similar in both the cases need not be recorded, because here you are not making two case studies but only a comparison of the cases.

The final goal of research is usually to reveal tne systematic structure, invariance, that is true not only for the cases that were studied, but for the entire group (population) where the cases came from. In other words, the goal is to generalize the findings. Of course, it would be foolhardy to assert anything about a larger group, if your study consisted of just two cases. The plausibility of your generalisation will increase, if you have instead of "Case 1", several cases from the same group, let us call it "Group 1", and similarly several cases from "Group 2". If all or the majority of these pairs show the same invariance, its credibility will quickly rise. There are statistical methods to calculate the credibility, or statistical significance of the findings. The question whether the found invariance then is

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true even outside the population, is something that the researcher normally leaves to be speculated by the readers of his report.

In the case that you wish to compare more than two groups, or the number of cases is large, the study begins to approach classification, a method that is discussed on another page.

In comparative like in most other studies there are two different styles, both of which will be discussed below:

- Descriptive Comparison aims at describing and perhaps also explaining the invariances of the objects. It does not aim at generating changes in the objects, on the contrary, it usually tries to avoid them.
- A special style of research is needed when the aim is not just to detect and explain but also to improve the present state of the object, or to help improving or developing similar objects in the future. This is the technique of Normative Comparison.

Descriptive Comparison

In descriptive study of products there are many situations where comparison is an adequate method. You could, for example, study comparable products which have been designed by different designers or made by different producers. Or you can study the same type of products as they are used in the same circumstances but in different countries.

Comparison may be useful even when the researcher is not interested in differences but in a single case. If the interesting object belongs to the researcher's own cultural environment, it is not always easy to perceive its special characteristics. The case may appear too obvious and non-problematic. "A fish cannot see that it is living in water." One method to reveal the specific nature of a too well known object is to compare it to other cases or specimens from another context.

In exploratory study it often happens that you need gradually add new aspects of comparison, or have to redefine them when your knowledge of the object increases. It is also common that in the initial phases of the study you only can reach descriptive answers to the question what the object is and what it is like, Another, more difficult task then is to explain or answer the question why the object is as it is.

	Case 1	*Case 2*
Potential reason	+	—
Potential effect	+	—

In comparative analysis you can apply all the usual types of explanation: by earlier events, by later events, and contextual explanation. It can be useful to make a table, like the one on the right, of potential reasons and potential effects. If there is conformity between likely reason and likely effect (i.e. there is effect only when the reason is present) it augments the plausibility of the hypothetical explanation. However, a mere correlation between two variables does not yet definitively confirm a hypothetical explanation, because the correlation can be

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due to other reasons which have not been registered, see a list of possible explanations.

It can be difficult to discover all potential causal influences in empirical study only, therefore it is usually advisable to start by doing a thorough study of literature for finding theory and data of comparable cases.

Field work tends to entail, in spite of its usually good validity, often mediocre reliability of the findings because of disturbances that obstruct discovering those relationships that the researcher would want to study. If such is the case, you should consider complementing the comparison with other methods like interview (if people are mixed up in the activity to be studied) or an experiment with appropriate shielding to keep out any disturbing influences.

Another usual technique for reducing not desirable influences on the object of study is to select the cases to be compared so that they are as similar as possible. For example, if you want to compare a case in your home town to another similar case, you should select the latter from another nearby town of the same size.

Normative Comparison

The difference between descriptive and normative styles of comparison is that in normative analysis one of the principal criteria is evaluative like "satisfaction", "usefulness" etc., and the aim of the study is to point out the best (in this respect) among the alternatives that are being studied. The final aim perhaps is not only to find the best, but also to improve it or similar objects later on.

The difference between descriptive and normative styles of comparison is that in normative analysis one of the principal criteria is evaluative like "satisfaction", "usefulness" etc., and the aim of the study is to point out the best (in this respect) among the alternatives that are being studied. Sometimes the final aim is not only to find the best, but also to improve it or similar objects later on, and comparative analysis is expected to provide grounds for the planning of improvements to existing circumstances or products.

Sometimes you can make use of already existing sources of evaluations, like the Customer Feedback System, if the company has one; or the public critique and the tests of new products that some institutions, associations and journals generate and publish habitually.

Car model:	**A**	**B**
Number of seats	5	8
Number of doors	2	4
Air bags	2	4
Fuel consumption	5,8	7,5
Special merits	(Descriptive text)	
Price	8500	9900

In these tests a number of competing products are judged according to a standard list of questions which includes only those aspects where the rivalling products differ.

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The comparison table works well even in the case that some of the items are expressed as numerical variables, others as qualitative verbal descriptions, and nothing prevents including in the table even pictorial presentations of the objects. However, in the final phase you have to translate all these descriptions into evaluations so that you can sum them up and point out the best alternative. Note that all the items on your list are seldom equally crucial, therefore you will need to define the weight of each item when summing them up.

Summary

1. The primary purpose for applied research is discovering, interpreting, and the development of methods and systems for the advancement of human knowledge on a wide variety of scientific matters of our world and the universe.
2. Exploratory research is a type of research conducted because a problem has not been clearly defined. Exploratory research helps determine the best research design, data collection method and selection of subjects.
3. Empirical research is any research that bases its findings on direct or indirect observation as its test of reality.
4. The historical method comprises the techniques and guidelines by which historians use primary sources and other evidence to research and then to write histories in form of accounts of the past.
5. Experimental research designs are used for the controlled testing of causal processes. The general procedure is one or more independent variables are manipulated to determine their effect on a dependent variable.
6. Case study research excels at bringing us to an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research.
7. Content analysis is a methodology in the social sciences for studying the content of communication. Earl Babbie defines it as "the study of recorded human communications, such as books, websites, paintings and laws."

Review Questions

1. Differentiate between Exploratory research and Constructive research.
2. What are relevance of primary and secondary research?
3. Discuss the procedure of experimental research methods.
4. How is constructive research conducted?
5. What is case study research? How is case study research applied?
6. Discuss content analysis research.
7. Write a short notes on evaluation research method.
8. Differentiate between descriptive and normative comparison.

Further Readings

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- Kidder, L. H. (1981) *Selltiz, Wrightsman and Cook's research methods in social relations.* New York: Holt, Rinehart and Winston. (Chapter 2: "Causal analysis and true experiments")

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UNIT – III

DATA COLLECTION

Learning Objectives

After going through the unit students will be able :

- to know various methods of data collection;
- to to understand the method of sampling;
- to state the concept of sampling and non-sampling.

INTRODUCTION

Data refers to information or facts usually collected as the result of experience, observation or experiment or premises. Data may consist of numbers, words, or images, particularly as measurements or observations of a set of variables. Data are often viewed as a lowest level of abstraction from which information and knowledge are derived.

You might be reading a newspaper regularly. Almost every newspaper gives the minimum and the maximum temperatures recorded in the city on the previous day. It also indicates the rainfall recorded, and the time of sunrise and sunset. In your school, you regularly take attendance of children and record it in a register. For a patient, the doctor advises recording of the body temperature of the patient at regular intervals.

If you record the minimum and maximum temperature, or rainfall, or the time of sunrise and sunset, or attendance of children, or the body temperature of the patient, over a period of time, what you are recording is known as data. Here, you are recording the data of minimum and maximum temperature of the city,

data of rainfall, data for the time of sunrise and sunset, and the data pertaining to the attendance of children.

As an example, the class-wise attendance of students, in a school, is as recorded in *Table 3.1*.

Table 3.1 Class-wise Attendance of Students

Class	No. of Students Present
VI	42
VII	40
VIII	41
IX	35
X	36
XI	32
XI1	30
Total	256

Table 3.1 gives the data for class-wise attendance of students. Here the data comprise 7 observations in all. These observations are, attendance for class VI, VII, and so on. So, data refers to the set of observations, values, elements or objects under consideration.

The complete set of all possible elements or objects is called a population. Each of the elements is called a piece of data. Data also refers to the known facts or things used as basis for inference or reckoning facts, information, material to be processed or stored.

NATURE OF DATA

For understanding the nature of data, it becomes necessary to study about the various forms of data, as shown below:

- Qualitative and Quantitative Data
- Continuous and Discrete Data
- Primary and Secondary Data

Qualitative and Quantitative Data

Let us consider a set of data given in *Table 3.2*.

Table 3.2 Management-wise Number of Schools

Management	No. of Schools
Government	4
Local Body	8
Private Aided	10
Private Unaided	2
Total	24

In *Table 3.2*, number of schools have been shown according to the management of schools. So the schools have been classified into 4 categories, namely, Government Schools, Local Body Schools, Private Aided Schools and Private Unaided Schools. A given school belongs to any one of the four categories. Such data is shown as Categorical or Qualitative Data. Here the category or the

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quality referred to is management. Thus categorical or qualitative data result from information which has been classified into categories. Such categories are listed alphabetically or in order of decreasing frequencies or in some other conventional way. Each piece of data clearly belongs to one classification or category.

We frequently come across categorical or qualitative data in the form of schools categorised according to Boys, Girls and Co-educational; Students' Enrolment categorised according to SC, ST, OBC and 'Others'; number of persons employed in various categories of occupations, and so on.

Let us consider another set of data given in *Table 3.3*.

Table 3.3 Number of Schools according to Enrolment

Enrolment	No. of Schools
Upto 50	6
51 - 100	15
101 - 200	12
201 - 300	8
Above 300	4
Total	45

In *Table 3.3*, number of schools have been shown according to the enrolment of students in the school. Schools with enrolment varying in a specified range are grouped together, e.g. there are 15 schools where the students enrolled are any number between 51 and 100. As the grouping is based on numbers, such data are called Numerical or Quantitative Data. Thus, numerical or quantitative data result from counting or measuring. We frequently come across numerical data in newspapers, advertisements etc. related to the temperature of the cities, cricket averages, incomes, expenditures and so on.

Continuous and Discrete Data

Numerical or quantitative data may be continuous or discrete depending on the nature of the elements or objects being observed.

Let us consider the *Table 3.4* depicting the heights of students of a class.

Table 3.4 Heights of Students of a Class

Height	No. of Students
4'8"- 4' 10"	2
4'10" - 5'0"	2
5'0" - 5'2"	5
5'2" - 5'4"	8
5'4" - 5'6"	12
5'6" - 5'8"	10
5'8"- 5'10"	2
Total	41

Table 3.4 gives the data pertaining to the heights of students of a class. Here the element under observation is the height of the students. The height varies from 4' 8" to 5' 10". The height of an individual may be anywhere from 4' 8" to

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5'10". Two students may vary by almost zero inch height. Even if we take two adjacent points, say 4' 8.00" and 4' 8.01" there may be several values between the two points. Such data are called Continuous Data, as the height is continuous. Continuous Data arise from the measurement of continuous attributes or variables, in which individual may differ by amounts just approaching zero. Weights and heights of children; temperature of a body; intelligence and achievement level of students, etc. are the examples of continuous data.

Let's consider *Table* 3.3 showing the number of students enrolled and the number of schools according to enrolment. Let us consider the enrolment of 2 schools as 60 and 61. Now in between 60 and 61, there cannot be any number, as the enrolment will always be in whole numbers. Thus there is a gap of one unit from 60 to 61. Such data, where the elements being observed have gaps are called Discrete Data.

Discbete Data are characterised by gaps in the scale, for which no real values may ever be found. Such data are usually expressed in whole numbers. The size of a family, enrolment of children, number of books etc. are the examples of discrete data. Generally data arising from meagurement are continuous, while data arising from counting or arbitrary classification are discrete.

The achievement scores of students, though presented in discrete form may be considered to constitute continuous data, since a score of 24 represents any point between 23.5 and 24.5. Actually achievement is a continuous attribute or variable.

All measurements of continuous attributes are approximate in character and as such do not provide a basis for distinguishing between continuous and discrete data. The distinction is made on the basis of variable being measured. 'Height' is a continuous variable but number of children would give discrete data.

Primary and Secondary Data

The data collected by or on behalf of the person or people who are going to make use of the data refers to primary data. For example, the attendance of children, the result of examinations conducted by you are primary data. If you contact the parents of the children and ask about their educational qualifications to relate them to the performance of the children, this also gives primary data. Actually, when an individual personally collects data or information pertaining to an event, a definite plan or design, it refers to primary data.

Sometimes an investigator may use the data already collected by you, such as the school attendance of children, or performance of students in various subjects. etc, for his/her study, then the data are secondary data. The data used by a person or people other than the people by whom or for whom the data were collected refers to secondary data. For many reasons we may have to use secondary data, which should be used carefully, since the data could have been collected with a purpose different from that of the investigator and may lose some detail or may not be fully relevant. For using secondary data, it is always useful to know :

(a) how the data have been collected and processed;

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(b) the accuracy of data;

(c) how far the data have been summarised;

(d) how comparable the data are with other tabulations; and

(e) how to interpret the data, especially when figures collected for one purpose are used for another purpose.

Secondary Data

In research, Secondary data is collecting and possibly processing data by people other than the researcher in question. Common sources of secondary data for social science include censuses, large surveys, and organizational records. In sociology primary data is data you have collected yourself and secondary data is data you have gathered from primary sources to create new research. In terms of historical research, these two terms have different meanings. A primary source is a book or set of archival records. A secondary source is a summary of a book or set of records.

Advantages to the secondary data collection method are— (1) it saves time that would otherwise be spent collecting data, (2) provides a larger database (usually) than what would be possible to collect on ones own. However; there are disadvantages to the fact that the researcher cannot personally check the data so its reliability may be questioned.

Secondary Data Analysis

There are two different types of sources that need to be established in order to conduct a good analysis. The first type is a primary source which is the initial material that is collected during the research process. Primary data is the data that the researcher is collecting themselves using methods such as surveys,direct observations, interviews, as well as logs(objective data sources).

Primary data is a reliable way to collect data because the researcher will know where it came from and how it was collected and analyzed since they did it themselves. Secondary sources on the other hand are sources that are based upon the data that was collected from the primary source. Secondary sources take the role of analyzing, explaining, and combining the information from the primary source with additional information.

Secondary data analysis is commonly known as second-hand analysis. It is simply the analysis of preexisting data in a different way or to answer a different question than originally intended. Secondary data analysis utilizes the data that was collected by someone else in order to further a study that you are interested in completing.

In contrast to secondary data, primary data comes from observations made by the researchers themselves. This often creates credibility issues that do not arise with secondary data.

Combining Data with Secondary Data

Where It's Used

For what different purposes can data from archives be used? The first and simplest case would be for descriptive purposes, such as a phone book. A particular

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contribution of the data archives can be made to comparative research, both, across nations and over time. In the early years of data archives, when secondary analysis was not yet a popular research strategy, the idea of comparative research based on archival data was promoted in conferences already some 40 years ago.

In the first case this would allow for comparative analysis over time, in the second for comparative analysis across societies or nations. Therefore, the design of comparative surveys is crucial for making empirical knowledge cumulative over space and time.

Combing Data From a Different Source with Different Time Periods

Equally important are longitudinal studies which can be compiled over time. For example, in a research project on "Attitudes Towards Technology" it is of crucial importance to include data collected in the fifties and sixties in order to answer the research question whether potential threats from new technologies have decreased the level of technology acceptance or whether tendencies to reject new developments concentrate on particular technologies only, and if so, under what circumstances.

Combining Existing Secondary Data Sources with New Primary Data Sources

Imagine that we could get hold of a good collection of surveys taken in earlier years, such as detailed studies about changes going on in this phase and hopefully additional studies in the years to come. Analyzing this data base over time could give us a good picture of what changes actually have taken place in the orientation of the population and of the extent to which new technical concepts did have an impact on subgroups of the population. Furthermore, data archives can help to prepare studies on change over time by monitoring what questions have been asked in earlier years and alerting principal investigators to important questions which should be repeated in planned research projects. Actually, data archives should consider including funds in their budgets which allow them to collect data for relevant questions in order to avoid interruptions in important time series.

Technical Challenges in Combining Data Sets

A number of methodological and technical requirements have to be observed and should be implemented rigorously. Just to mention the most important: Some methodologists require that the questions should be functionally equivalent, whereas others claim that the question texts must be phrased identically. Frequently, it is not the linguistic identity which matters. Sometimes it is much more important, whether the questions are understood by the respondent in the same way.

Thus, a thermometer or scale used as a representation for intensity of attitudes in the more developed societies may be replaced by a ladder in less developed societies. Both, thermometer and ladder, would still measure the same dimension in the conceptual world of the respective respondents. A second requirement would be comparability of samples, thus, a cross-national representative random sample would be hard to compare with the local quota

sample in one community in a different nation. Several other factors have to be controlled as well, in particular contextual influences at the time of field work or political or environmental events, which are related to the topic of the research.

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Collecting, Reviewing, and Analyzing Secondary Data

The Design and Purpose of Research

Secondary data analysis consists of collecting data that was compiled through research by another person and using that data to get a better understanding of a concept. A good way to begin your research using secondary data that you are collecting to further support your concept is to clearly define the goals of your research and the design that you anticipate using. An important thing to remember when defining your plan is to ensure that you have established what kind of data you plan on using for your research and the exact goal. Establishing what type of research design is an important component. In terms of using secondary data for research it helps to create an outline of what the final product will look like consisting of all the types of data to be used along with a list of sources that were used to compile the research. In order to use secondary data three steps must be completed:

1. locate the data
2. evaluate the data
3. verify the data

Locating the data can be easily done with the advancements of searching sources online. However, people need to be aware of the details when searching online since pages can be out of date or poorly put together. Therefore, use caution and pay attention to whether it is a reliable data source online and check when the last update was. To evaluate the data a researcher must carefully examine the secondary data they are considering to ensure that it meets their needs and purpose of study. The person must look at the population and what the sample strategy and type were. It is also important to look at when the data was collected, how it was collected, how it was coded and edited, along with the operational definitions of measures that were used. Finally, the data must be verified to ensure good quality material to be used in new research.

Determining the Types of Data and Information Needed to Conduct Analysis

Data and information collection for secondary data analysis will depend entirely upon the subject that is central to the focal point of the study. The purpose of conducting secondary data analysis is to further develop an improved understanding of the subject matter at hand. Some important types of data and information that should be collected and summarized include demographic information, information gathered by government agencies (i.e. the Census), and social science surveys.

There is also the possibility of reanalyzing data that was collected in experimental studies or data collected with qualitative measures that can be applied in secondary data analysis. The most important component is to ensure that the information and data being collected needs to relate to the subject of study.

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Determine the Quality of Sources of Data

In secondary data analysis, most individuals who do not have much experience in research training or technical expertise can be trained accordingly. However, this advantage is not without difficulty as the individual must be able to judge the quality of the data or information that has been gathered. These key tips will assist you in assessing the quality of the data: Determine the original purpose of the data collection, attempt to discover the credentials of the source(s) or author(s) of the information, consider if the document is a primary or secondary source, verify that the source well-referenced, and finally find out the: date of the publication; the intended audience, and coverage of the report or document.

Challenges of Secondary Data Analysis

Advantages

Using secondary data can allow for the analyses of social processes in what would otherwise be inaccessible settings. It also saves time and money since the work has already been done to collect the data. That lets the researcher avoid problems with the data collection process. Using someone else's data can also facilitate a comparison with other data samples and allow multiple sets of data to be combined. There is also the chance that other variables could be included, resulting in a more diverse sample than would have been feasible before.

Disadvantages

There are several things to take into consideration when using preexisting data. Secondary data does not permit the progression from formulating a research question to designing methods to answer that question. It is also not feasible for a secondary data analyst to engage in the habitual process of making observations and developing concepts. These limitations hinder the ability of the researcher to focus on the original research question. Data quality is always a concern because its source may not be trusted. Even data from official records may be bad because the data is only as good as the records themselves. There are six questions that a secondary analyst should be able to answer about the data they wish to analyze.

1. What were the agency's or researcher's goals when collecting the data?
2. What data was collected and what is it supposed to measure?
3. When was the data collected?
4. What methods were used? Who was responsible and are they available for questions?
5. How is the data organized?
6. What information is known about the success of that data collection? How consistent is the data with data from other sources?

METHODS OF DATA COLLECTION

Data Collection is an important aspect of any type of research study. Inaccurate data collection can impact the results of a study and ultimately lead to invalid results. In this section, we will discuss some of the most important methods of data collection.

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Primary Data Collection Methods

In primary data collection, you collect the data yourself using methods such as interviews and questionnaires. The key point here is that the data you collect is unique to you and your research and, until you publish, no one else has access to it.

There are many methods of collecting primary data and the main methods include:

- questionnaires
- interviews
- focus group interviews
- observation
- case-studies
- diaries
- critical incidents
- portfolios.

Questionnaires

Questionnaires are a popular means of collecting data, but are difficult to design and often require many rewrites before an acceptable questionnaire is produced.

Advantages:

- Can be used as a method in its own right or as a basis for interviewing or a telephone survey.
- Can be posted, e-mailed or faxed.
- Can cover a large number of people or organisations.
- Wide geographic coverage.
- Relatively cheap.
- No prior arrangements are needed.
- Avoids embarrassment on the part of the respondent.
- Respondent can consider responses.
- Possible anonymity of respondent.
- No interviewer bias.

Disadvantages:

- Design problems.
- Questions have to be relatively simple.
- Historically low response rate (although inducements may help).
- Time delay whilst waiting for responses to be returned.
- Require a return deadline.
- Several reminders may be required.
- Assumes no literacy problems.
- No control over who completes it.
- Not possible to give assistance if required.

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- Problems with incomplete questionnaires.
- Replies not spontaneous and independent of each other.
- Respondent can read all questions beforehand and then decide whether to complete or not. For example, perhaps because it is too long, too complex, uninteresting, or too personal.

The Response Process

While the process is simple and straight forward, there are many opportunities for error.

- The question must be read.
- The question must be understood.
- The respondent must create a response.
- This response must be translated into the categories or values present for the question.

Fundamental Concerns

We are asking about a person's knowledge, attitudes, beliefs, feelings, motivations, anticipations, future plans or past behavior. What can we do to motivate people to respond and to respond truthfully? For example, one older study found that about 20 percent of those without library cards claimed to have one when asked. There is a strong tendency to give answers that are socially desirable, make the respondent look good, or that will please the researcher. While we begin with an assumption of truthfulness, it may be useful to use variants of the same question to capture more of reality.

Another concern is whether or not the respondent knows enough to provide a meaningful answer. Someone who has never used the teen collection may find it difficult to indicate if it is valued.

Validity is the degree to which we are measuring what we need to measure. The questionnaire should gather valid responses. Reliability is the degree to which we receive the same measurement over time. Would we receive the same response if the respondent had answered the questionnaire earlier or later?

Cost

At the beginning and throughout the process, you need to consider these questions:

1. How much money will be needed to collect this data?
2. How much time will be needed to collect this data?
3. Is cost-sharing possible and will that be helped by sponsorship or endorsement?
4. How many completed questionnaires will be needed and what response rate does that require?

If possible, begin with another's questionnaire, especially if you are doing a use and user-survey [do receive permission first]. This is less expensive, but there are other advantages. Others should have validated their instrument. You will be able to compare your findings with theirs and built upon previous generalizations. Knowledge can cumulate. Library Literature is also quite useful via the survey tag. Ideally, you would keep changes to a minimum to facilitate comparison, but

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you may build upon an existing instrument by adding additional questions or making essential changes.

The Process

Ordinarily, there are six steps:

1. Identifying what information is needed
2. Deciding what sort of questionnaire to use
3. Creating the first draft
4. Editing and revising
5. Pre testing and revising
6. Specifying procedures for its use.

A few deep thoughts are needed at the beginning:

- Are you certain that this study is worth doing?
- Are your research questions and key variables clearly identified?
- What answers do you need to have?
- What sort of questions are likely to gather those answers?
- What problems are likely to be encountered in getting a good response?

The number of questions must be limited to insure a good response. Response rate declines rapidly as the number of questions, especially those that require time and thought are added. Questions can usually be divided into two categories: (1) absolutely necessary and (2) interesting. Be certain that the information to be gathered is not available elsewhere, i.e. in census data or another report. Respondents are much less likely to respond to a question if they feel the answer is readily available.

Questions will need to be placed in a logical sequence.

Type of Information Sought

Typically, information sought falls into four categories:

1. Attitudes or what people see/understand about certain things
2. Beliefs or what people think is true [more strongly felt than attitudes]
3. Behavior or what people do
4. Attributes or what people are.

Attitude questions ask people to indicate if they favor or oppose, if they prefer or not, should or should not, right versus wrong, desirable versus undesirable. These questions require sensitive, thoughtful wording.

Belief questions ask people if something is true or false, correct or incorrect, accurate or inaccurate.

Behavior questions ask people what they have done, what they do, or what they plan to do.

Attribute or demographic questions ask about age, income, education, and the like.

Question Type

Open-ended Questions

Open-ended questions provide no answer choices. They are easy to ask and allow for a wide variety of responses, including the creative and unusual.

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Open-ended questions are especially useful when you don't know the likely values or cannot anticipate how the respondent will respond. The information gathered by open-ended questions could then be used to develop appropriate close-ended questions for another questionnaire.

These questions force the respondent to think and allow the respondent to clarify and explain a response. If the respondent takes needed time and makes the effort, responses can be illuminating and yield much useful information.

The response rate will be lower because the blank space is demanding and intimidating, especially for those who don't like to write. Illegible handwriting may be a problem.

Since responses are not really ordered, analysis requires considerable time and effort. It may be difficult to measure and classify responses. Responses may be off base because there is inadequate guidance from the instrument itself.

Close-ended Questions

These questions provide specific answer choices although there may be an "other" value with brief space for adding an additional value. With close-ended questions, there is always the possibility that the right question will not be asked and valuable information will not be gathered. GIGO certainly applies here.

Ordered

Ordered close-ended questions require respondents to select a particular response. The responses are easily selected. They take little time, at least by most respondents.

These questions require well defined variables and values. They work best when there are a small number of reasonable answer possibilities.

Unordered

Unordered questions ask respondents to rank values and are useful for identifying priorities. Requires well defined variables and values. Unordered close-ended questions are not reliable if there are more than five values. Most respondents find ranking after one or two values to be difficult.

Criteria for ranking must be clearly identified and the order of the values must make sense to the respondent.

Partially close-ended

These questions may be ordered or not, but they do include the "other" option which adds some flexibility and provides the opportunity to add information not otherwise captured by the instrument.

More flexibility may mean better and more valid responses. New values may be selected from the leading "other" values, but this will make analysis more challenging

Number of Values

Close-ended questions may be categorized by the number of values. Two value questions are dichotomous. These questions are easy to ask and are quickly answered. Analysis is straight-forward and quick.

However, two alternatives are usually not enough. Some times, respondents will select the first value so the ordering of the values has some impact. Each value must be exclusive. The researcher must know the notable alternatives.

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Multiple choice questions [more than two values]are also easy to analyze, but do require more time and effort. These questions require more time and effort by the respondent. Typically, respondents tend to choose from the top or middle of the list.

Wording Questions

Audience

The first step is to visualize the audience. Next ask two questions:

1. How are these people likely to respond to particular words and phrases?
2. What are they likely to know and be familiar with?

Select Words With Care

Avoid wrong words. Wrong words are vague, too specific, misunderstood, objectionable, irrelevant, and uninteresting. It takes time to select the right word. One researcher went through 41 versions of a question before the words were just right.

Insure that words are uniformly understood and provide brief definitions if needed. For example, how will the patron define "use" when asked questions about the degree of library or information center use. Words like "often," "rarely," "few," and "many" are used flexibly and different people have very different ideas as to what these words mean.

Use simpler, but specific words. For example, "free-time" is better than "leisure time." Substitute specifics for "several," "most," "usually," and the like to insure better reliability. When possible, use shorter words. Clearly define professional words if the audience is not professional, for example "volume" and "bibliographic instruction" may mean little to most college students. Insure that each word in a question is necessary. What would happen if that word was removed.

Avoid abbreviations and initialisms. If used, do spell out in the first mention, and again later if at some distance from the first mention. Read and reread for directness and clarity. For example, how clear is "What changes should the government make in its policies toward libraries?"

Avoid the too specific and use ranges instead. Few respondents will know how many books they have checked out from a public library in the last year.

Avoid value-oriented words that might bias the response, i.e. "should the library collection contain filthy books?"

Avoid self-incriminating questions such as "have you ever abused [definition needed] library materials" and attempt a more subtle approach. For example,

- Do you consider abuse of library materials to be a problem?
- Has abuse of library materials increased in the last year?
- Do you know anyone who has abused library materials?
- Have you ever considered abusing library materials?
- Have you ever abused library materials?

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Avoid double questions such as "are reference librarians friendly and knowledgeable" and use two separate questions instead.

Avoid negatives such as "should the librarian not be directly responsible to the city manager?"

Insure that choices are exclusive. For example, there is a problem if age choices are " 18-35 years" and "35-50" years. Similarly, asking "how did you learn about our new library service" with the values "from a friend or relative," "at work," or "from the newspaper" is problematic because the values are not exclusive.

Avoid questions that assume too much knowledge such as "do you agree with the governor's stand on regional libraries?"

Do provide appropriate time referents such as "how many times have you gone to the library in November of this year?"

Avoid speculative questions because the response are often not reliable. For example, the question "if the library provided a full-text database on blumpf, how often would you use it?" is likely to yield information of minimal value.

Revise the wording of each question until it is just right.

Response Options

Do include an option for "don't know. Double check to insure that values are exclusive and independent. Balance scales used in close-ended questions with an equal number on each side of the middle position. It is better to arrange values vertically rather than horizontally to eliminate the between the value response.

Sequencing Questions

There are at least three different approaches for you to consider. One is to begin with easy questions in order to build confidence and make the respondent comfortable. The second is to place the more important questions first to motivate and give a sense that the questionnaire is important and well worth the respondent's time. The third is to place general questions first with the more specific ones to follow.

There is some disagreement over the placement of demographic questions. One approach is place them at the beginning because they set the stage and are easily answered. The other approach is to place them at the end because some respondents don't like to answer any "personal" questions. An incomplete response would still yield some useful data.

It is usually helpful to group questions by the type of response required. This makes responding easier. There should be a logical transition, with appropriate text, between question groups.

Objectionable, time-consuming, or especially difficult questions should be at the end. These questions are less likely to skew responses to preceding questions. Respondents have an investment in responding to the questionnaire and are less likely to quit.

Selecting the first question is crucial. It should be clearly related to the problem, be interesting to the respondent, and be easy to respond to. The question should be objective or neutral. It should apply to everyone in the population.

Finally, it should establish a visual or graphic precedent for the questions that follow.

General Format

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Size, shape, weight, color, paper quality, design, and layout all answer these important questions:

1. Is this questionnaire worth my time?
2. Has the questionnaire been created by a thoughtful professional?
3. Will it be difficult and time-consuming to complete?

The first impression is crucial in improving the response rate.

Your job is to make it as easy as possible to complete the questionnaire quickly and with minimal effort. Consider the traditional negatives associated with Questionnaires:

- Long
- Difficult to understand or confusing
- Complicated
- Boring
- Poorly organized.

Avoid gimmicks or unusually creative formats.

Use white or off-white paper with black or blue ink. The paper needs to be light enough to reduce postage, but not so light as to appear cheap.

There should be no errors.

Printing or reproduction should be of letter quality and appear original. Print should be dark and clear.

Response spaces should be in the same position on each question and pushed toward the left or right margin where they are easily found. Place column numbers for coding near the question number and in parenthesis. Consider data analysis from the beginning. Construct your code book as soon as your questionnaire has finished pre-testing. All questions and pages should be clearly numbered. If both sides of the paper are used, a large, bold, OVER must appear at the right footer of each verso page.

Your return address should appear at the foot of the questionnaire and probably at the head as well. The study title should be clear, understandable to lay people and in a larger, bold font.

Clear, brief instructions are needed at the head and in the body as needed. Deadline information may or may not be useful. It is an asset by encouraging respondents to reply promptly. It is a liability of potential respondents decide not to reply because the deadline is near or past.

Do provide a reasonable space at the end for comments. Also at the end, indicate what will happen next with the study. If dealing with a professional audience, indicate that a copy of the study will be available and how they might get a copy.

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Page Format

Introduction

This is a slow process and must be done with care. Pages should be neat and aesthetically pleasing.

Use lower case letters for the questions and upper case letters for the answers [responses]. Each value should be numbered and the number should be circled. Use the same number throughout for the same value. For example, yes should always be "1." Do not split questions between pages.

Flow and Order

Establish vertical flow with the beginning of the question and the beginning of the answers. Leave enough white space between questions. Directions should appear in parentheses so that they stand out. You may use multiple columns and hats to conserve space as in the example below.

FATHER..... MOTHER

1..... 1..... NO FORMAL EDUCATION

2..... 2 .....SOME GRADE SCHOOL.

Skipping not applicable questions is always a problem. Use arrows to direct to next applicable question. Indent questions dependent on an earlier response. Use text boxes to direct respondents to the next applicable question.

Use transitions for continuity and to stimulate motivation. Transitions are needed for new topics and to break monotony.

Opening

The opening is extremely important. It should be short, interesting, and stimulate response. In particular, you must convincingly demonstrate why the study is important, why their response is especially important, and how they will benefit from the study. The title of the study, clearly understandable by the lay person, must be included. The name of the principal investigator and the institutional address should appear here.

Close

The close is also important. There should be an opportunity for comment as well as a thank you for participation. The name of the PI and contact information should also be included.

Length

Shorter is better. Ask no unnecessary questions. Ask only questions that can be answered. If the question is longer, it must look easy to respond to. If the audience is really interested in the topic, length is less important.

Pre-testing

Pre-testing is absolutely necessary. Don't be too eager to begin collecting data. Here are typical questions that pre-testing should answer:

- Does each question measure what it is supposed to?
- Are all the words understood?
- Are questions interpreted similarly by each respondent?

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- Does each close-ended question have an answer that applies to each respondent?
- Did the questionnaire create a positive impression?
- Are questions answered properly?
- Did any aspect of the questionnaire suggest bias?
- How long did it take to complete?

Pre testing may be done by three types of people. Colleagues are a logical choice, but may give you only a superficial examination. Too, that may not want to offend you with critical comment. Potential users of the data should have substantive knowledge of the topic. Finally, and best, are people drawn from the population to be surveyed. These people cannot then be used in the final study.

Revise and continue to test until your are satisfied that the questionnaire is as good as it can be.

Pre-cover Letters

These are not typical, but they may be useful in stimulating a better response rate. The evidence regarding cost-benefit is mixed. This alert letter "the questionnaire is coming" — should include:

- Study purpose and importance
- Why the respondent was selected and is important
- What to expect
- When to expect it.

Cover Letters

The major liability of the questionnaire is the low response rate. Causes of poor response include:

- The questionnaire never reached its destination because of poor address
- The questionnaire arrived, but was discarded unopened because it looked like junk mail
- The questionnaire was examined, but there was some question as to who should respond so it was not returned
- The questionnaire was examined, but the respondent was unconvinced of its importance, and it was discarded.
- The questionnaire was examined, but was put aside and forgotten because it would take too much time to complete.
- The questionnaire was examined, but the return envelope was misplaced and so the questionnaire was not returned.

Appeal Elements

There are three typical appeal elements:

- The first is essentially an appeal for help or "will you do me a favor?" Here, we emphasize our personal appreciation and gratitude. This is a weak appeal if much time and effort is required. Follow-ups can be difficult.
- The second appeal focuses on a shared problem that we must solve together. Their help is needed to find a solution that will improve some aspect of

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their life. Here we have an exchange relationship with each helping the other.

- The third appeal element is rarely used by information professional researchers. Here an incentive is included to help compensate the respondent for her time. These incentives are usually inexpensive tokens, but winning a prize may make a difference. Dr. Bill once won a $100.00 Amazon gift certificate for participating in a study.

You will need to decide how formal or informal you will be in the cover letter. You want to personalize the letter and establish rapport, but you don't want to be too familiar, especially with people you have not met.

An endorsement by an individual or group well known to your audience can increase response rates and is well worth the effort. Can you identify some endorsement possibilities?

The letter should look like an original with letterhead and an original-looking signature.

Format and Content

The cover letter should be limited to a single page.

The first paragraph should explain what the study is about and convince the respondent that the study is important and useful. How does the study relate to their problems? Why will the study make a difference? How will the results be used? It is best to avoid the words "questionnaire" and "survey" in this paragraph because of their negative associations.

The second paragraph focuses on why the particular respondent is important to the success of the study. Why were you selected? Why the population segment that you represent is important? Who should complete the instrument?

The third paragraph considers the questionnaire itself. It will not take too long to complete and the questions themselves are not difficult. We also emphasize that all responses are confidential and anonymous.

The fourth paragraph looks at social utility. We focus on the difference that the responses may make and how the results will be used to affect change.

The fifth paragraph closes with a statement that the investigator is willing to answer any questions or concerns. There is also a thank you statement.

The Envelope

The envelope must appear professional and be clearly distinguished from junk mail. It should the correct size to hold the questionnaire without unnecessary folding.

Postage

First class mail is best because of its positive impression. Note too that first class mail is delivered more quickly, is forwarded, and is returned to the sender if undeliverable. Interestingly, stamps on the envelope rather than the postage meter seem to increase the response rate.

SASE

The self-addressed stamped envelop is essential, but only use the kind where pay only if the envelope is used [requires postal permit]. This will cost more than

first class mail by the piece, but will save money because many of the envelopes will not be used.

Mail out Date

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Early in the week works best, but avoid Monday because of mail buildup over the weekend. Avoid holidays, December, and early January.

Follow-ups

A post card reminder/thank you jogs memories and reminds. Send after one or two weeks. This should make the response seem more important. Text includes reminder of the respondent's importance and an invitation to get a replacement questionnaire if needed.

After the third or fourth week, send a letter and a replacement questionnaire with essentially the same message.

After the sixth week, send a final, certified letter and replacement questionnaire [individual researchers are unlikely to afford this step].

Check-in

It is important to have a logical, well ordered process to check in responses as they are received and begin data coding.

Interviews

Interviewing is a technique that is primarily used to gain an understanding of the underlying reasons and motivations for people's attitudes, preferences or behaviour. Interviews can be undertaken on a personal one-to-one basis or in a group.

They can be conducted at work, at home, in the street or in a shopping centre, or some other agreed location.

Persónal interview

Advantages:

- Serious approach by respondent resulting in accurate information.
- Good response rate.
- Completed and immediate.
- Possible in-depth questions.
- Interviewer in control and can give help if there is a problem.
- Can investigate motives and feelings.
- Can use recording equipment.
- Characteristics of respondent assessed – tone of voice, facial expression, hesitation, etc.
- Can use props.
- If one interviewer used, uniformity of approach.
- Used to pilot other methods.

Disadvantages:

- Need to set up interviews.

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- Time consuming.
- Geographic limitations.
- Can be expensive.
- Normally need a set of questions.
- Respondent bias – tendency to please or impress, create false personal image, or end interview quickly.
- Embarrassment possible if personal questions.
- Transcription and analysis can present problems – subjectivity.
- If many interviewers, training required.

Types of interview

Structured:

- Based on a carefully worded interview schedule.
- Frequently require short answers with the answers being ticked off.
- Useful when there are a lot of questions which are not particularly contentious or thought provoking.
- Respondent may become irritated by having to give over-simplified answers.

Semi-structured

The interview is focused by asking certain questions but with scope for the respondent to express him or herself at length.

Unstructured

This also called an in-depth interview. The interviewer begins by asking a general question. The interviewer then encourages the respondent to talk freely. The interviewer uses an unstructured format, the subsequent direction of the interview being determined by the respondent's initial reply. The interviewer then probes for elaboration – 'Why do you say that?' or, 'That's interesting, tell me more' or, 'Would you like to add anything else?' being typical probes.

The following section is a step-by-step guide to conducting an interview. You should remember that all situations are different and therefore you may need refinements to the approach.

Planning an interview:

- List the areas in which you require information.
- Decide on type of interview.
- Transform areas into actual questions.
- Try them out on a friend or relative.
- Make an appointment with respondent(s) – discussing details of why and how long.
- Try and fix a venue and time when you will not be disturbed.

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Conducting an interview:

• Personally	–	arrive on time be smart smile employ good manners find a balance between friendliness and objectivity.
• At the start	–	introduce yourself re-confirm the purpose assure confidentiality – if relevant specify what will happen to the data.
• The questions	–	speak slowly in a soft, yet audible tone of voice control your body language know the questions and topic ask all the questions.
• Responses	–	recorded as you go on questionnaire written verbatim, but slow and time-consuming summarised by you taped – agree beforehand – have alternative method if not acceptable consider effect on respondent's answers proper equipment in good working order sufficient tapes and batteries minimum of background noise.
• At the end	–	ask if the respondent would like to give further details about anything or any questions about the research thank them.

Telephone interview

This is an alternative form of interview to the personal, face-to-face interview.

Advantages:

- Relatively cheap.
- Quick.
- Can cover reasonably large numbers of people or organisations.
- Wide geographic coverage.
- High response rate – keep going till the required number.
- No waiting.
- Spontaneous response.
- Help can be given to the respondent.
- Can tape answers.

Disadvantages:

- Often connected with selling.
- Questionnaire required.
- Not everyone has a telephone.
- Repeat calls are inevitable – average 2.5 calls to get someone.

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- Time is wasted.
- Straightforward questions are required.
- Respondent has little time to think.
- Cannot use visual aids.
- Can cause irritation.
- Good telephone manner is required.
- Question of authority.

Getting started

Locate the respondent:

- Repeat calls may be necessary especially if you are trying to contact people in organisations where you may have to go through secretaries.
- You may not know an individual's name or title – so there is the possibility of interviewing the wrong person.
- You can send an advance letter informing the respondent that you will be telephoning. This can explain the purpose of the research.

Getting them to agree to take part:

- You need to state concisely the purpose of the call scripted and similar to the introductory letter of a postal questionnaire.
- Respondents will normally listen to this introduction before they decide to co-operate or refuse.
- When contact is made respondents may have questions or raise objections about why they could not participate. You should be prepared for these.

Ensuring quality

- *Quality of questionnaire* – follows the principles of questionnaire design. However, it must be easy to move through as you cannot have long silences on the telephone.
- *Ability of interviewer* – follows the principles of face-to-face interviewing.

Table 3.5: Comparison of the three common methods of surveys

	Postal survey	**Telephone survey**	**Personal interview**
Cost (assuming a good response rate)	Often lowest	Usually in-between	Usually highest
Ability to probe	No personal contact or observation	Some chance for gathering additional data through elaboration on questions, but no personal observation	Greatest opportunity for observation, building rapport, and additional probing

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Respondent ability to complete at own convenience	Yes	Perhaps, but usually no	Perhaps, if interview time is prearranged with respondent
Interview bias	No chance	Some, perhaps due to voice inflection	Greatest chance
Ability to decide who actually responds to the questions	Least	Some	Greatest
Impersonality	Greatest	Some due to lack of face-to-face contact	Least
Complex questions	Least suitable	Somewhat suitable	More suitable
Visual aids Potential negative respondent reaction	Little opportunity 'Junk mail'	No opportunity 'Junk calls'	Greatest opportunity Invasion of privacy
Interviewer control over interview environment	Least	Some in selection of time to call	Greatest
Time lag between soliciting and receiving response	Greatest	Least	May be considerable if a large area involved
Suitable types of questions	Simple, mostly dichotomous (yes/no) and multiple choice	Some opportunity for open-ended questions especially if interview is recorded	Greatest opportunity for open-ended questions
Requirement for technical skills in conducting interview	Least	Medium	Greatest
Response rate	Low	Usually high	High

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Focus group interviews

A focus group is an interview conducted by a trained moderator in a non-structured and natural manner with a small group of respondents. The moderator leads the discussion. The main purpose of focus groups is to gain insights by listening to a group of people from the appropriate target market talk about specific issues of interest.

Observation

Observation involves recording the behavioural patterns of people, objects and events in a systematic manner. Observational methods may be:

- structured or unstructured
- disguised or undisguised
- natural or contrived
- personal
- mechanical
- non-participant
- participant, with the participant taking a number of different roles.

Structured or unstructured

In structured observation, the researcher specifies in detail what is to be observed and how the measurements are to be recorded. It is appropriate when the problem is clearly defined and the information needed is specified.

In unstructured observation, the researcher monitors all aspects of the phenomenon that seem relevant. It is appropriate when the problem has yet to be formulated precisely and flexibility is needed in observation to identify key components of the problem and to develop hypotheses. The potential for bias is high. Observation findings should be treated as hypotheses to be tested rather than as conclusive findings.

Disguised or undisguised

In disguised observation, respondents are unaware they are being observed and thus behave naturally. Disguise is achieved, for example, by hiding, or using hidden equipment or people disguised as shoppers.

In undisguised observation, respondents are aware they are being observed. There is a danger of the Hawthorne effect – people behave differently when being observed.

Natural or contrived

Natural observation involves observing behaviour as it takes place in the environment, for example, eating hamburgers in a fast food outlet.

In contrived observation, the respondents' behaviour is observed in an artificial environment, for example, a food tasting session.

Personal

In personal observation, a researcher observes actual behaviour as it occurs. The observer may or may not normally attempt to control or manipulate the phenomenon being observed. The observer merely records what takes place.

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Mechanical

Mechanical devices (video, closed circuit television) record what is being observed. These devices may or may not require the respondent's direct participation. They are used for continuously recording on-going behaviour.

Non-participant

The observer does not normally question or communicate with the people being observed. He or she does not participate.

Participant

In participant observation, the researcher becomes, or is, part of the group that is being investigated. Participant observation has its roots in ethnographic studies (study of man and races) where researchers would live in tribal villages, attempting to understand the customs and practices of that culture. It has a very extensive literature, particularly in sociology (development, nature and laws of human society) and anthropology (physiological and psychological study of man). Organisations can be viewed as 'tribes' with their own customs and practices.

The role of the participant observer is not simple. There are different ways of classifying the role:

- Researcher as employee.
- Researcher as an explicit role.
- Interrupted involvement.
- Observation alone.

Researcher as employee

The researcher works within the organisation alongside other employees, effectively as one of them. The role of the researcher may or may not be explicit and this will have implications for the extent to which he or she will be able to move around and gather information and perspectives from other sources. This role is appropriate when the researcher needs to become totally immersed and experience the work or situation at first hand.

There are a number of dilemmas. Do you tell management and the unions? Friendships may compromise the research. What are the ethics of the process? Can anonymity be maintained? Skill and competence to undertake the work may be required. The research may be over a long period of time.

Researcher as an explicit role

The researcher is present every day over a period of time, but entry is negotiated in advance with management and preferably with employees as well. The individual is quite clearly in the role of a researcher who can move around, observe, interview and participate in the work as appropriate. This type of role is the most favoured, as it provides many of the insights that the complete observer would gain, whilst offering much greater flexibility without the ethical problems that deception entails.

Interrupted involvement

The researcher is present sporadically over a period of time, for example, moving in and out of the organisation to deal with other work or to conduct

interviews with, or observations of, different people across a number of different organisations. It rarely involves much participation in the work.

Observation alone

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The observer role is often disliked by employees since it appears to be 'eavesdropping'. The inevitable detachment prevents the degree of trust and friendship forming between the researcher and respondent, which is an important component in other methods.

Choice of roles

The role adopted depends on the following:

- *Purpose of the research:* Does the research require continued longitudinal involvement (long period of time), or will in-depth interviews, for example, conducted over time give the type of insights required?
- *Cost of the research:* To what extent can the researcher afford to be committed for extended periods of time? Are there additional costs such as training?
- *The extent to which access can be gained:* Gaining access where the role of the researcher is either explicit or covert can be difficult, and may take time.
- *The extent to which the researcher would be comfortable in the role:* If the researcher intends to keep his identity concealed, will he or she also feel able to develop the type of trusting relationships that are important? What are the ethical issues?
- *The amount of time the researcher has at his disposal:* Some methods involve a considerable amount of time. If time is a problem alternate approaches will have to be sought.

SAMPLING TECHNIQUES

Sampling is that part of statistical practice concerned with the selection of individual observations intended to yield some knowledge about a population of concern, especially for the purposes of statistical inference. Each observation measures one or more properties (weight, location, etc.) of an observable entity enumerated to distinguish objects or individuals. Survey weights often need to be applied to the data to adjust for the sample design. Results from probability theory and statistical theory are employed to guide practice.

The sampling process comprises several stages:

- Defining the population of concern
- Specifying a sampling frame, a set of items or events possible to measure
- Specifying a sampling method for selecting items or events from the frame
- Determining the sample size
- Implementing the sampling plan
- Sampling and data collecting
- Reviewing the sampling process

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Population Definition

Successful statistical practice is based on focused problem definition. In sampling, this includes defining the population from which our sample is drawn. A population can be defined as including all people or items with the characteristic one wishes to understand. Because there is very rarely enough time or money to gather information from everyone or everything in a population, the goal becomes finding a representative sample (or subset) of that population.

Sometimes that which defines a population is obvious. For example, a manufacturer needs to decide whether a batch of material from production is of high enough quality to be released to the customer, or should be sentenced for scrap or rework due to poor quality. In this case, the batch is the population.

Although the population of interest often consists of physical objects, sometimes we need to sample over time, space, or some combination of these dimensions. For instance, an investigation of supermarket staffing could examine checkout line length at various times, or a study on endangered penguins might aim to understand their usage of various hunting grounds over time. For the time dimension, the focus may be on periods or discrete occasions.

In other cases, our 'population' may be even less tangible. For example, Joseph Jagger studied the behaviour of roulette wheels at a casino in Monte Carlo, and used this to identify a biased wheel. In this case, the 'population' Jagger wanted to investigate was the overall behaviour of the wheel (i.e. the probability distribution of its results over infinitely many trials), while his 'sample' was formed from observed results from that wheel. Similar considerations arise when taking repeated measurements of some physical characteristic such as the electrical conductivity of copper.

This situation often arises when we seek knowledge about the cause system of which the observed population is an outcome. In such cases, sampling theory may treat the observed population as a sample from a larger 'superpopulation'. For example, a researcher might study the success rate of a new 'quit smoking' program on a test group of 100 patients, in order to predict the effects of the program if it were made available nationwide. Here the superpopulation is "everybody in the country, given access to this treatment" — a group which does not yet exist, since the program isn't yet available to all.

Note also that the population from which the sample is drawn may not be the same as the population about which we actually want information. Often there is large but not complete overlap between these two groups due to frame issues etc. Sometimes they may be entirely separate for instance, we might study rats in order to get a better understanding of human health, or we might study records from people born in 2008 in order to make predictions about people born in 2009.

Time spent in making the sampled population and population of concern precise is often well spent, because it raises many issues, ambiguities and questions that would otherwise have been overlooked at this stage.

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Sampling Frame

In the most straightforward case, such as the sentencing of a batch of material from production (acceptance sampling by lots), it is possible to identify and measure every single item in the population and to include any one of them in our sample. However, in the more general case this is not possible. There is no way to identify all rats in the set of all rats. There is no way to identify every voter at a forthcoming election (in advance of the election).

These imprecise populations are not amenable to sampling in any of the ways below and to which we could apply statistical theory.

As a remedy, we seek a sampling frame which has the property that we can identify every single element and include any in our sample. The most straightforward type of frame is a list of elements of the population (preferably the entire population) with appropriate contact information. For example, in an opinion poll, possible sampling frames include:

- Electoral register
- Telephone directory

Not all frames explicitly list elements of the population. For example, a street map can be used as a frame for a door-to-door survey; although it doesn't show individual houses, we can select streets from the map and then visit all houses on those streets. (One advantage of such a frame is that it would include people who have recently moved and are not yet on the list frames discussed above.)

The sampling frame must be representative of the population and this is a question outside the scope of statistical theory demanding the judgment of experts in the particular subject matter being studied. All the above frames omit some people who will vote at the next election and contain some people who will not; some frames will contain multiple records for the same person. People not in the frame have no prospect of being sampled. Statistical theory tells us about the uncertainties in extrapolating from a sample to the frame. In extrapolating from frame to population, its role is motivational and suggestive.

"To the scientist, however, representative sampling is the only justified procedure for choosing individual objects for use as the basis of generalization, and is therefore usually the only acceptable basis for ascertaining truth." (Andrew A. Marino). It is important to understand this difference to steer clear of confusing prescriptions found in many web pages.

In defining the frame, practical, economic, ethical, and technical issues need to be addressed. The need to obtain timely results may prevent extending the frame far into the future.

The difficulties can be extreme when the population and frame are disjoint. This is a particular problem in forecasting where inferences about the future are made from historical data. In fact, in 1703, when Jacob Bernoulli proposed to Gottfried Leibniz the possibility of using historical mortality data to predict the probability of early death of a living man, Gottfried Leibniz recognized the problem in replying:

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"Nature has established patterns originating in the return of events but only for the most part. New illnesses flood the human race, so that no matter how many experiments you have done on corpses, you have not thereby imposed a limit on the nature of events so that in the future they could not vary."

A frame may also provide additional 'auxiliary information' about its elements; when this information is related to variables or groups of interest, it may be used to improve survey design. For instance, an electoral register might include name and sex; this information can be used to ensure that a sample taken from that frame covers all demographic categories of interest. (Sometimes the auxiliary information is less explicit; for instance, a telephone number may provide some information about location.)

Having established the frame, there are a number of ways for organizing it to improve efficiency and effectiveness.

It's at this stage that the researcher should decide whether the sample is in fact to be the whole population and would therefore be a census.

Probability and Nonprobability Sampling

A probability sampling scheme is one in which every unit in the population has a chance (greater than zero) of being selected in the sample, and this probability can be accurately determined. The combination of these traits makes it possible to produce unbiased estimates of population totals, by weighting sampled units according to their probability of selection.

Example: We want to estimate the total income of adults living in a given street. We visit each household in that street, identify all adults living there, and randomly select one adult from each household. (For example, we can allocate each person a random number, generated from a uniform distribution between 0 and 1, and select the person with the highest number in each household). We then interview the selected person and find their income.

People living on their own are certain to be selected, so we simply add their income to our estimate of the total. But a person living in a household of two adults has only a one-in-two chance of selection. To reflect this, when we come to such a household, we would count the selected person's income twice towards the total. (In effect, the person who is selected from that household is taken as representing the person who isn't selected.)

In the above example, not everybody has the same probability of selection; what makes it a probability sample is the fact that each person's probability is known. When every element in the population does have the same probability of selection, this is known as an 'equal probability of selection' (EPS) design. Such designs are also referred to as 'self-weighting' because all sampled units are given the same weight.

Probability sampling includes: Simple Random Sampling, Systematic Sampling, Stratified Sampling, Probability Proportional to Size Sampling, and Cluster or Multistage Sampling. These various ways of probability sampling have two things in common: (1) Every element has a known nonzero probability of being sampled and (2) involves random selection at some point.

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Nonprobability sampling is any sampling method where some elements of the population have no chance of selection (these are sometimes referred to as 'out of coverage'/'undercovered'), or where the probability of selection can't be accurately determined. It involves the selection of elements based on assumptions regarding the population of interest, which forms the criteria for selection. Hence, because the selection of elements is nonrandom, nonprobability sampling does not allow the estimation of sampling errors. These conditions place limits on how much information a sample can provide about the population. Information about the relationship between sample and population is limited, making it difficult to extrapolate from the sample to the population.

Example: We visit every household in a given street, and interview the first person to answer the door. In any household with more than one occupant, this is a nonprobability sample, because some people are more likely to answer the door (e.g. an unemployed person who spends most of their time at home is more likely to answer than an employed housemate who might be at work when the interviewer calls) and it's not practical to calculate these probabilities.

Nonprobability Sampling includes: Accidental Sampling, Quota Sampling and Purposive Sampling. In addition, nonresponse effects may turn any probability design into a nonprobability design if the characteristics of nonresponse are not well understood, since nonresponse effectively modifies each element's probability of being sampled.

Sampling Methods

It is incumbent on the researcher to clearly define the target population. There are no strict rules to follow, and the researcher must rely on logic and judgment. The population is defined in keeping with the objectives of the study.

Sometimes, the entire population will be sufficiently small, and the researcher can include the entire population in the study. This type of research is called a census study because data is gathered on every member of the population.

Usually, the population is too large for the researcher to attempt to survey all of its members. A small, but carefully chosen sample can be used to represent the population. The sample reflects the characteristics of the population from which it is drawn.

Sampling methods are classified as either probability or nonprobability. In probability samples, each member of the population has a known non-zero probability of being selected. Probability methods include random sampling, systematic sampling, and stratified sampling. In nonprobability sampling, members are selected from the population in some nonrandom manner. These include convenience sampling, judgment sampling, quota sampling, and snowball sampling. The advantage of probability sampling is that sampling error can be calculated. Sampling error is the degree to which a sample might differ from the population. When inferring to the population, results are reported plus or minus the sampling error. In nonprobability sampling, the degree to which the sample differs from the population remains unknown.

Random sampling is the purest form of probability sampling. Each member of the population has an equal and known chance of being selected. When there

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are very large populations, it is often difficult or impossible to identify every member of the population, so the pool of available subjects becomes biased.

Systematic sampling is often used instead of random sampling. It is also called an Nth name selection technique. After the required sample size has been calculated, every N^{th} record is selected from a list of population members. As long as the list does not contain any hidden order, this sampling method is as good as the random sampling method. Its only advantage over the random sampling technique is simplicity. Systematic sampling is frequently used to select a specified number of records from a computer file.

Stratified sampling is commonly used probability method that is superior to random sampling because it reduces sampling error. A stratum is a subset of the population that share at least one common characteristic. Examples of stratums might be males and females, or managers and non-managers. The researcher first identifies the relevant stratums and their actual representation in the population. Random sampling is then used to select a sufficient number of subjects from each stratum. "Sufficient" refers to a sample size large enough for us to be reasonably confident that the stratum represents the population. Stratified sampling is often used when one or more of the stratums in the population have a low incidence relative to the other stratums.

Convenience sampling is used in exploratory research where the researcher is interested in getting an inexpensive approximation of the truth. As the name implies, the sample is selected because they are convenient. This nonprobability method is often used during preliminary research efforts to get a gross estimate of the results, without incurring the cost or time required to select a random sample.

Judgment sampling is a common nonprobability method. The researcher selects the sample based on judgment. This is usually and extension of convenience sampling. For example, a researcher may decide to draw the entire sample from one "representative" city, even though the population includes all cities. When using this method, the researcher must be confident that the chosen sample is truly representative of the entire population.

Quota sampling is the nonprobability equivalent of stratified sampling. Like stratified sampling, the researcher first identifies the stratums and their proportions as they are represented in the population. Then convenience or judgment sampling is used to select the required number of subjects from each stratum. This differs from stratified sampling, where the stratums are filled by random sampling.

Snowball sampling is a special nonprobability method used when the desired sample characteristic is rare. It may be extremely difficult or cost prohibitive to locate respondents in these situations. Snowball sampling relies on referrals from initial subjects to generate additional subjects. While this technique can dramatically lower search costs, it comes at the expense of introducing bias because the technique itself reduces the likelihood that the sample will represent a good cross section from the population.

Good data collection involves:

- Following the defined sampling process
- Keeping the data in time order
- Noting comments and other contextual events
- Recording non-responses

Most sampling books and papers written by non-statisticians focus only in the data collection aspect, which is just a small though important part of the sampling process.

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PRECISION AND ACCURACY OF SAMPLE BASED RESEARCH

The best sampling method is the method that most effectively meets the particular goals of the study in question. The effectiveness of a sampling method depends on many factors. Because these factors interact in complex ways, the "best" sampling method is seldom obvious. Good researchers use the following strategy to identify the best sampling method.

- List the research goals (usually some combination of accuracy, precision, and/or cost).
- Identify potential sampling methods that might effectively achieve those goals.
- Test the ability of each method to achieve each goal.
- Choose the method that does the best job of achieving the goals.

It is important to distinguish from the start a different between accuracy and precision:—

(1) Accuracy is the degree to which information in a digital database matches true or accepted values. Accuracy is an issue pertaining to the quality of data and the number of errors contained in a dataset or map.

- The level of accuracy required for particular applications varies greatly.
- Highly accurate data can be very difficult and costly to produce and compile.

(2) Precise attribute information may specify the characteristics of features in great detail. It is important to realize, however, that precise data—no matter how carefully measured—may be inaccurate. Surveyors may make mistakes or data may be entered into the database incorrectly.

- The level of precision required for particular applications varies greatly. Engineering projects such as road and utility construction require very precise information measured to the millimeter or tenth of an inch. Demographic analyses of marketing or electoral trends can often make do with less, say to the closest zip code or precinct boundary.
- Highly precise data can be very difficult and costly to collect.

High precision does not indicate high accuracy nor does high accuracy imply high precision. But high accuracy and high precision are both expensive.

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Two additional terms are used as well:

1. Data quality refers to the relative accuracy and precision of a particular database. These facts are often documented in data quality reports.
2. Error encompasses both the imprecision of data and its inaccuracies.

Quality of Survey Results

When researchers describe the quality of survey results, they may use one or more of the following terms.

- *Accuracy:* Accuracy refers to how close a sample statistic is to a population parameter. Thus, if you know that a sample mean is 99 and the true population mean is 100, you can make a statement about the sample accuracy. For example, you might say the sample mean is accurate to within 1 unit.
- *Precision:* Precision refers to how close estimates from different samples are to each other. For example, the standard error is a measure of precision. When the standard error is small, estimates from different samples will be close in value; and vice versa. Precision is inversely related to standard error. When the standard error is small, sample estimates are more precise; when the standard error is large, sample estimates are less precise.
- *Margin of error:* The margin of error expresses the maximum expected difference between the true population parameter and a sample estimate of that parameter. To be meaningful, the margin of error should be qualified by a probability statement. For example, a pollster might report that 50% of voters will choose the Democratic candidate. To indicate the quality of the survey result, the pollster might add that the margin of error is +5%, with a confidence level of 90%. This means that if the same sampling method were applied to different samples, the true percentage of Democratic voters would fall within the margin of error 90% of the time.

The margin of error is equal to half of the width of the confidence interval In a previous lesson, the tutorial described how to construct a confidence interval.

Sample Design

A sample design can be described by two factors.

- *Sampling method:* Sampling method refers to the rules and procedures by which some elements of the population are included in the sample.
- *Estimator:* The estimation process for calculating sample statistics is called the estimator. Different sampling methods may use different estimators. For example, the formula for computing a mean score with a simple random sample is different from the formula for computing a mean score with a stratified sample. Similarly, the formula for the standard error may vary from one sampling method to the next.

The "best" sample design depends on survey objectives and on survey resources. For example, a researcher might select the most economical design that provides a desired level of precision. Or, if the budget is limited, a researcher

might choose the design that provides the greatest precision without going over budget. Or other factors might guide the choice of sample design.

SAMPLING AND NON-SAMPLING ERRORS

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Estimates derived from sample surveys are subject to two types of errors—sampling errors and nonsampling errors. Nonsampling errors can be attributed to many sources, such as response differences, definitional difficulties, differing respondent interpretations, and respondent inability to recall information.

Sampling errors (the focus of this presentation) occur when estimates are derived from a sample rather than a census of the population. The sample used for a particular survey is only one of a large number of possible samples of the same size and design that could have been selected. Even if the same questionnaire and instructions were used, the estimates from each sample would differ from the others. This difference, termed sampling error, occurs by chance, and its variability is measured by the standard error associated with a particular survey.

Assessing the Accuracy of Estimates

Having estimated a population quantity such as a mean or total, it is desirable to assess the accuracy of the estimate. The customary approach is to construct a confidence interval within which one is sufficiently sure the true population value lies. The standard error of a survey estimate measures the precision with which an estimate from one sample approximates the true population value, and thus can be used to construct a confidence interval for a survey parameter to assess the accuracy of the estimate. Let $\hat{\theta}$ be an estimator of a parameter of interest θ with a standard error $SE(\hat{\theta})$. If the sample size is large, then an approximate $(1-\alpha)100$ percent confidence interval for θ is

$$\{\hat{\theta} - z_{\alpha/2} SE(\hat{\theta}), \hat{\theta} + z_{\alpha/2} SE(\hat{\theta})\},$$

where $z_{\alpha/2}$ is the upper $\alpha/2$ percentage point of the normal distribution with mean zero and variance one.

If the process of selecting a sample from the population were repeated many times and an estimate and its standard error calculated for each sample, then:

- Approximately 90 percent (α=0.10) of the intervals from 1.645 ($=z_{\alpha}$) standard errors below the estimate to 1.645 standard errors above the estimate will include the true population value.
- Approximately 95 percent (α=0.05) of the intervals from 1.96 ($=z_{\alpha/2}$) standard errors below the estimate to 1.96 standard errors above the estimate will include the true population value.
- Approximately 99 percent (α=0.01) of the intervals from 2.575 ($=z_{\alpha/2}$) standard errors below the estimate to 2.575 standard errors above the estimate will include the true population value.

With an estimate of the standard error and the factors above (1.645, 1.96, or 2.575), a data user may construct a confidence interval, or range of values, that includes the true population value with the given probability α (=0.10, 0.05, or 0.01).

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Sampling Error

In statistics, sampling error or estimation error is the error caused by observing a sample instead of the whole population.

An estimate of a quantity of interest, such as an average or percentage, will generally be subject to sample-to-sample variation. These variations in the possible sample values of a statistic can theoretically be expressed as sampling errors, although in practice the exact sampling error is typically unknown. Sampling error also refers more broadly to this phenomenon of random sampling variation.

The likely size of the sampling error can generally be controlled by taking a large enough random sample from the population, although the cost of doing this may be prohibitive; see sample size and statistical power for more detail. If the observations are collected from a random sample, statistical theory provides probabilistic estimates of the likely size of the sampling error for a particular statistic or estimator. These are often expressed in terms of its standard error.

Sampling error can be contrasted with non-sampling error. Non-sampling error is a catch-all term for the deviations from the true value that are not a function of the sample chosen, including various systematic errors and any random errors that are not due to sampling. Non-sampling errors are much harder to quantify than sampling error.

Non-Sampling Error

In statistics, non-sampling error is a catch-all term for the deviations from the true value that are not a function of the sample chosen, including various systematic errors and any random errors that are not due to sampling. Non-sampling errors are much harder to quantify than sampling errors.

In a census or sample survey, we obtain observations through personal enquiry, direct observation, direct questionnaire, mail enquiry or other methods on age, income, saving, buying performance, attitude on a particular problem, occupation, business activities or other characteristics of a person, household, farm business, area or other unit.

The planning of the statistical enquiry needs detailed and systematic planning to obtain the relevant, accurate and timely data to satisfy the objectives set. The set of measurements or observations recorded in the data collection operation are normally examined for internal consistency and acceptability, certain corrections made and some of the entries are coded to identify them in a classification system. The results are then summarized into frequency tables as well as various types of statistics such as tables, averages, correlations or other relevant statistical measures.

The pre data collection activities are parts of the process of specification of various parameters for systematic preparation of the whole statistical enquiry. The mistakes or faults occurring in these activities are called the specification mistakes or faults made by the survey designer. The data collection and processing operations constitute the measurement process and are the sources of measurement errors. The above mentioned faults and errors are collectively called as non-sampling errors.

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Classification of Non-Sampling Errors

There are several types of non-sampling errors. A detailed study of the sources, measurement and control of these errors requires that they be broken down and categorized in ways that facilitate understanding of their nature. Several schemes for classifying non-sampling errors are possible; none is perfect, each serve a purpose.

Errors by stage of survey process

One approach is to classify non-sampling errors by the stage of the survey in which they occur. The three major stages are

1. Survey design and preparation
2. Data collection
3. Data processing and analysis

Each of these stages can be subdivided. The subdivisions could be made as follows—

Survey design and preparation could make mistakes in the activities,

- Determination of the purpose of survey
- Developing concepts and definition of survey data items
- Designing the questionnaire and guiding the way to complete the form
- Selecting and training of interviewers
- Preparation of survey area
- Selecting the data collection method of enquiry

Data collection could involve errors such as—

- interviewers omit some survey units
- Interviewers omit to do coding
- Interviewers omit the survey items
- Interviewers record the survey data items on the inquiry sheets themselves
- Interviewers ask the questionnaires through other person
- Interviewee does not remember the event
- Interviewee gives wrong answers intentionally

Data processing and analysis could mark errors in the following activities—

- Receiving inquiry sheets
- checking inquiry sheet, encoding and checking the encoding of information written in inquiry sheets
- Checking the result of entering information
- Entering omitted codes
- Entering coincided, omitted codes

This classification is especially useful in studying the non-sampling errors at each stage in the planning and execution of a household survey.

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Sources of non-sampling errors

A second method of classifying non-sampling error is on the basis of the source or type of error.

Sources and Type of non-sampling errors

Non-sampling errors arise due to various causes right from the initial stage when the survey is being planned to the final stage when the data are processed and analysed.

A household survey program is a set of rules which specify various operations. The rules, for instance, describe the population under coverage, specify concepts, definitions to be used, methods of data collection and measurements to be made and tabulation. If various survey operations are carried out according to the rules laid down, it is possible to obtain a true value of the characteristics under study for every unit in the population. However, it is rarely achieved in practice even though the survey operations are strictly carried out according to the set rules. This is due to a large number of factors, some of which are uncontrollable, which may affect the conduct of the survey operations.

In general, non-sampling may arise from one or more of the following factors.

a. Data specifications being inadequate and/or inconsistent with the objectives of survey

b. Duplication or omission of units due to the imprecise of the boundaries of area units, incomplete or wrong identification particulars of units or faulty methods of enumerations

c. Inappropriate methods of interview, observation or measurement using ambiguous questionnaires, definitions or instructions

d. lack of trained and experienced field enumerators including lack of good field supervisors

e. Difficulties involved in actual field data collection arising from recall error and other types of errors on the part of respondents (including non-response)

f. Inadequate scrutiny of the basic data

g. Errors in data processing operations such as coding, keying, verification and tabulation

h. Errors during presentation and publications

These source errors are not exhaustive but are given to indicate the possible sources of errors. In a sample survey, non-sampling may also arise due to defective frame and faulty selection of sampling units.

Types of non-sampling errors

Biemer and Lyberg (2003) identify five major components of non-sampling errors, namely *(a)* specification, *(b)* frame, *(c)* non–response, *(d)* measurement and *(e)* processing errors. Although frame, non-response and measurement errors are thought of as occurring in the data collecting phase of the survey, frequently

they are the result of poor decision or choices in the survey design and preparation phase.

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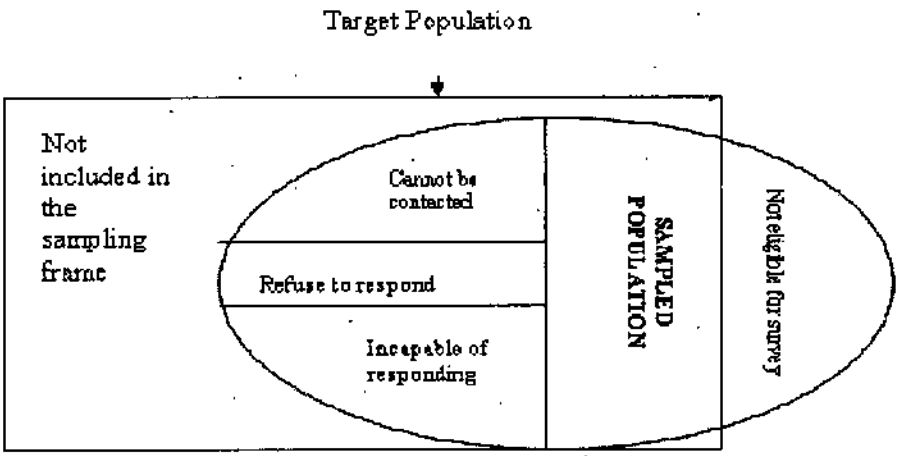
(a) Specification Errors

Imperfections in the initial specifications lead to non-sampling error. This occurs when the concept implied by the question is different from the underlying construct that should b measured. Survey planners should, at an early stage, develop a fairly precise definitions of each of the key variables. Variables such as household, income, labour force status, education, literacy, food consumption, medical care, disability etc. cannot be translated into sets of survey questions unless they are defined into considerable details. In a disability survey, a general question asking people whether or not they have a disability can be subject to different interpretations depending on the severity of impairment or the respondent's perception of disability. People with a minor disability may perceive themselves to have no disability. Unless the right screening and filter questions are included in the questionnaire, the answer may not bring out the total number of people with disability. Furthermore, there will be no chance of measuring and controlling non-sampling errors unless the concept is clearly defined in sufficient details.

(b) Frame Errors

In most area surveys primary sampling units comprise clusters of geographic units which are generally called enumeration units (EA). It is common that the demarcation of EAs is not properly carried out during census mapping. Thus households may be omitted or duplicated in the second stage frame.



Sampling Frame Imperfections

Frame imperfection can bias the estimates in the following ways: if units are not represented in the frame but should have been part of the frame, this results in zero probability of selection for these units omitted from the frame. If some units are duplicated, this results in over coverage with some units having larger probabilities of selection. The frame imperfections may be depicted in the *figure above.*

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Errors associated with the frame can, therefore, result in both over coverage and under coverage. Under coverage is the most common form in large scale surveys in developing countries. In multi-stage household surveys which is commonly used in large scale surveys, sampling involves a number of stages, such as selection of area units in one or more stages, listing and selection of households; and listing and selection of persons within selected households. Coverage error can arise in any of these stages. It is important to note that neither the magnitude nor the effect of coverage error is easy to estimate because it requires the information not only external to the sample bur also by definition, external to the sampling frame used.

Non-coverage denotes failure to include some sample units of a defined survey population in the sampling frame. Because such units have zero probability of selection, they are effectively excluded from the survey results. It is important to note that non-coverage does not refer to deliberate and explicit exclusion of sections of a larger population from survey population. For example, attitudinal surveys on marriage may exclude persons under the minimum age for legal marriage.

When computing non-coverage rates, members of groups deliberately and explicitly excluded should not be counted either in survey population or under non-coverage. In this regard defining the Non-coverage also refers to missed elements, omission due to faulty execution of survey operations. Non-coverage refers to the negative errors resulting from failure to include elements that would under normal circumstances, belong to the sample. Positive errors of over coverage also occur due to inclusion in the sample of elements that do not belong there.

The term gross coverage error refers to the sum of absolute values errors of non-coverage and over coverage error rates. The net non-coverage refers to the excess of non-coverage over over-coverage. It is therefore their algebraic sum. The net non-coverage error is the gross coverage error only if the over coverage is absent. In most social surveys, non-coverage is a much more common problem than over-coverage.

Corrections and weightings for non-coverage are much more difficult than for non-response because coverage rates cannot be obtained from the sample itself, but only from outside sources.

Reducing frame errors

The most effective way to reduce frame errors is to improve the frame by excluding the erroneous units and duplicates as well as updating the frame through field work to identify missing units from the frame. It is also important to undertake a good mapping exercise during the preparatory stages of a population and housing census. However, the frame prepared during the census should be updated regularly. It is also important to put in place procedures that will ensure the coverage of all selected sample units.

Kish provided useful fourfold classification of frame problems and possible solutions. The four problems with suggested solutions are

(i) *Missing elements:* The problem occurs when some population elements are not included in the frame. Missing elements may occur because the

frame is inadequate meaning that it is not intended to cover the whole of the target population or because it is incomplete meaning that it fails to include some elements from the target population.

The problem may be sidestepped by defining by defining the survey population to exclude the missing elements. The imperfect solution is often used when the exclude group is a negligible proportion of the total population.

A preferable solution is to find supplementary frames to cover the missing elements when no suitable supplementary frame is available, as is often the case, linking procedures to attach missing elements to specified listing may be used.

(ii) *Clusters:* This problems occurs when some listing refers to group of elements, not to the individual elements. When a sample of persons or households is required but the list of sampling frame is a list of dwellings. One possible solution is to include all the elements in the selected clusters of the sample. This solution has the benefit of giving the elements the same chance of appearing in the sample as their listings. This also works well for household surveys because most dwelling units contain only one household and this selection reduced fieldwork difficulties. But this "take-all" solution leads to large design effect. Moreover, a contamination of responses within a cluster occurs.

(iii) *Blanks or foreign elements :* This problem occurs when some listing do not relate to elements of survey population. Blanks or foreign elements are listings for elements that no longer exist in the population such as persons who have died or migrated or dwellings that have been demolished or listings for elements that are correctly on the frame but outside the scope of the survey such as unemployed people in a survey of wage earners.

The straightforward way is simply to ignore the selection if a blank is drawn. This will result in reduced sample size. If we substitute the next element on the list when a blank is being sampled as in systematic selection, it will increase the probability of selection for the next element.

(iv) *Duplicated listings:* This problem occurs when some population listings have more than one listings and often arises when a sampling frame is composed of several lists and some elements occur on more than one list.

One obvious way is to remove the duplicates from the whole frame, but often this is not feasible. The second possibility is to get a unique identification associated with each element with one the listing, normally the first oldest listing and treating the other listing for that element as blanks. Since the substantial proportion of the survey cost is incurred in making contact with respondents, it is uneconomical to reject some selections at interviews.

Non-response

Non-response is an error of non-observation like an coverage error. However, non-response differs from coverage error in that non-response reflects an successful

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attempt to obtain the desired information from an eligible unit, whereas the coverage error reflect the failure to have the sample unit uniquely defined in the frame.

In most cases, non-response is not evenly spread across the sample units but is concentrated in some groups. As a result of differential non-response, the distribution of the achieved sample across the sub-groups will deviate from that of the selected sample. This deviation is likely to give the non-response bias if the survey variables are also related to the subgroups.

There are two types of non-response: unit non-response and item non-response. Unit non-response implies that no information is obtained from certain sample elements. This may be because respondents cannot be contacted or they refuse to participate in the survey when contacted. The magnitude of unit non-response is indicative of the general acceptability, complexity, organization and management of the survey. Item non-response refers to a situation where for some units the information collected is incomplete. Reasons may be due to refusals and incapacity by respondents or omissions by enumerators. The extent of item non-response is indicative of the complexity, clarity and acceptability of particular items in a questionnaire and the quality of the interviewer work in handling these items.

Reducing non-response

It is important in designing and executing a household survey to develop good survey procedures aimed at increasing response rates, in a bid to minimize response bias. A number of procedures can be used in survey design in an attempt to reduce the number of refusals. For example in face-to-face interviews, interviewers are supposed to be carefully trained in strategies to avoid refusals, and they are to return to conduct an interview at the convenience of the respondent. The objectives and value of the surveys should generally and carefully be explained to respondents so that they can appreciate and cooperate. Assurance of confidentiality can help to alleviate fear respondents may have about the use of their responses for purposes other than those stipulated for the survey.

The following are some of the steps that can be undertaken to reduce non-response on household surveys:

a. *Good frames:* In many developing countries there are problems of locating sample units. This results in some form of non-response error. In such cases it would be helpful to have good frames of both area units and housing listings, to facilitate easy identification of all respondents. In addition, the workloads of enumeration staff should be manageable within the allotted time frame for the survey. This enables them to reach all sample units within the assigned cluster or enumeration area. During listing of households, for example, enough auxiliary information should be collected to facilitate distinction and easy location of the sample unit. Whenever, possible enumerators should know the area they work in very well and should preferably be stationed in the assigned work areas.

b. *Interview training, selection and supervision:* In personal interview surveys, the enumerator can play an important role in maximising response from

respondents. The way interviewers introduce themselves, what they say about the survey, the identity they carry, and the courtesy they show to respondents matter. In most household surveys the enumerator is the only link between the survey organisation and respondent. It is for this reason that enumerators and their supervisors should be carefully selected, well trained and motivated. Close supervision of enumerator's work and feedback on achieved response rate is of paramount importance.

c. *Follow up of non-responding units:* There should be follow up of non-respondents or make all effort to collect information from a sub-sample of the units who did not respond in the first place. This can be treated as a different stratum, from the responding stratum, in which better enumerators or supervisors may be assigned to interview respondents. The extent of refusals will depend on the subject matter of the survey (sensitive subjects are prone to high refusals), length of and complexity of the questionnaire and skills of the survey team. The not-at-home respondents should be followed up. Depending on the resources and duration of the survey in face-to-face interviews at least four callbacks are recommended. These should be made during different days and different times of the day (villages give example of farming period).

Measurement Error

This type of error arises from the failure of the recorded responses to reflect the true characteristics of the respondents. These errors centre on the content of the survey such as definition of survey objectives, their transformation into questionnaires, obtaining response record responses. These errors concern the accuracy of measurement at the level of the individual unit.

Sources of Measurement Errors

The following are possible general sources of measurement errors.

- The specification problems relating to wrong or misleading definitions and concepts on frame construction and questionnaire design which lead to incomplete coverage and varied interpretations by different interviewers leading to inaccuracies in the collected data
- Inadequate instructions with vague and unclear instructions leave enumerators to use their own judge their own judgment in carrying out field work. Sometimes sample units in the population lack precise definitions resulting in defective frames
- Interviewers record wrong information on some item due to inadequate training
- Age reporting is another common measurement problem through age heaping and digital preference. Depending on the type and nature of enquiry or information, these errors may be due to the interviewer or respondent or both
- Measurement devices may be defective or techniques may be defective and may cause observational errors and due to inadequate supervision of

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interviewers, inadequately trained and experienced field staff, problems involved in data collection and other type of errors on the part of the respondents arise

- Different procedures of observation on data collection mode (e.g. mail, telephone or in person). Respondents may answer questions differently in the presence of interviewers, over the phone or by themselves
- Respondents also may introduce errors because of the following reasons.
  - o Failure to understand the question
  - o Careless and incorrect answer from the respondent due to lack of understanding the objectives of the survey. The respondents may not give sufficient time to think over the questions
  - o Deliberate inclination to give wrong answers, for example, in surveys dealing with sensitive issues, such as income and stigmatized disease
  - o Memory lapses if there is a large reference period, for example, collecting information on non-durable commodities in expenditure survey

Measurement Error control and assessment

Measurement errors can be due to the cumulative effect from different sources which may be considerable since errors from different sources may not cancel. The net effect of such error can be a large bias. In interview survey , the interview error is major source of error. Three different means to control interviewer errors are—

Training: Many believe that the standardization of the measurement process especially as it relates to interviewers' task leads to decrease in interviewers' effects. Standardization can be achieved through a training program of sufficient length to cover interviewer's skills and techniques as well as information on the specific survey.

Supervision or Monitoring: These are essential ingredients of a quality control system to monitor interviewer performance though monitoring and performance statistics and identify problem questions. Reinterview programs and field observation are conducted to evaluate individual performance.

Workload Manipulation: This way of controlling is from a bias point of view in to change the average workload ; however, interviewer bias increases as average workload increases.

The respondent effect is another major measurement error. Both the traditional models of interviewer process and the cognitive science will play a ro;e on the survey response of the respondent. The five sequential stages in the formulation and provision o answers by survey respondent are Encoding of information, Comprehension of survey question, Retrieval of information from memory, Judgment of appropriate answer and communication of the response. There are many survey processes that can affect the quality of the respondent response.

Record Check Study A comparison of the survey results for individual sample cases with an external source generally assumed to have the true value

for the survey variables. Such studies are used to estimate the response bias resulting from the joint effect of all sources of measurement errors.

Processing Error

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Processing error comprise

- editing error
- coding error
- data entry error

Since processing error are often considered part of the administration or operation of the survey, it is often emphasized to use process control techniques and continuous quality management.

While programming errors in survey instruments or other gross errors in preparing data processing systems can occur, it is assumed that adequate review processes are implemented to avoid them.

Editing errors: Editing refers to procedures designed and used for detecting erroneous or questionable survey data with the goal of correcting these as much as possible.

Coding Errors: Some type of pre-edit coding of the survey returns is required before they can be further processed in editing, imputation and summary systems. Item response coding involves coding an actual response for a survey question into a category. This is the case in the industry and occupation coding. The recording of open-ended responses into a category variable by coders who interpret and catalogue each response.

Data Entry errors: These errors occur in the process of transferring collected data to an electronic medium. Quality control mechanisms to ensure the quality of captured data such as double key entry should be put in place to ensure that data entry errors are kept to an absolute minimum.

Summary

1. Data refers to information or facts usually collected as the result of experience, observation or experiment or premises. Data may consist of numbers, words, or images, particularly as measurements or observations of a set of variables.
2. The data collected by or on behalf of the person or people who are going to make use of the data refers to primary data. For example, the attendance of children, the result of examinations conducted by you are primary data.
3. In research, Secondary data is collecting and possibly processing data by people other than the researcher in question.
4. In primary data collection, you collect the data yourself using methods such as interviews and questionnaires.
5. Sampling is that part of statistical practice concerned with the selection of individual observations intended to yield some knowledge about a population of concern, especially for the purposes of statistical inference.
6. Sampling errors (the focus of this presentation) occur when estimates are derived from a sample rather than a census of the population.

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Review Questions

1. Differentiate between qualitative and quantitative data.
2. What are relevance of primary and secondary data in research?
3. How is primary data collected for research?
4. Write a short notes on probability and non-probability sampling.
5. Discuss an acurate sampling method of research.
6. How is sampling and non-sampling errors differentiated?

Further Readings

- Bhanwar Lal garg, Renu Kavdia, Sulochana Agrawal and Umesh Kumar Agarwal; ***An Introduction to Research Methodology***, RBSA Publcation.
- K. Chandrakandan and Karthikeyan; ***Behavioural Research Methodology***, Classical.
- *Applied Sampling*, by Seymour Sudman. Academic Press, New York, 1976. No book on sampling is simple (except for mathematicians) but this one is easier to understand than most.

UNIT – IV

DATA ANALYSIS AND PRESENTATION

STRUCTURE

LEARNING OBJECTIVES

After going through this unit, students will be able :

- to state the concept and method of data analysis;
- to understand the method of graphical and tabular presentation of data;
- to state the concept of various typres of graphs such as pie-graph, histograms, polygons and line graphs;

INTRODUCTION

In general, most evaluations conducted by local programs would lend themselves to descriptive analysis of data. Descriptive analysis is a way of summarizing and aggregating results from groups. If an evaluation has been conducted which employs a control group, or measures changes in program participants over time, then it might be appropriate to employ inferential analysis in which a decision is made about whether the particular results of the study are "real". More emphasis will be placed on descriptive analysis in this fact sheet.

Many reports rely on narrative information to present most, if not all, of the necessary information. Narrative information may be presented in three ways: standard writing style; tables; and/or, figures, diagrams, maps, and charts.

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Data analysis is a practice in which raw data is ordered and organized so that useful information can be extracted from it. The process of organizing and thinking about data is key to understanding what the data does and does not contain. There are a variety of ways in which people can approach data analysis, and it is notoriously easy to manipulate data during the analysis phase to push certain conclusions or agendas. For this reason, it is important to pay attention when data analysis is presented, and to think critically about the data and the conclusions which were drawn.

Charts, graphs, and textual writeups of data are all forms of data analysis. These methods are designed to refine and distill the data so that readers can glean interesting information without needing to sort through all of the data on their own. Summarizing data is often critical to supporting arguments made with that data, as is presenting the data in a clear and understandable way. The raw data may also be included in the form of an appendix so that people can look up specifics for themselves.

DATA ANALYSIS

In general, most evaluations conducted by local programs would lend themselves to descriptive analysis of data. Descriptive analysis is a way of summarizing and aggregating results from groups. If an evaluation has been conducted which employs a control group, or measures changes in program participants over time, then it might be appropriate to employ inferential analysis in which a decision is made about whether the particular results of the study are "real". More emphasis will be placed on descriptive analysis in this fact sheet.

Verbal Description of Data

Many reports rely on narrative information to present most, if not all, of the necessary information. Narrative information may be presented in three ways: standard writing style; tables; and/or, figures, diagrams, maps, and charts.

Standard writing style, that is, the use of sentences and paragraphs, is often the best way to present information, especially to audiences that are not accustomed to working with charts, graphs, tables, numbers, etc. It is the only way to present information such as examples and explanations. If standard writing style is used to summarize the results of open ended questions ("What do you like most about the program?"), it is often useful to give some indication of how often a particular response was given.

Tables represent narrative or numerical information in tabular fashion. A table arranges information in rows or columns, so that data elements may be referred to easily. They provide a clear and succinct way to present data, and are often more simple and understandable than standard writing style. They also facilitate the interpretation of data.

Figures, diagrams, maps and charts present verbal information visually. They often describe information more clearly than several paragraphs of description. Common forms of figures are flow charts; organization charts; GANT charts; and/or maps.

- Flow charts are particularly useful for presenting relationships and/or describing the sequence of events and the location and result of decisions.
- Organization charts are useful for presenting the chain of responsibility in a program.
- GANT charts list a set of tasks. They indicate the time each task is to be performed and by whom.
- Maps visually describe certain geographical areas. They are useful in describing different conditions for individual geographical areas.

Numerical Description of Data

Data are not only described in narrative, they are often described numerically. Three of the most basic types of summarization are:

- frequency distribution;
- percent; and
- average.

Each of these types of summarization may be presented as part of the text or arranged in tables or figures (graphs). Inclusion as part of text ("The average age for children served was 18 months") is an obvious way to report data.

Frequency distribution determines the number of units (e.g., people) which fall into each of a series of specified categories. In order to do a frequency distribution one must have categories. Reporting on age, for example, requires that you group the data first before constructing a frequency distribution (e.g., "birth to 2 years," or "3 to 5 years"). The evaluation might look to see how many parents were members of particular racial or ethnic categories, how many were known to protective services, or how many were referred from a range of referral sources.

Percent is another useful way of describing data. A frequency count can be converted to percent by dividing the number of units for a particular category by the total number of units and multiplying by 100. Percents are often more easily understood than the corresponding frequency counts. Percents can be represented in the same manner as frequency counts. In addition, a pie chart is useful in breaking the total group of people into the percentage of the total represented by each category. An average is a way of summarizing all of the information into one number. It can be used with data which is non-categorical numerical data. You cannot have a numerical average for gender or race, for example. Using a numerical average is very powerful, but it can also be misleading. A few data points which are very different from the others could substantially change the numerical average. For example, if the ages of children you serve are generally between 1 and 3 years, but you get one child who is 18, the average may be thrown off. Averages can be represented in tables or graphs.

Analysis of Data

The purpose of analysing data is to obtain usable and useful information. The analysis, irrespective of whether the data is qualitative or quantitative, may:

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- describe and summarise the data
- identify relationships between variables
- compare variables
- identify the difference between variables
- forecast outcomes.

Before we look at the various ways of analysing, presenting and discussing data, we need to clarify the differences between qualitative research, quantitative research, qualitative data and quantitative data. Earlier, we distinguished between qualitative research and quantitative research. It is highly unlikely that your research will be purely one or the other – it will probably be a mixture of the two approaches. For instance, you may have taken a small sample (normally associated with qualitative research) but then conducted a structured interview or used a questionnaire (normally associated with quantitative research) to determine people's attitudes to a particular phenomenon (qualitative research). It is therefore likely that your 'mixed' approach will take a qualitative approach some of the time and a quantitative approach at others. It depends on where you are in the research process.

A misconception, and source of confusion for many people, is the belief that qualitative research generates just qualitative data (text, words, opinions, etc) and that quantitative research generates just quantitative data (numbers). Sometimes this is the case, but both types of data can be generated by each approach. For instance, a postal questionnaire or structured 'interview (quantitative research) will often gather factual information, for example, age, salary, length of service (quantitative data) – but may also seek opinions and attitudes (qualitative data).

A second misconception is that statistical techniques are only applicable for quantitative data. Once again, this is not so. There are many statistical techniques that can be applied to qualitative data, such as ratings scales, that has been generated by a quantitative research approach.

Unfortunately, many people are worried about numbers, and in particular about statistics, and everything that word implies. Quantitative research and the analysis of quantitative data is consequently something to be avoided. But as we have indicated above, this is rarely possible because qualitative data can also be analysed using statistics. An understanding of basic statistical terms and ideas and the ability to carry out some statistical analysis (elementary or otherwise) is essential for most researchers. Also competence in these techniques, even at a basic level, is a useful skill in its own right.

A third misconception is that qualitative data analysis is easy. There are many ways of conducting qualitative research and thus many ways of analysing the resulting (qualitative) data. For example, having conducted an interview, transcription and organisation of data are the first stages of analysis. This would then be continued by systematically analysing the transcripts, grouping together comments on similar themes and attempting to interpret them and draw conclusions.

We deal with data that can be analysed statistically (quantitative data and some types of qualitative data) in the section called quantitative data analysis. We cover data that cannot, or is very difficult, to analyse statistically in the section called qualitative data analysis.

Qualitative Data Analysis

Qualitative data is subjective, rich, and in-depth information normally presented in the form of words. In undergraduate dissertations, the most common form of qualitative data is derived from semi-structured or unstructured interviews, although other sources can include observations, life histories and journals and documents of all kinds including newspapers.

Qualitative data from interviews can be analysed for content (content analysis) or for the language used (discourse analysis). Qualitative data is difficult to analyse and often opportunities to achieve high marks are lost because the data is treated casually and without rigour. Here we concentrate on the content analysis of data from interviews.

Theory

When using a quantitative methodology, you are normally testing theory through the testing of a hypothesis. In qualitative research, you are either exploring the application of a theory or model in a different context or are hoping for a theory or a model to emerge from the data. In other words, although you may have some ideas about your topic, you are also looking for ideas, concepts and attitudes often from experts or practitioners in the field.

Collecting and Organising Data

The means of collecting and recording data through interviews and the possible pitfalls are well documented elsewhere but in terms of subsequent analysis, it is essential that you have a complete and accurate record of what was said. Do not rely on your memory (it can be very selective!) and either tape record the conversation (preferably) or take copious notes. If you are taking notes, write them up straight after the interview so that you can elaborate and clarify. If you are using a tape recorder, transcribe the exact words onto paper.

However you record the data, you should end up with a hard copy of either exactly what was said (transcript of tape recording) or nearly exactly what was said (comprehensive notes). It may be that parts of the interview are irrelevent or are more in the nature of background material, in which case you need not put these into your transcript but do make sure that they are indeed unnecessary. You should indicate omissions in the text with short statements.

You should transcribe exactly what is said, with grammatical errors and so on. It does not look very authentic if all your respondents speak with perfect grammar and BBC English! You may also want to indicate other things that happen such as laughter.

Each transcript or set of notes should be clearly marked with the name of the interviewee, the date and place and any other relevant details and, where

appropriate, cross-referenced to clearly labelled tapes. These transcripts and notes are not normally required to be included in your dissertation but they should be available to show your supervisor and the second marker if required.

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You may wonder why you should go to all the bother of transcribing your audiotapes. It is certainly a time-consuming business, although much easier if you can get access to a transcription machine that enables you to start and stop the tape with your feet while carrying on typing. It is even easier if you have access to an audio-typist who will do this labour intensive part for you. The advantage of having the interviews etc. in hard copy is that you can refer to them very quickly, make notes in the margins, re-organise them for analysis, make coding notations in the margins and so on. It is much slower in the long run to have to continually listen to the tapes. You can read much faster than the tape will play! It also has the advantage, especially if you do the transcription yourself, of ensuring that you are very familiar with the material.

Content Analysis

Analysis of qualitative data is not simple, and although it does not require complicated statistical techniques of quantitative analysis, it is nonetheless difficult to handle the usually large amounts of data in a thorough, systematic and relevant manner. Marshall and Rossman offer this graphic description:

> "Data analysis is the process of bringing order, structure and meaning to the mass of collected data. It is a messy, ambiguous, time-consuming, creative, and fascinating process. It does not proceed in a linear fashion; it is not neat. Qualitative data analysis is a search for general statements about relationships among categories of data."—Marshall and Rossman,

Hitchcock and Hughes take this one step further:

> "...the ways in which the researcher moves from a description of what is the case to an explanation of why what is the case is the case."

Content analysis consists of reading and re-reading the transcripts looking for similarities and differences in order to find themes and to develop categories. Having the full transcript is essential to make sure that you do not leave out anything of importance by only selecting material that fits your own ideas. There are various ways that you can mark the text:

Coding paragraphs – This is where you mark each paragraph with a topic/theme/category with an appropriate word in the margin.

Highlighting paragraphs/sentences/phrases – This is where you use highlighter pens of different colours or different coloured pens to mark bits about the different themes. Using the example above, you could mark the bits relating to childcare and those relating to pay in a different colour, and so on. The use of coloured pens will help you find the relevant bits you need when you are writing up.

With both the above methods you may find that your categories change and develop as you do the analysis. What is important is that you can see that by analysing the text in such a way, you pick up all the references to a given topic

and don't leave anything out. This increases the objectivity and reduces the risk of you only selecting bits that conform to your own preconceptions.

You then need to arrange the data so that all the pieces on one theme are together. There are several ways of doing this:

Cut and put in folders approach

Make several copies of each transcript (keeping the master safe) and cut up each one according to what is being discussed (your themes or categories). Then sort them into folders, one for each category, so that you have all together what each interviewee said about a given theme. You can then compare and look for similarities/differences/conclusions etc. Do not forget to mark each slip of paper with the respondent's name, initials or some sort of code or you won't be able to remember who said what. Several copies may be needed in case one paragraph contains more than one theme or category. This is time consuming and messy at first, but easier in the long run especially if you have a lot of data and categories.

Card index system

Each transcript must be marked with line numbers for cross-referencing purposes. You have a card for each theme or category and cross-reference each card with each transcript so that you can find what everyone has said about a certain topic. This is quicker initially but involves a lot of referring back to the original transcripts when you write up your results and is usually only suitable for small amounts of data.

Computer analysis

If you have access to a computer package that analyses qualitative data (e.g. NUDIST) then you can use this. These vary in the way they work but these are some of the basic common principles. You can upload your transcripts created in a compatible word-processing package and then the software allows you to mark different sections with various headings/themes. It will then sort all those sections marked with a particular heading and print them off together. This is the electronic version of the folders approach! It is also possible to use a word-processing package to cut and paste comments and to search for particular words.

There is a great danger of subjective interpretation. You must accurately reflect the views of the interviewees and be thorough and methodical. You need to become familiar with your data. You may find this a daunting and stressful task or you may really enjoy it sometimes so much that you can delay getting down to the next stage which is interpreting and writing up!

Presenting qualitative data in your dissertation

This would normally follow the topics, themes and categories that you have developed in the analysis and these, in turn, are likely to have been themes that came out in the literature and may have formed the basis for your interview questions. It is usually a mistake to go through each interviewee in turn and what they said on each topic. This is cumbersome and does not give the scope to compare and contrast their ideas with the ideas of others.

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Do not analyse the data on a question-by-question basis. You should summarise the key themes that emerge from the data and may give selected quotes if these are particularly appropriate.

By presenting we mean a factual description/summary of what you found. The discussion element is your interpretation of what these findings mean and how they confirm or contradict what you wrote about in your literature section.

If you are trying to test a model then this will have been explored in your literature review and your methodology section will explain how you intend to test it. Your methodology should include who was interviewed with a clear rationale for your choices to explain how this fits into your research questions, how you ensured that the data was unbiased and as accurate as possible, and how the data was analysed. If you have been able to present an adapted model appropriate to your particular context then this should come towards the end of your findings section.

It may be desirable to put a small number of transcripts in the appendices but discuss this with your supervisor. Remember you have to present accurately what was said and what you think it means.

In order to write up your methodology section, you are strongly recommended to do some reading in research textbooks on interview techniques and the analysis of qualitative data. There are some suggested texts in the Further Reading section at the end of this pack.

Quantitative Data Analysis

Here we are concerned with the basics of statistical analysis. However, we do not cover the techniques in detail but provide a brief overview. If you are unsure of these or have forgotten them, you should refer to your notes from previous studies or consult introductory statistics textbooks. We begin by looking at some basic ideas about analysis and presentation of data. These are 'variables' and the related idea of 'scales of measurement'.

Variables

Constant reference is made in statistics textbooks to the term variable. A variable is a characteristic of interest that varies from one item to another and may take any one of a specified set of values or attributes. Variables are usually classified as quantitative or qualitative. For example, consider a study of guests at a hotel. We may be interested in the age of a guest, their spend and length of stay. Each characteristic is a quantitative variable because the data that each generates is numerical – for instance, a guest may be 34 years of age, spend £500 and stay for seven days. Quantitative variables generate quantitative data.

On the other hand, qualitative variables generate non-numerical or qualitative data. For instance, 'nationality of hotel guest' is a qualitative variable because nationality can be classified as British, American, French, etc.

Scales of measurement

Many people are confused about what type of analysis to use on a set of data and the relevant forms of pictorial presentation or data display. The decision is based on the scale of measurement of the data. These scales are nominal, ordinal and numerical. (Strictly numerical can be sub-divided into interval and ratio – however, we do not draw that distinction here.)

Nominal scale

A nominal scale is where:

- the data can be classified into a non-numerical or named categories, and
- the order in which these categories can be written or asked is arbitrary.

Ordinal scale

An ordinal scale is where:

- the data can be classified into non-numerical or named categories
- an inherent order exists among the response categories.

Ordinal scales are seen in questions that call for ratings of quality (for example, very good, good, fair, poor, very poor) and agreement (for example, strongly agree, agree, disagree, strongly disagree).

Numerical scale

A numerical scale is:

- where numbers represent the possible response categories
- there is a natural ranking of the categories
- zero on the scale has meaning
- there is a quantifiable difference within categories and between consecutive categories.

Organising the data

Once you have collected the raw data, you need to organise it. This is a two-stage process:

1. The first step is to tabulate all the responses to each question for each respondent in a data sheet using the coded values. It is advisable to construct this on a spreadsheet.
2. The second step is to construct a summary sheet.

This summary sheet will be an amended version of the original question sheet (either questionnaire or interview schedule) and contains:

- a brief overview of the data collection process, including:
  - data collection method
  - sample size and sampling method
- a count for each response alongside each question
- the percentage equivalents.

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- GANT charts list a set of tasks. They indicate the time each task is to be performed and by whom.
- Maps visually describe certain geographical areas. They are useful in describing different conditions for individual geographical areas.

Data refers to information or facts usually collected as the result of experience, observation or experiment or premises. Data may consist of numbers, words, or images, particularly as measurements or observations of a set of variables. Data are often viewed as a lowest level of abstraction from which information and knowledge are derived.

You might be reading a newspaper regularly. Almost every newspaper gives the minimum and the maximum temperatures recorded in the city on the previous day. It also indicates the rainfall recorded, and the time of sunrise and sunset. In your school, you regularly take attendance of children and record it in a register. For a patient, the doctor advises recording of the body temperature of the patient at regular intervals.

If you record the minimum and maximum temperature, or rainfall, or the time of sunrise and sunset, or attendance of children, or the body temperature of the patient, over a period of time, what you are recording is known as data. Here, you are recording the data of minimum and maximum temperature of the city, data of rainfall, data for the time of sunrise and sunset, and the data pertaining to

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the attendance of children. As an example, the class-wise attendance of students, in a school, is as recorded in Table 1.

TABLE 1 CLASS-WISE ATTENDANCE OF STUDENTS

Class	No. of Students Present
VI	42
VII	40
VIII	41
IX	35
X	36
XI	32
XI1	30
Total	256

Table 1 gives the data for class-wise attendance of students. Here the data comprise 7 observations in all. These observations are, attendance fgr class VI, VII, and so on. So, data refers to the set of observations, values, elements or objects hder consideration.

The complete set of all possible elements or objects is called a population. Each of the elements is called a piece of data. Data also refers to the known facts or things used as basis for inference or reckoning facts, information, material to be processed or stored.

NATURE OF DATA

For understanding the nature of data, it becomes necessary to study about the various forms of data, as shown below :

- Qualitative and Quantitative Data
- Continuous and Discrete Data
- Primary and Secondary Data

QUALITATIVE AND QUANTITATIVE DATA

Let us consider a set of data given in Table 2.

TABLE 2 MANAGEMENT-WISE NUMBER OF SCHOOLS

Management	No. of Schools
Government	4
Local Body	8
Private Aided	10
Private Unaided	2
Total	24

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In Table 2, number of schools have been shown according to the management of schools. So the schools have been classified into 4 categories, namely, Government Schools, Local Body Schools, Private Aided Schools and Private Unaided Schools. A given school belongs to any one of the four categories. Such data is shown as Categorical or Qualitative Data. Here the category or the quality referred to is management. Thus categorical or qualitative data result from information which has been classified into categories. Such categories are listed alphabetically or in order of decreasing frequencies or in some other conventional way. Each piece of data clearly belongs to one classification or category.

We frequently come across categorical or qualitative data in the form of schools categorised according to Boys, Girls and Co-educational; Students' Enrolment categorised according to SC, ST, OBC and 'Others'; number of persons employed in various categories of occupations, and so on.

Let us consider another set of data given in Table 3.

TABLE 3 NUMBER OF SCHOOLS ACCORDING TO ENROLMENT

Enrolment	No. of Schools
Upto 50	6
51 - 100	15
101 - 200	12
201 - 300	8
Above 300	4
Total	45

In Table 3, number of schools have been shown according to the enrolment of students in the school. Schools with enrolment varying in a specified range are grouped together, e.g. there are 15 schools where the students enrolled are any number between 51 and 100. As the grouping is based on numbers, such data are called Numerical or Quantitative Data. Thus, numerical or quantitative data result from counting or measuring. We frequently come across numerical data in newspapers, advertisements etc. related to the temperature of the cities, cricket averages, incomes, expenditures and so on.

CONTINUOUS AND DISCRETE DATA

Numerical or quantitative data may be continuous or discrete depending on the nature of the elements or objects being observed.

Let us consider the Table 4 depicting the heights of students of a class.

TABLE 4 HEIGHTS OF STUDENTS OF A CLASS

Height	No. of Students
4'8"- 4' 10"	2

4'10" - 5'0"	2
5'0" - 5'2"	5
5'2" - 5'4"	8
5'4" - 5'6"	12
5'6" - 5'8"	10
5'8"- 5'10"	2
Total	41

Table 4 gives the data pertaining to the heights of students of a class. Here the element under observation is the height of the students. The height varies from 4' 8" to 5' 10". The height of an individual may be anywhere from 4' 8" to 5'10". Two students may vary by almost zero inch height. Even if we take two adjacent points, say 4' 8.00" and 4' 8.01" there may be several values between the two points. Such data are called Continuous Data, as the height is continuous. Continuous Data arise from the measurement of continuous attributes or vdriables, in which individual may differ by amounts just approaching zero. Weights and heights of children; temperature of a body; intelligence and achievement level of students, etc. are the examples of continuous data.

Let ds consider Table 3 showing the number of students enrolled and the number of schools according to enrolment. Let us,consider the enrolment of 2 schools as 60 and 61. Now in between 60 and 61, there cannot be any number, as the enrolment will always be in whole numbers. Thus there is a gap of one unit from 60 to 61. Such data, where the elements being observed have gaps are called Discrete Data.

Discbete Data are characterised by gaps in the scale, for which no real values may ever be found. Such data are usually expressed in whole numbers. The size of a family, enrolment of children, number of books etc. are the examples of discrete data. Generally data arising from meagurement are continuous, while data arising from counting or arbitrary classification are discrete.

The achievement scores of students, though presented in discrete form may be considered to constitute continuous data, since a score of 24 represents any point between 23.5 and 24.5. Actually achievement is a continuous attribute or variable.

All peasurements of continuous attributes are approximate in character and as such do not prodide a basis for distinguishing between continuous and discrete data. The distinction is made on the basis of variable being measured. 'Height' is a continuous variable but number of children would give discrete data.

Primary and Secondary Data

The data collected by or on behalf of the person or people who are going to make use of the data refers to primary data. For example, the attendance of

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children, the result of examinations conducted by you are primary data. If you contact the parents of the children and ask about their educational qualifications to relate them to the performance of the children, this also gives primary data. Actually, when an individual personally collects data or information pertaining to an event, a definite plan or design, it refers to primary data.

Sometimes an investigator may use the data already collected by you, such as the school attendance of children, or performance of students in various subjects. etc, for his/her study, then the data are secondary data. The data used by a person or people other than the people by whom or for whom the data were collected refers to secondary data. For many reasons we may have to use secondary data, which should be used carefully, since the data could have beeb collected with a purpose different from that of the investigator and may lose some detail or may not be fully relevant. For using secondary data, it is always useful to know :

(a) how the data have been collected and processed;

(b) the accuracy of data;

(c) how far the data have been summarised;

(d) how comparable the data are with other tabulations; and

(e) how to interpret the data, especially when figures collected for one purpose are used for another purpose.

Secondary Data

In research, Secondary data is collecting and possibly processing data by people other than the researcher in question. Common sources of secondary data for social science include censuses, large surveys, and organizational records. In sociology primary data is data you have collected yourself and secondary data is data you have gathered from primary sources to create new research. In terms of historical research, these two terms have different meanings. A primary source is a book or set of archival records. A secondary source is a summary of a book or set of records.

Advantages to the secondary data collection method are - 1) it saves time that would otherwise be spent collecting data, 2) provides a larger database (usually) than what would be possible to collect on ones own However there are disadvantages to the fact that the researcher cannot personally check the data so it's reliability may be questioned.

Secondary Data Analysis

There are two different types of sources that need to be established in order to conduct a good analysis. The first type is a primary source which is the initial material that is collected during the research process. Primary data is the data that the researcher is collecting themselves using methods such as surveys,direct

observations, interviews, as well as logs(objective data sources). Primary data is a reliable way to collect data because the researcher will know where it came from and how it was collected and analyzed since they did it themselves. Secondary sources on the other hand are sources that are based upon the data that was collected from the primary source. Secondary sources take the role of analyzing, explaining, and combining the information from the primary source with additional information.

Secondary data analysis is commonly known as second-hand analysis. It is simply the analysis of preexisting data in a different way or to answer a different question than originally intended. Secondary data analysis utilizes the data that was collected by someone else in order to further a study that you are interested in completing.

In contrast to secondary data, primary data comes from observations made by the researchers themselves. This often creates credibility issues that do not arise with secondary data.

TABULAR PRESENTATION OF DATA

It is cumbersome to study or interpret large data without grouping it, even if it is arranged sequentially. For this, the data are usually organised into groups called classes and presented in a table which gives the frequency in each group. Such a frequency table gives a better overall view of the distribution of data and enables a person to rapidly comprehend important characteristics of the data.

For example, a test of 50 marks is administered on a class of 40 students and the marks obtained by these students are as listed below in Table 5.

TABLE 5

35, 40, 22, 32, 41, 18, 20, 40, 36, 29, 24, 28, 28, 31, 39, 37, 27, 29, 40, 35, 38, 30,
45, 26, 20, 25, 32, 31, 42, 28, 33, 32, 29, 26, 48, 32, 16, 46, 18, 44.

By going through the marks of 40 students listed in Table 5, you may be able to see that the marks vary from 16 to 48, but if you try to comprehend the overall performance it is a difficult proposition.

Now conbider the same set of marks, arranged in a tabular form, as shown in Table 6.

TABLE 6

Marks	No. of Students
45 - 49	3
40 - 44	6
35 - 39	6

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30 - 34	8
25 - 29	10
20 - 24	4
15 - 19	3
Total	40

From Table 6 one can easily comprehend the distribution of marks *e.g.,* 10 students have scores from 25 to 29, while only 7 students have a score lower than 50% etc. Various terms related to the tabulation of data are being discussed below:

Table 6 shows the marks arranged in descending order of magnitude and their corresponding frequencies. Such a table is known as frequency distribution. A grouped frequency distribution has a minimum of two columns - the first has the classes arranged in some meaningful order, and a second has the corresponding frequencies. The classes are also referred to as class intervals. The range of scores or values in each class interval is the same. In the given example the first class interval is from 45 to 49 having a range of 5 marks *i.e.,* 45, 46, 47, 48 and 49. Here 45 is the lower class limit and 49 is the upper class limit. As discussed earlier the score of 45 may be anywhere from 44.5 to 45.5, so the exact lower class limit is 44.5 instead of 45. Similarly, the exact upper class limit is 49.5 instead of 49. The range of the class interval is 49.5 - 44.5 = 5 *i.e.,* the difference between the upper limit of class interval and the lower limit of class interval.

For the presentation of data in the form of a frequency distribution for grouped data, a number of steps are required. These steps are :

1. Selection of non-overlapping classes.
2. Enumeration of data values that fall in each class.
3. Construction of the table.

Let us consider the score of 120 students of class X of a school in Mathematics, shown in Table 7.

TABLE 7 MATHEMATICS SCORE OF 120 CLASS X STUDENTS

71	85	41	88	98	45	75	66	81	38	52	67	92	62	83	49	64	52	90	61	58	63	91 5748
75	89	73	64	80	67	76	65	76	65	61	68	84	72	57	77	63	52	56	41	60	55	75 53 45
37	91	57	40	73	66	76	52	88	62	78	68	55	67	39	65	44	47	58	68	42	90	89 39 69
48	82	91	39	85	44	71	68	56	48	90	44	62	47	83	80	96	69	88	24	44	38	74 93 39
72	56	46	71	80	46	54	77	58	81	70	58	51	78	64	84	50	95	87	59			

First we have to decide about the number of classes. We usually have 6 to 20 classes of equal length. If the number of scores/events is quite large, we usually have 10 to 20 classes. The number of classes when less than 10 is considered only when the number of scores values is not too large. For deciding the exact number of classes to be taken, we have to find out the range of scores. In Table 7 scores vary from 37 to 98 so the range of the score is 62 (98.5 - 36.5 = 62).

The length of class interval preferred is 2, 3, 5, 10 and 20. Here if we take class length of 10 then the number of class intervals will be 62/10 = 6.2 or 7 which is less than the desired rumber of classes. If we take class length of 5 then the number of class intervals will be (62/5 = 12.4 or 13 which is desirable.

Now, where to start the first class interval ? The highest score of 98 is included in each of the three class intervals of length 5 *i.e.*, 94 - 98, 95 - 99 and 96 - 100. We choose the interval 95- 99 as the score 95 is multiple of 5. So the 13 classes will be 95 - 99, 90 - 94, 85 - 89, 80 -84, ... , 35 - 39. Here, we have two advantages. One, the mid points of the classes are whole numbers, which sometimes you will have to use. Second, when we start with the multiple of the length of class interval, it is easier to mark tallies. When the size of class interval is 5, we start with 0, 5, 10, 15, 20 etc.

To know about these advantages, you may try the other combinations also *e.g.*, 94 -98, 89 -93, 84 - 88, 79 -83 etc. You will observe that marking tallies in such classes is a bit more difficult. You may also take the size of the class interval as 4. There you will observe that the mid points are not whole numbers. So, while selecting the size of the class interval and the limits of the classes, one has to be careful.

After writing the 13 class intervals in descending order and putting tallies against the concerned class interval for each of the scores, we present the frequency distribution as shown in Table 8.

Table 8 Frequency Distribution of Mathematics Scores of 120 Class X Students

Scores	Tally	No. of Students
95 -99	III	3
90 - 94	IIII III	8
85 - 89	IIII III	8
80 - 84	IIII IIII	10
75 - 79	IIII IIII	10
70 - 74	IIII IIII	10
65 - 69	IIII IIII IIII	14
60 - 64	IIII IIII I	11
55 - 59	IIII IIII III	13
50 - 54	IIII III	8
45 - 49	IIII IIII	10
40 - 44	IIII III	8
35 - 39	IIII II	7
	Total	120

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Procedure for Writing the Class Intervals

At the top we write the first class interval which is 95 - 99. Then we find the second class interval by substracting 5 points from the corresponding figures *i.e.*, 90 - 94, and write it under 95- 99. On substracting 5 from 90- 94, the third class interval will be 85 - 89. The procedure is to be followed till we reach the class interval having the lowest score.

Procedure for Marking the Tallies

Let us take the first score in the first row *i.e.*, 71. The score of 71 is in the class interval 70 -74 (70, 71, 72, 73, 74) so a tally (/) is marked against 70 - 74. The second score in the first row is 85, which lies in the class interval 85 - 89 (85, 86, 87, 88, 89), so a tally (/) is marked against 86 - 89. Similarly, by taking, all the 120 scores, tallies are put one by one. While marking the tallies, put your finger on the scores, as a mistake can reduce the whole process to naughlt. The total tallies should be 120 *i.e.*, total number of scores. When against a particular class interval there are four tallies (////) and you have to mark the fifth tally, cross the four tallies (////) to make it 5. So while marking the tallies we make the cluster of 5 tallies. By counting the number of tallies, the frequencies are recorded against each of the class intervals. It completes the construction of table.

In Table 8, the exact limits of class interval 95 - 99 are 94.5 and 99.5, as the score of 95 ranges from 94.5 to 99.5 and the score of 99 ranges from 98.5 to 99.5, making the exact range from (94.5 to 99.5. As discussed earlier the data are continuous based on the nature of the variable. The class interval, though customarily arranged in descending order, can also be arranged in ascending order.

GRAPHICAL PRESENTATION OF DATA

Most people show lack of interest or have no time to go through facts and figures given in a daily newspaper or a magazine. But if these figures are graphically presented, they become easier to grasp and catch the eye and have a more lasting effect on the reader's mind.

The graphical representation of data makes the reading more interesting, less time-consuming and easily understandable. The disadvantage of graphical presentation is that it lacks details and is less accurate. In our study, we have the following graphs:

1. Bar Graphs
2. Pie Charts
3. Frequency Polygon
4. Histogram

Bar Graphs

This is the simplest type of graphical presentation of data. The following types of bar graphs are possible: *(a)* Simple bar graph *(b)* Double bar graph *(c)* Divided bar graph.

Pie Charts

Sometimes a circle is used to represent a given data. The various parts of it are proportionally represented by sectors of the circle. Then the graph is called a Pie Graph or Pie Chart.

Frequency Polygon

In a frequency distribution, the mid-value of each class is obtained. Then on the graph paper, the frequency is plotted against the corresponding mid-value. These points are joined by straight lines. These straight lines may be extended in both directions to meet the X - axis to form a polygon.

Histogram

A two dimensional frequency density diagram is called a histogram. A histogram is a diagram which represents the class interval and frequency in the form of a rectangle.

TYPES OF GRAPHICAL PRESENTATION OF DATA

Here only a few of the standard graphic forms of representing the data are being discussed as listed below (Beriefly we have discussed above):

- Histogram
- Bar Diagram or Bar Graph
- Frequency Polygon
- Cumulative Frequency Curve or Ogive

Histogram

The most common form of graphical presentation of data is histogram. For plotting a histogram, one has to take a graph paper. The values of the variable are taken on the horizontal axis/scale known as X-axis and the frequencies are taken on the vertical axis/scale known as Y-axis. For each class interval a rectangle is drawn with the base equal to the length of the class interval and height according to the frequency of the C.I. When C.I. are of equal length, which would generally be the case in the type of data you are likely to handle in school situations, the heights of rectangles must be proportional to the frequencies of the Class Intervals.

When the C.I. are not of equal length, the areas of rectangles must be proportional to the frequencies indicated (most likely you will not face this type of situation). As the C.I.s for any variable are in continuity, the base of the rectangles

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Local Body	8
Private Aided	10
Private Unaided	2
Total	24

The bar graph will be as shown below in Figure 3.

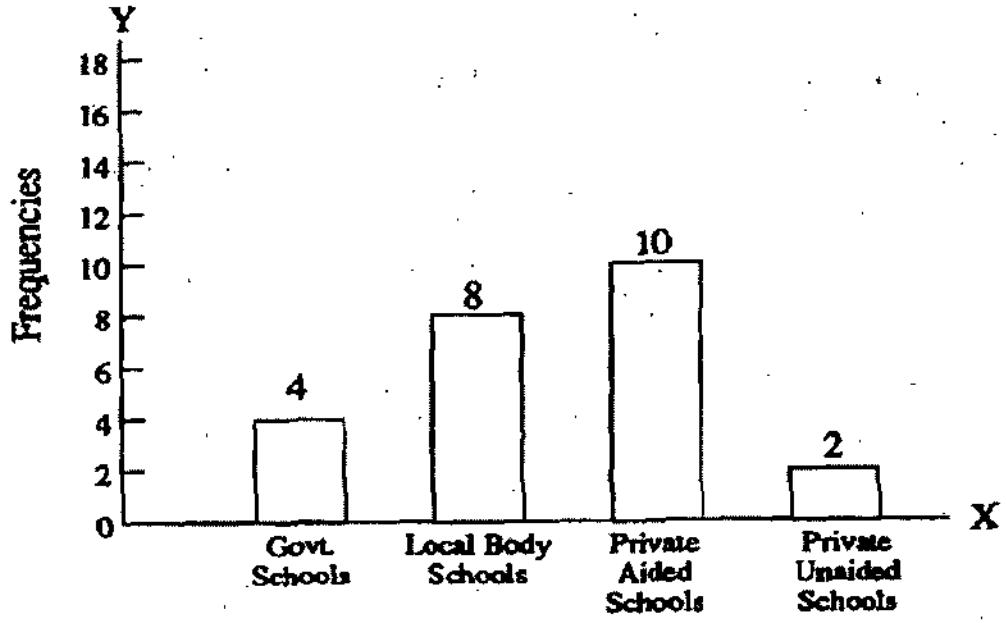

FIG. 3: MANAGEMENT-WISE DISTRIBUTION OF SCHOOLS IN A TOWN

For a discrete variable the unit of measure on the horizontal axis is not important. Neither are the classes related to each other. So the bars are equally spaced and are of equal width on the horizontal axis. However, the height of the bars are proportionate to the respective frequencies. Bar graphs are frequently used for pictorial presentation of discrete data. If two variables are used simultaneously, even then bar graphs may be quite effective. For example, if alongwith the total number of schools (management-wise) the number of boys' schools, girls' schools and co-education schools are also to be indicated then this can be done on the same graph paper by using different colours, each indicating the sex-wise category. For each management there will be 4 bars having different colours indicating different categories.

FREQUENCY POLYGON

For plotting a frequency polygon, as in case of histogram, the values of the variable are taken on the horizontal axis of the graph and the frequencies are taken on the vertical axis of the graph. In the case of a frequency polygon, one has to indicate the mid points of the C.I. on the horizontal axis, instead of indicating the boundaries of the interval, Here the mid point of the intervals just before the lowest interval and just after the highest interval are also to be indicated.

Now by taking the mid points one by one, the points above them are to be plotted corresponding to the frequencies of the intervals. In case of the two additional mid points, the frequency being zero, the points to be plotted are on the X-axis itself. The adjoining points so plotted are to be jained by straight line segments.

Let us again consider the frequency distribution of mathematics scores shown in Table 9 and prepare the frequency polygon for the same. The mid points of the C.I.s are respectively 34.5, 44.5, 54.5, ... 94.5. Two additional mid points required are 24.5 and 104.5. Now on the horizontal axis of the graph locate the points 24.5, 34.5, 44.5, ...94.5, 104.5 as shown in Figure 4.

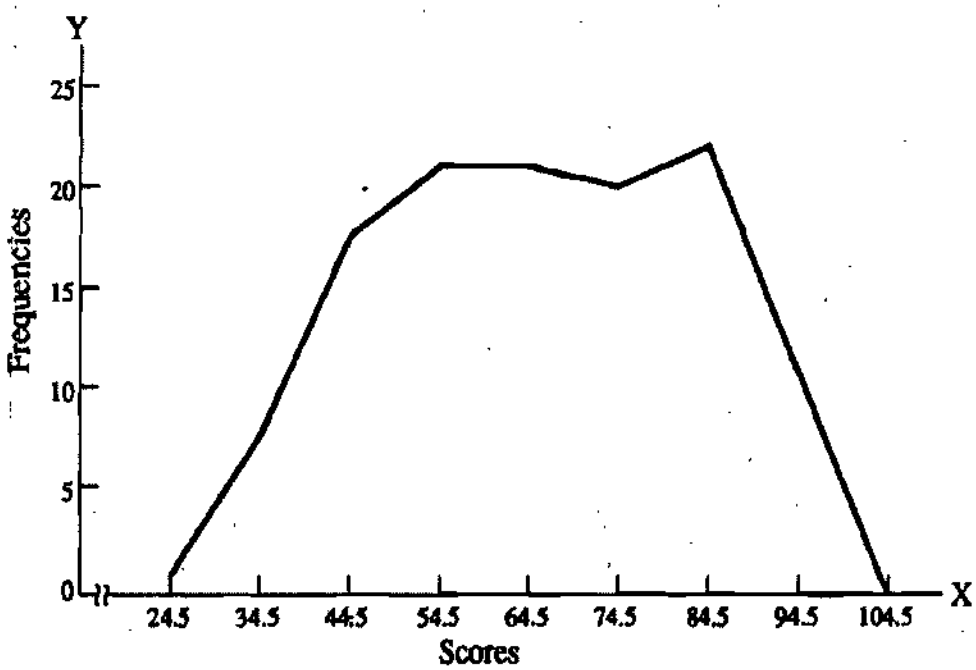

FIG. 4: FREQUENCY POLYGON OF MATHEMATICS SCORES

Take the points above the plotted points by taking the heights as 0,7, 18, 21, 25, 20, 18, 11 and 0 respectively. Join these points in a sequence. The frequency polygon obtained will be as shown in Figure 4.

Compare the Figure 2 and 4. You will find that if in Fig. 2 you join the mid points of the tops of the rectangle and extend them to one interval on either end of the figure with zero frequency, the figure so obtained will be the frequency polygon shown in Fig. 4.

The primary purpose of frequency polygon is to show the shape of the distribution. When two or more frequency distributions are to be compared, the relative frequency polygons are constructed against the same set of axes. Any difference in the shape of these distributions becomes visible. Frequency polygon has an advantage over the histogram.

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CUMULATIVE FREQUENCY CURVE OR OGIVE

For plotting a cumulative frequency curve or Ogive, first of all cumulative frequencies against each of the intervals are to be written. If we take the frequency distribution of Table 9, it will be as shown in Table 10.

TABLE 10 CUMULATIVE FREQUENCY DISTRIBUTION OF SCORES

Scores	Frequency	Cumulative Frequency
30 - 39	7	7
40 - 49	18	25
50 - 59	21	46
60 - 69	25	71
70 - 79	20	91
80 - 89	18	109
90 - 99	11	120

For getting the cumulative frequencies of a C.I. we take the cumulative frequencies upto the previous interval and add the frequency of that interval into it. Here C.F. indicates that upto 39.5 there are 7 cases, upto 49.5 there are 25 cases, upto 59.5 there are 46 cases, and so on. The difference between the construction of the frequency polygon and ogive is that for frequency polygon, one takes the mid points of the C.I. on horizontal axis, while for ogive one takes the upper boundary of the C.I. on horizontal axis. Again on the vertical axis, in case of Ogive one takes cumulative frequency/cumulative percentage instead of frequency only. The cumulative frequency curve or Ogive for the given data in Table 10, will be as shown in Fig. 5.

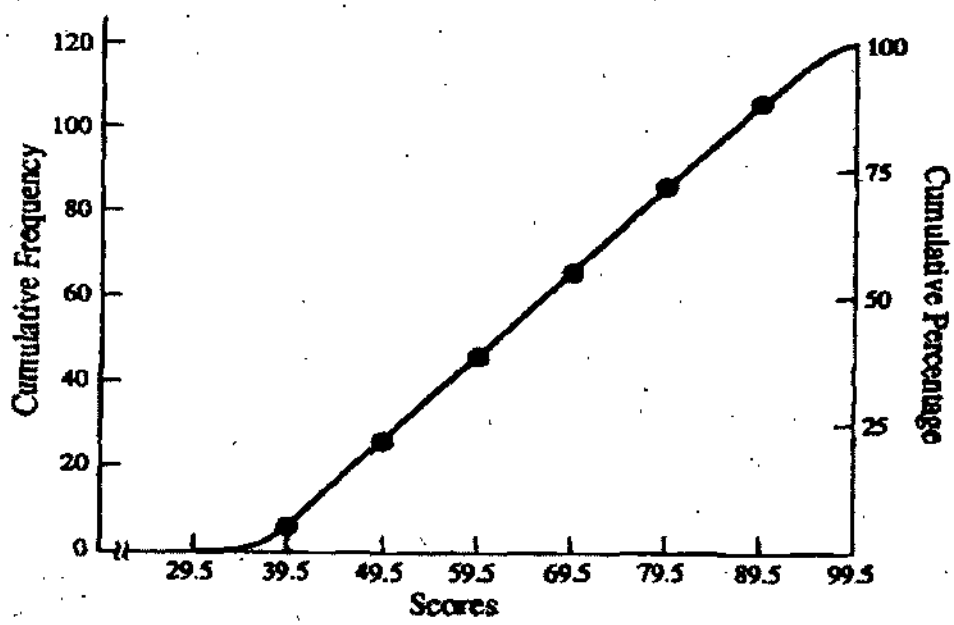

FIG. 5: CUMULATIVE FREQUENCY CURVE OR OGIVE

In Fig. 5, the curve starts from 29.5 (0 Cumulative Frequency) and moves upto 99.5 (120 C.F.). In this case the points have been joined in a sequence with a smoothened cuve, instead of straight line segments. From ogive we can easily find out a point on horizontal axis upto which the specified number of cases or the specified percentage of cases will be available. The only difference between the cumulative frequency curve and ogive is that for cumulative frequency curve, on vertical axis, we take cumulative frequencies, while in case of ogive we also have to take cumulative percentages.

UNVARIED AND MULTIVARIATE TABLES

The main use of Tables is to obtain univariate or bivariate frequency tables with optional row, column and corner percentages and optional univariate and bivariate statistics. Tables of mean values of a variable can also be obtained.

Both univariate/bivariate tables and bivariate statistics can be output to a file so that can be used with a report generating program, or can be input to Graph ID or other packages such as Excel for graphical display.

Univariate Tables: Both univariate frequencies and cumulative univariate frequencies may be generated for any number of input variables and may also be expressed as percentages of the weighted or unweighted total frequency. In addition, the mean of a cell variable can be obtained.

Bivariate Tables: Any number of bivariate tables may be generated. In addition to the weighted and/or unweighted frequencies, a table may contain frequencies expressed as percentages based on the row marginals, column marginals or table total, and the mean of a cell variable. These various items may be placed in a single table with a possible six items per cell, or each may be obtained as a distinct table.

Multivariate

Multivariate Data Analysis refers to any statistical technique used to analyze data that arises from more than one variable. This essentially models reality where each situation, product, or decision involves more than a single variable. The information age has resulted in masses of data in every field. Despite the quantum of data available, the ability to obtain a clear picture of what is going on and make intelligent decisions is a challenge. When available information is stored in database tables containing rows and columns, Multivariate Analysis can be used to process the information in a meaningful fashion.

Multivariate analysis methods typically used for:

- Consumer and market research.

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- Quality control and quality assurance across a range of industries such as food and beverage, paint, pharmaceuticals, chemicals, energy, telecommunications, etc.
- Process optimization and process control.
- Research and development.

With Multivariate Analysis you can:

- Obtain a summary or an overview of a table. This analysis is often called Principal Components Analysis or Factor Analysis. In the overview, it is possible to identify the dominant patterns in the data, such as groups, outliers, trends, and so on. The patterns are displayed as two plots
- Analyze groups in the table, how these groups differ, and to which group individual table rows belong. This type of analysis is called Classification and Discriminant Analysis
- Find relationships between columns in data tables, for instance relationships between process operation conditions and product quality. The objective is to use one set of variables (columns) to predict another, for the purpose of optimization, and to find out which columns are important in the relationship. The corresponding analysis is called Multiple Regression Analysis or Partial Least Squares (PLS), depending on the size of the data table

Tools for Multivariate Analysis

Among the various, multivariate tools available, The Unscrambler stands out as an all-in-one multivariate data analysis software product. This product and related ones from CAMO are proven tools that have enabled different organizations solve their Multivariate Analysis requirements.

The main use of TABLES is to obtain univariate or bivariate frequency tables with optional row, column and corner percentages and optional univariate and bivariate statistics. Tables of mean values of a variable can also be obtained.

Summary

- Tables represent narrative or numerical information in tabular fashion. A table arranges information in rows or columns, so that data elements may be referred to easily.
- The graphical representation of data makes the reading more interesting, less time-consuming and easily understandable. The disadvantage of graphical presentation is that it lacks details and is less accurate.
- This is the simplest type of graphical presentation of data. The following types of bar graphs are possible: *(a)* Simple bar graph *(b)* Double bar graph *(c)* Divided bar graph.

- In a frequency distribution, the mid-value of each class is obtained. Then on the graph paper, the frequency is plotted against the corresponding mid-value.
- Multivariate Data Analysis refers to any statistical technique used to analyze data that arises from more than one variable. This essentially models reality where each situation, product, or decision involves more than a single variable.

REVIEW QUESTIONS

1. How is data presentated using tabular method?
2. Discuss various graphs used in graphical presentation of data.
3. What is unvariate and bi-variate table?
4. What do you understand by multivariate data analysis?
5. How is frequency polygon plotted? Discuss with an appropriate example.

FURTHER READINGS

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NOTES

UNIT – V

REPORT WRITING AND EVALUATION STUDIES

STRUCTURE

Learning Objectives

After going through the unit students will be able:

- to know the principal components of research report writing
- to give final touch to the research report writing
- to understand current trends of research in LIS

INTRODUCTION

A report is a very formal document that is written for a variety of purposes in the sciences, social sciences, engineering and business disciplines. Generally, findings pertaining to a given or specific task are written up into a report. It should be noted that reports are considered to be legal documents in the workplace and, thus, they need to be precise, accurate and difficult to misinterpret. A report is a systematic, well organised document which defines and analyses a subject or problem, and which may include:

- the record of a sequence of events
- interpretation of the significance of these events or facts
- evaluation of the facts or results of research presented
- discussion of the outcomes of a decision or course of action
- conclusions
- recommendations

Reports must always be:

- accurate

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- concise
- clear
- well structured

How many different types of reports are there?

laboratory reports	health and safety reports
research reports	case study reports
field study reports	cost-benefit analysis reports
proposals	comparative advantage reports
progress reports	feasibility studies
technical reports	instruction manuals
financial reports	And on it goes ...

When would I be asked to write a report?

Engineering Reports can outline a proposal for a project; report on progress of a project; present research and findings from a project; detail the technical aspects of innovations; present results from a feasibility or cost-benefit analytical study.

Education and Health Science Practicum reports are based on experiences at prac. school or hospital. Ongoing journal entries are written up into a report at the end of term. There are field and research reports.

Science and some Social Sciences Laboratory reports outline, analyse and evaluate results from experiments. Research or field reports are findings from the field and make recommendations based on this. Feasibility studies report investigations into the feasibility of something and make recommendations accordingly. Case study reports are found especially in the areas of social welfare, social work, and psychology.

Business Report writing is frequently used in business subjects. Reports can range from short memos to lengthy reports such as cost-benefit analysis reports; research and field reports; financial reports; proposals; progress reports; health and safety reports; quality reports; case study reports.

How does the structure of a report differ from the structure of an essay?

Reports are organised into separate sections according to the specific requirements of the given task. While it is important that paragraphs are structured and there is unity, coherence and logical development to the report, it is not a continuous piece of writing like an essay. Each type of report serves a very specific purpose and is aimed at a very particular audience.

Report writing may seem repetitive to us, but this is because reports are not usually read from cover-to-cover by one person. For example, a manager may read only the synopsis or abstract and act on the advice it contains while a technical officer may read only the section that explains how things work. On

the other hand, a personnel officer may look at only the conclusions and recommendations that directly affect his or her working area.

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Types of Report

A report is a dreadfully official document that is written to serve the range of purpose in the engineering and business disciplines; sciences and social sciences. Therefore, they need to be clear-cut and accurate. Good report writing call for—professionalism, profound knowledge of the subject, attentiveness, and outstanding writing proficiency.

Types of Report Writing —

- Research Report Writing
- Business Report Writing
- Science Report Writing

Research Report Writing— To presents the tangible proof of the conducted research is the major intention of the academic assignment. When writing on research report, you must ponder over clarity, organization, and content. Research reports are all the more same to technical reports, lab reports, formal reports and scientific papers which comprise a quite consistent format that will facilitate you to put your information noticeably, making it crystal clear.

Business Report Writing— In business milieu, Business report writing happens to be an indispensable part of the communication process. Executive summary is written in a non-technical manner. By and large, audience for business reports will consist of upper level manager, for that reason you should take the audience needs in consideration. Go on with the introduction to articulate the problem and determine the scope of the research. To attain the desired results, don't fail to state about the precise quantitative tools.

Science Report Writing— Parallel to a business report, science report writing also corresponds with the line of investigation. To report upon an empirical investigation, these reports make use of standard scientific report format, portraying technique, fallout and conclusions. As an assignment in undergraduate papers within the scientific disciplines, it is required frequently.

The main objective of the Science report is to boast an aim, the technique which enlightens how the project has been analyzed, the outcomes which presents the findings and the conclusion. This embraces advance research suggestions and your own biased opinion on the topic which has been talked about.

When writing a science report, do not fail to remember to use heading and subheadings in order to direct a reader through your work. In the form of tables and graphs, Statistical evidence should be incorporated in appendices. Than refer to it in the body of your scientific report.

Reports are a common form of writing because of the inclusion of recommendations which are helpful in implementing the decision.

MAIN COMPONENTS OF A RESEARCH REPORT

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The research report should contain the following components:

TITLE and COVER PAGE

SUMMARY OF STUDY DESIGN, FINDINGS AND RECOMMENDATIONS

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

List of tables, figures (optional)

List of abbreviations (optional)

1. INTRODUCTION (statement of the problem in its local context, including relevant literature)
2. OBJECTIVES
3. METHODOLOGY
4. RESEARCH FINDINGS
5. DISCUSSION
6. CONCLUSIONS AND RECOMMENDATIONS

REFERENCES

ANNEXES (data collection tools; tables)

Report Structure

- Cover page

The cover page should contain the title, the names of the authors with their titles and positions, the institution that is publishing the report, and the month and year of publication. The title could consist of a challenging statement or question, followed by an informative subtitle covering the content of the study and indicating the area where the study was implemented.

- Summary

The summary should be written only after the first or even the second draft of the report has been completed. It should contain:

— a very brief description of the problem (WHY this study was needed)— the main objectives (WHAT has been studied)

— the place of study (WHERE)

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- the type of study and methods used (HOW)
- major findings and conclusions, followed by
- the major (or all) recommendations.

The summary will be the first (and for busy health decision makers most likely the only) part of your study that will be read. Therefore, its writing demands thorough reflection and is time consuming. Several drafts may have to be made, each discussed by the research team as a whole.

As you will have collaborated with various groups during the drafting and implementation of your research proposal, you may consider writing different summaries for each of these groups.

- Acknowledgements

It is good practice to thank those who supported you technically or financially in the design and implementation of your study. Also your employer who has allowed you to invest time in the study and the respondents may be acknowledged. Acknowledgements are usually placed right after the title page or at the end of the report, before the references.

- Table of contents

A table of contents is essential. It provides the reader a quick overview of the major sections of your report, with page references, so that (s)he can go through the report in a different order or skip certain sections.

- List of tables, figures

If you have many tables or figures it is helpful to list these also, in a 'table of contents' type of format with page numbers.

- List of abbreviations (optional)

If abbreviations or acronyms are used in the report, these should be stated in full in the text the first time they are mentioned. If there are many, they should be listed in alphabetical order as well. The list can be placed before the first chapter of the report.

The table of contents and lists of tables, figures, abbreviations should be prepared last, as only then can you include the page numbers of all chapters and sub-sections in the table of contents. Then you can also finalise the numbering of figures and tables and include all abbreviations.

Chapter 1: Introduction

The introduction is a relatively easy part of the report that can best be written after a first draft of the findings has been made. It should certainly contain some relevant (environmental/ administrative/ economic/ social) background data about the country, the health status of the population, and health service data which are related to the problem that has been studied.

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You may slightly comprise or make additions to the corresponding section in your research proposal, including additional literature, and use it for your report.

Then the statement of the problem should follow, again revised from your research proposal with additional comments and relevant literature collected during the implementation of the study. It should contain a paragraph on what you hope(d) to achieve with the results of the study.

Global literature can be reviewed in the introduction to the statement of the problem if you have selected a problem of global interest. Otherwise, relevant literature from individual countries may follow as a separate literature review after the statement of the problem. You can also introduce theoretical concepts or models that you have used in the analysis of your data in a separate section after the statement of the problem.

Chapter 2: Objectives

The general and specific objectives should be included as stated in the proposal. If necessary, you can adjust them slightly for style and sequence. However, you should not change their basic nature. If you have not been able to meet some of the objectives this should be stated in the methodology section and in the discussion of the findings. The objectives form the HEART of your study. They determined the methodology you chose and will determine how you structure the reporting of your findings.

Chapter 3: Methodology

The methodology you followed for the collection of your data should be described in detail. The methodology section should include a description of:

- the study type;
- major study themes or variables (a more detailed list of variables on which data was collected may be annexed);
- the study population(s), sampling method(s) and the size of the sample(s);
- data-collection techniques used for the different study populations;
- how the data was collected and by whom;
- procedures used for data analysis, including statistical tests (if applicable).

If you have deviated from the original study design presented in your research proposal, you should explain to what extent you did so and why. The consequences of this deviation for meeting certain objectives of your study should be indicated. If the quality of some of the data is weak, resulting in possible biases, this should be described as well under the heading 'limitations of the study'.

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Chapter 4: Research findings

The systematic presentation of your findings in relation to the research objectives is the crucial part of your report.

The description of findings should offer a good combination or triangulation of data from qualitative and quantitative components of the study. There are two different ways in which you can present your findings:

Chapter 5: Discussion

The findings can now be discussed by objective or by cluster of related variables or themes, which should lead to conclusions and possible recommendations. The discussion may include findings from other related studies that support or contradict your own.

Chapter 6: Conclusions and recommendations

The conclusions and recommendations should follow logically from the discussion of the findings. Conclusions can be short, as they have already been elaborately discussed in chapter 5. As the discussion will follow the sequence in which the findings have been presented (which in turn depends on your objectives) the conclusions should logically follow the same order.

It makes easy reading for an outsider if the recommendations are again placed in roughly the same sequence as the conclusions. However, the recommendations may at the same time be summarised according to the groups towards which they are directed.

References

The references in your text can be numbered in the sequence in which they appear in the report and then listed in this order in the list of references (Vancouver system). Another possibility is the Harvard system of listing in brackets the author's name(s) in the text followed by the date of the publication and page number, for example: (Shan 2000: 84). In the list of references, the publications are then arranged in alphabetical order by the principal author's last name.

You can choose either system as long as you use it consistently throughout the report.

Annexes or Appendices

The annexes should contain any additional information needed to enable professionals to follow your research procedures and data analysis.

Information that would be useful to special categories of readers but is not of interest to the average reader can be included in annexes as well.

Examples of information that can be presented in annexes are:

- tables referred to in the text but not included in order to keep the report short;

- lists of hospitals, districts, villages etc. that participated in the study;
- questionnaires or check lists used for data collection.

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Note:

Never start writing without an outline. Make sure that all sections carry the headings and numbers consistent with the outline before they are word-processed. Have the outline visible on the wall so everyone will be aware immediately of any additions or changes, and of progress made.

Prepare the first draft of your report double-spaced with large margins so that you can easily make comments and corrections in the text.

Have several copies made of the first draft, so you will have one or more copies to work on and one copy on which to insert the final changes for revision.

STYLE AND LAYOUT

(1) Style of writing

Remember that your reader:

- Is short of time
- Has many other urgent matters demanding his or her interest and attention
- Is probably not knowledgeable concerning 'research jargon'

Therefore the rules are:

- Simplify. Keep to the essentials.
- *Justify. Make no statement that is not based on facts and data.*
- Quantify when you have the data to do so. Avoid 'large', 'small'; instead, say '50%', 'one in three'.
- Be precise and specific in your phrasing of findings.
- Inform, not impress. Avoid exaggeration.
- Use short sentences.
- Use adverbs and adjectives sparingly.
- Be consistent in the use of tenses (past or present tense). Avoid the passive voice, if possible, as it creates vagueness (e.g., 'patients were interviewed' leaves uncertainty as to who interviewed them) and repeated use makes dull reading.

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- Aim to be logical and systematic in your presentation.

(2) Layout of the report

A good physical layout is important, as it will help your report:

- make a good initial impression,
- encourage the readers, and
- give them an idea of how the material has been organised so the reader can make a quick determination of what he will read first.

Particular attention should be paid to make sure there is:

- An attractive layout for the title page and a clear table of contents.
- Consistency in margins and spacing.
- Consistency in headings and subheadings, e.g.: font size 16 or 18 bold, for headings of chapters; size 14 bold for headings of major sections; size 12 bold, for headings of sub-sections, etc.
- Good quality printing and photocopying. Correct drafts carefully with spell check as well as critical reading for clarity by other team-members, your facilitator and, if possible, outsiders.
- Numbering of figures and tables, provision of clear titles for tables, and clear headings for columns and rows, etc.
- Accuracy and consistency in quotations and references.

COMMON WEAKNESSES IN WRITING

Writing is always a challenging job, which requires courage. Starting is usually most difficult. Don't be afraid to make mistakes, otherwise you will never begin! However, it is good to be aware of common pitfalls, which you might try to avoid.

An almost universal weakness of beginning report writers is omitting the obvious. Hardly ever does the description of the country or area contain sufficient data to permit outsiders to follow the presentation of findings and discussion without problems. On the other hand, some data (e.g., exact geographical location on the globe) could be left out which are usually in.

Endless description without interpretation is another pitfall. Tables need conclusions, not detailed presentation of all numbers or percentages in the cells which readers can see for themselves. The chapter discussion, in particular, needs comparison of data, highlighting of unexpected results, your own or others' opinions on problems discovered, weighing of pro's and con's of possible solutions. Yet, too often the discussion is merely a dry summary of findings.

Neglect of qualitative data is also quite common. Still, quotes of informants as illustration of your findings and conclusions make your report lively. They also

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have scientific value in allowing the reader to draw his/her own conclusions from the data you present. (Assuming you are not biased in your presentation!)

Sometimes qualitative data (e.g., open opinion questions) are just coded and counted like quantitative data, without interpretation, whereas they may be providing interesting illustrations of reasons for the behaviour of informants or of their attitudes. This is serious maltreatment of data that needs correction.

Revising and Finalising the Text

When a first draft of the findings, discussion and conclusions has been completed, all working group members and facilitators should read it critically and make comments.

The following questions should be kept in mind when reading the draft:

- Have all important findings been included?
- Do the conclusions follow logically from the findings? If some of the findings contradict each other, has this been discussed and explained, if possible? Have weaknesses in the methodology, if any, been revealed?
- Are there any overlaps in the draft that have to be removed?
- Is it possible to condense the content? In general a text gains by shortening. Some parts less relevant for action may be included in annexes. Check if descriptive paragraphs may be shortened and introduced or finished by a concluding sentence.
- Do data in the text agree with data in the tables? Are all tables consistent (with the same number of informants per variable), are they numbered in sequence, and do they have clear titles and headings?
- Is the sequence of paragraphs and subsections logical and coherent? Is there a smooth connection between successive paragraphs and sections? Is the phrasing of findings and conclusions precise and clear?

The original authors of each section may prepare a second draft, taking into consideration all comments that have been made. However, you might consider the appointment of two editors amongst yourselves, to draft the complete version.

In the meantime, other group members may (re)write the introductory sections (INTRODUCTION, OBJECTIVES and METHODOLOGY, adjusted from your original proposal).

Now a first draft of the SUMMARY can be written.

FINALISING THE RESEARCH REPORT

It is advisable to have one of the other groups and facilitators read the second draft and judge it on the points mentioned in the previous section. Then a final version of the report should be prepared. This time you should give extra

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care to the presentation and layout: structure, style and consistency of spelling (use spell check!).

Use verb tenses consistently. Descriptions of the field situation may be stated in the past tense (e.g., 'Five households owned less than one acre of land.') Conclusions drawn from the data are usually in the present tense (e.g., 'Food taboos hardly have any impact on the nutritional status of young children.)

Note:— For a final check on readability you might skim through the pages and read the first sentences of each paragraph. If this gives you a clear impression of the organisation and results of your study, you may conclude that you did the best you could.

Group Work

1. Make an outline for your report on a flipchart, after reviewing your objectives, your sources of information and the outcomes of your data analysis. Number proposed sections and subsections. Stick the outline to the wall in a visible place. Leave sufficient space between the lines for additions (more subsections, for example) and for changes.
2. Start writing, beginning with the chapter on findings. Decide with your facilitator whether you will interpret the data presenting it by variable, by objective or by study population. If you are unsure in the beginning which method of organising the presentation will work best, record your findings and interpretations by study population. In the second draft you can decide how to reorganise and shorten the presentation. Divide writing tasks among sub-groups of one or two persons.
3. Discuss your findings in relation to each other, to the objectives and to other literature, and write the chapter Discussion. Then list the major conclusions in relation to possible recommendations.
4. Develop at the same time the introductory chapters (background and statement of the problem, including new literature, objectives and methodology), adapting what you prepared for the proposal.
5. Finally, develop the summary following the outline given earlier in this module. Take at least half a day for this, working systematically.
6. Keep track of progress in writing and typing, making notes on the flipchart that has the outline of your report.
7. Go over the first draft with the group as a whole checking it for gaps, overlaps, etc. before the second draft is prepared. Have a facilitator from another group read the whole draft report before it is finalised.

BIBLIOMETRICS

Bibliometrics is a type of research method used in library and information science. It utilizes quantitative analysis and statistics to describe patterns of publication within a given field or body of literature. Researchers may use

bibliometric methods of evaluation to determine the influence of a single writer, for example, or to describe the relationship between two or more writers or works. One common way of conducting bibliometric research is to use the Social Science Citation Index, the Science Citation Index or the Arts and Humanities Citation Index to trace citations.

Laws of Bibliometrics

One of the main areas in bibliometric research concerns the application of bibliometric laws. The three most commonly used laws in bibliometrics are: Lotka's law of scientific productivity, Bradford's law of scatter, and Zipf's law of word occurrence.

Lotka's Law

Lotka's Law describes the frequency of publication by authors in a given field. It states that " . . . the number (of authors) making n contributions is about $1/n^2$ of those making one; and the proportion of all contributors, that make a single contribution, is about 60 percent" (Lotka 1926, cited in Potter 1988). This means that out of all the authors in a given field, 60 percent will have just one publication, and 15 percent will have two publications ($1/2^2$ times .60). 7 percent of authors will have three publications ($1/3^2$ times .60), and so on. According to Lotka's Law of scientific productivity, only six percent of the authors in a field will produce more than 10 articles. Lotka's Law, when applied to large bodies of literature over a fairly long period of time, can be accurate in general, but not statistically exact. It is often used to estimate the frequency with which authors will appear in an online catalog (Potter 1988).

Bradford's Law

Bradford's Law serves as a general guideline to librarians in determining the number of core journals in any given field. It states that journals in a single field can be divided into three parts, each containing the same number of articles: 1) a core of journals on the subject, relatively few in number, that produces approximately one-third of all the articles, 2) a second zone, containing the same number of articles as the first, but a greater number of journals, and 3) a third zone, containing the same number of articles as the second, but a still greater number of journals. The mathematical relationship of the number of journals in the core to the first zone is a constant n and to the second zone the relationship is n^2. Bradford expressed this relationship as $1:n:n^2$. Bradford formulated his law after studying a bibliography of geophysics, covering 326 journals in the field. He discovered that 9 journals contained 429 articles, 59 contained 499 articles, and 258 contained 404 articles. So it took 9 journals to contribute one-third of the articles, 5 times 9, or 45, to produce the next third, and 5 times 5 times 9, or 225, to produce the last third. As may be seen, Bradford's Law is not statistically accurate, strictly speaking. But it is still commonly used as a general rule of thumb (Potter 1988).

Zipf's Law

Zipf's Law is often used to predict the frequency of words within a text. The Law states that in a relatively lengthy text, if you "list the words occurring

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within that text in order of decreasing frequency, the rank of a word on that list multiplied by its frequency will equal a constant. The equation for this relationship is: r x f = k where r is the rank of the word, f is the frequency, and k is the constant (Potter 1988). Zipf illustrated his law with an analysis of James Joyce's Ulysses. "He showed that the tenth most frequent word occurred 2,653 times, the hundredth most frequent word occurred 265 times, the two hundredth word occurred 133 times, and so on. Zipf found, then that the rank of the word multiplied by the frequency of the word equals a constant that is approximately 26,500" (Potter 1988). Zipf's Law, again, is not statistically perfect, but it is very useful for indexers.

Citation Analysis

Another major area of bibliometric research uses various methods of citation analysis in order to establish relationships between authors or their work. Here is a definition of citation analysis, and definitions of co-citation coupling and bibliographic coupling, which are specific kinds of citation analysis.

When one author cites another author, a relationship is established. Citation analysis uses citations in scholarly works to establish links. Many different links can be ascertained, such as links between authors, between scholarly works, between journals, between fields, or even between countries. Citations both from and to a certain document may be studied. One very common use of citation analysis is to determine the impact of a single author on a given field by counting the number of times the author has been cited by others. One possible drawback of this approach is that authors may be citing the single author in a negative context (saying that the author doesn't know what s/he's talking about, for instance) (Osareh 1996).

Co-citation Coupling

Co-citation coupling is a method used to establish a subject similarity between two documents. If papers A and B are both cited by paper C, they may be said to be related to one another, even though they don't directly cite each other. If papers A and B are both cited by many other papers, they have a stronger relationship. The more papers they are cited by, the stronger their relationship is.

Bibliographic Coupling

Bibliographic coupling operates on a similar principle, but in a way it is the mirror image of co-citation coupling. Bibliographic coupling links two papers that cite the same articles, so that if papers A and B both cite paper C, they may be said to be related, even though they don't directly cite each other. The more papers they both cite, the stronger their relationship is.

Web Applications of Bibliometrics

Recently, a new growth area in bibliometrics has been in the emerging field of webmetrics, or cybermetrics as it is often called. Webmetrics can be defined as using of bibliometric techniques in order to study the relationship of different sites on the World Wide Web. Such techniques may also be used to map out (called "scientific mapping" in traditional bibliometric research) areas of the Web that appear to be most useful or influential, based on the number of times they are hyperlinked to other Web sites.

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RESEARCH IN LIS IN INDIA

Professional higher education in library and information science (LIS) in India, now nine decades old, is centred in universities. Exceptions are two national institutes, namely, the Documentation Research and Training Centre (DRTC) in Bangalore, and the education section of the Indian National Scientific Documentation Centre (INSDOC) in New Delhi. These two institutes concentrate on the training of professionals for special and industrial libraries and information centres. Their course contents are biased toward information science and technology. These two institutes are a class apart from other programmes in their environment and products. There are some regional library associations conducting certificate courses of a few months duration and women polytechnics offering post-masters two year diplomas in library science to train paraprofessionals.

At the university level, the Master's degree in library and information science is earned in two yearlong (or, in some places, four semesters) courses after 10+2+3 years of education in any faculty. Of late there are two streams: the majority of the universities conduct two separate courses for the Bachelor's degree followed by the Master of Library and Information Science of one year (or two semesters) duration each. In recent years, some institutions have offered two years of integrated courses in four semesters. This integrated approach affords space for a cohesive and non-repetitive syllabus. Indeed syllabi in such schools are quite modernised. Students have the advantage that they do not have to reseek and compete for admission to master degree courses. In some of the places admission to the Master's degree course could be a competitive ordeal.

Curriculum

The University Grants Commission (UGC), a statutory body to plan, co-ordinate, audit and partially finance (non-technical) higher education in India, has from time to time recommended the broader outlines of courses to be taught. The latest effort has been through a UGC Curriculum Development Committee (1993). Every university being autonomous is free to frame its own course of studies. Debate has been going on whether we should go in for a uniform syllabus at least at regional levels. But there seems no obvious advantage to this drab uniformity. In fact there is no co-ordinating body to do this. Verbal pleas and repeated seminar resolutions to have some national level accrediting body (as the American Library Association in USA) have not borne fruit.

The classes taught at the bachelor level are the library in society; cataloguing and classification (theory and practice); reference service and sources; library operations and management; and introduction to information systems and retrieval techniques. There are more variations at the Master's level. The basic set of courses includes universe of knowledge and research methodology; sources of information and bibliography in social/natural sciences/humanities, etc.; information retrieval systems and techniques; library systems in public/academic/special libraries; computer applications in libraries; and a small research project to be completed before the commencement of examination. In principle there

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are many optional classes available to the students. But due to the shortage of teachers most students have to opt for a topic for which a teacher is available. Syllabi are not very relevant and no worthwhile effort has been done at the national level to do research on the relevance of the curricula. There is an urgent need to widen the scope of studies available and to respond to the market forces.

Intake and Teaching Methods

There is always a rush for admission. The number of admission seekers is more than the seats available. This is despite the opening of many distance education programmes that rarely disappoint the admission seekers. But the intake of students is generally of poor quality. Library science courses are never the first option of the majority of students. Most of the students turn to library science after having failed to secure admission to other prestigious courses of study. Thus, it is a career of the mediocre at best.

Teaching is predominantly by the lecture method. In some central states, Hindi is also allowed as a medium of examination as a general policy of the state government. Only a few schools have apprenticeship programmes for the students– otherwise classroom teaching with blackboard and chalk is the norm. Dictation of notes and their cramming by students are still popular. Neither class discussion nor questioning by students is encouraged. New methods of teaching are not tried. Use of educational technology in teaching is rather rare. It can be easily inferred from one of the recommendations of the 15th IATLIS Seminar (1997):

> It is observed that [the] majority of LIS schools are lacking adequate infrastructure facilities to teach/train LIS students in IT. Hence it is recommended that the UGC should provide special financial assistance to develop adequate need-based IT infrastructural facilities in LIS schools.

Infrastructure

About a dozen universities have introduced the M.Phil. Degree, predominantly an intermediate research degree. During the last decade there has been a mushrooming of LIS courses available through correspondence courses or by the more respectable nomenclature of distance education. Except for one, most of such open schools are ill equipped for LIS education, though they have proved money minting machines for the parent universities due to higher enrolment. Some such schools do not have even full-time or regular teachers – good libraries or workshops are not even considered. There is always a cry for improvement or for closing of such courses – but they go on thriving.

Proliferation of Library Education

At present about 107 institutions, mostly university colleges and polytechnics, have library science education courses. Of these, the M.Lib.I.Sc. course is being offered by 67 universities; 11 universities offer the M.Phil. though this degree has no value in the job market. Today 32 Universities have Ph.D. research facilities (Handbook 1997, III). One University recently awarded a D.Litt.

that it claimed to be the first such degree in library science all over the world. It may not be an odious comparison that up to 1986 only 38 universities had master programmes; and 18 universities provided doctoral research facilities though not all these 18 universities had master programmes then (Kumar 1987, vii). The words of the eminent librarian, former President of the Indian Library Association, and former President of the Indian Association of Teachers of Library and Information Science (IATLIS), P.N. Kaula, starkly hold true today. A decade ago, Kaula (1992, 10) said:

> It has been observed that more and more institutions and libraries are opening library science courses without having even the minimum facilities for teaching. Even with poor libraries and funds they have started M.L.I.Sc. Programmes. In some universities there are not full time teachers to teach B.L.I.Sc. courses and yet some of them have also started M.L.I.Sc. programme. Open universities have also started [M/]B.Lib. Sc. programmes. Some private colleges have been conducting large number of C Lib. Sc. programmes with little or practically no facilities for books and libraries. This uncontrolled growth has bought down the standard of the courses. Library associations have also been having large intake of students without accessing the employment opportunities of the products.

Another problem with library schools has been a lack of public relations and marketing of their images and products. The late C. G. Vishwanathan (1990, 88), a veteran librarian, aptly wrote:

> At present library schools and professional training centres in India are yet to receive a kind word from any section of the public ... Even the academic world still does not believe that there can be anything like education for librarianship and curriculum of studies for library science. But at the same time everyone wants library service to be first rate.

The Beginning of Research in Library and Information Science

The roots of research in our profession are not very deep. Research in library science is a twentieth century occurrence ushered in by the library school of the University of Chicago in mid-1920s. The visionary efforts of the Chicago School bore abundant fruit and offered leadership to the world in library science research (Shera 1976, 145). The pace of library research is picking up everywhere today due to social pressure as well as inspiration. In justifying the Ph.D. programme in our profession, it has been urged that "if librarianship aspires to become a profession, it should depend upon research to develop its knowledge base and its theoretical framework" (Wilkinson 1983, 39).

The Indian Context

In India following British tradition and American precedent as established by Asa Don Dickinson (1876–1960), Librarian, Panjab University, Lahore, 1915–1916, library schools for advanced professional education have remained attached to universities. The growth of universities in Independent India ensured their

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constant growth. In a university, apart from teaching, a teacher is expected to do and guide research. The third function of a university, namely service and consultation, has always remained weak in India despite many newly established universityindustry linkage programmes. (Mitra 1997, 1–4).

Ranganathan's Work

The credit for the formal institution of the doctoral degree programme in library science in India goes undeniably to Dr. S.R. Ranganathan (1892–1972). In 1951, he started one at the University of Delhi surmounting many difficulties and facing personal ridicule. The University of Delhi awarded the first de jure degree in library science in 1957 to D.B. Krishan Rao who worked on a faceted classification for agriculture. Doctoral research remained in the wilderness when Ranganathan shook the Delhi soil off his feet in 1955.

The Documentation Research and Training Centre (DRTC) in Bangalore, founded by Ranganathan in 1962, is technically not empowered to award the Ph.D. Therefore, for the rest of his life, from 1962 to 1972, Ranganathan only advocated solo and team research with stress on quality, relevance and basics. No big research projects were taken up at DRTC though individual teachers and students maintained both the quality and the tempo of research. Since the death of Ranganathan almost the entire DRTC faculty has earned Ph.D.s from other Indian universities on topics of research relevant to DRTC (Satija 1998, 80–87). Now the DRTC teachers are approved Ph.D. guides in many Indian universities, and they have already produced many Ph.D.s.

Growth of Doctoral Research in India

Elsewhere in India other individual librarians and library science teachers eager to earn doctorates were hampered by the non-existence of programmes. In the 1960s and 1970s some doctorates on library-related topics were earned by library professionals from some other faculties such as sociology, history, law, economics, management, and the like. The mantle of reviving and furthering doctoral research facilities was assumed by J. S. Sharma (1924–1993), then the university librarian and head of the library science department of the Panjab University, Chandigarh. Under his guidance the second de jure Ph.D. in library science was awarded in 1977 after a gap of full two decades. Thereafter, there was no looking back. Many universities followed with mostly individual efforts and enthusiasm. Doctoral research got a fillip in the 1980s. India maintained its Third World leadership in library research as well as in library education and literature. Ph.D. programmes have rather mushroomed even despite the lack of facilities or adherence to standards.

Facilities for Research

A conscientious university teacher is always in a dilemma over how to divide the time between teaching and research. Teaching is a primary compulsive and urgent duty to be performed. Students expect their teachers to give them time and personal attention. There may be appreciation in good teaching but the rewards lie in research.

The university expects its teachers to do research for its prestige and fame lie therein. But when it comes to supporting of research many universities in India are neither generous nor unambivalent. Ordinarily piecemeal research, especially in social sciences, is not supported financially. Internal support for research trickles through a tedious and off-putting bureaucracy and political manoeuvring. Colleagues are unsupportive. They are unappreciative, intolerant and jealous. Library facilities are poor. Thus most of the teachers are driven to the passivity of guiding doctoral research instead of doing postdoctoral work.

The Deterioration of Standards

The University Grants Commission (UGC) preconditions for faculty employment and promotions have prompted many library professionals to acquire Ph.D. degrees, though many may not have the aptitude and the intrinsic ability to do research. Standards have not only been diluted but have been kept at abeyance. Supervisors and the examiners have become obligingly compromising. The cut-off date of December, 1992 (then advanced to December, 1993) for obtaining the Ph.D. degree to get an exemption from the (difficult) national level test for teaching jobs in universities/colleges has done incalculable damage to research standards. An eminent academician has corroborated the ill effects of this policy:

> They were required to submit their theses before the deadline (December 31, 1993) regardless of the date of registration. Some of the candidates on whom Ph.D.'s were conferred were not fully acquainted with the contents of their dissertations. In some cases even the supervisors were innocent of any knowledge of what the theses were about. The incitement came from the UGC. (Kaul 1998, 7).

Programmes for Ph.D. research have been introduced and expanded mindlessly. As a result, there has been a bit of doctoral boom – a spectacular rise in Ph.D. awarding universities and awardees– though many institutions lack utterly the resources of people or material or both. A 1987 bibliography listed 41 Ph.D. theses written from 1957 to 1985 (Kumar 1987, vii). In a recently published bibliography of doctoral dissertations in India from 1950 to March 1997 about 340 titles have been listed (Sharma 1997). This record of 340 dissertations, though not wholly authentic, is reliable by and large. Its demographic distribution unveils an interesting picture:

Period	No. of theses	year	No. of theses
1950s	2	1990	16
1960s	3	1991	26
1970s	8	1992	47
1980s	98	1993	28
		1994	41
		1995	32
		1996	33
		1997	24 *

1998	11 *
1999 (Up to may)	08*

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In productivity the Panjab University, Chandigarh, led up to the mid-1980s. Thereafter, it lost the number game to the universities of the south. The universities that have so far awarded up to ten degrees are ranked below:

Karnataka University, Dharwad	44
Jiwaji University, Gwalior	27
University of Rajasthan, Jaipur	26
Andhra University, Vishakapatnam	25
University of Delhi	17
University of Pune	16
Gulbarga University	15
Utkal University, Bhubaneswar	11
University of Burdwan	10

The universities in Bangalore, Banaras Hindu University in Varanasi, and Nagpur University are picking up in research.

Relevance of Research

In a developing country like India, there could not be a dearth of research problems to be investigated. But there seems a lack of perception to visualise and identify valid problems for research. A cursory glance of the topics worked on will at once reveal that the topics chosen do not have a problem or hypothesis but merely survey the state of the art or the existing conditions. The popular areas for research have been, in order of popularity: university libraries, bibliometrics, library use and user studies, information seeking behaviour, information systems, classification and indexing, special libraries, library history, reference service and sources, and library science education.

Document selection and procurement, cataloguing, and experimental designs in library management are the least popular topics – though these seem practical and relevant to present day needs. That basic research is the most neglected area is endorsed by other surveys of doctoral research. (Lahiri 1996; Varalakshmi 1994). Library automation, library software, networking and information technology are just emerging. There is need to revive research in classification especially in context of OPACs, information networks and the electronic information environment in general. The Curriculum Development Committee (CDC) on Library and Information Science (1992) of the University Grants Commission rehashed the importance of research, though it did not dwell at length on this aspect in its report. The blue document listed some areas for research, which are no less broad than the current courses being taught at the Master's level (UGC 1992).

- Structure and development of knowledge
- Classification, cataloguing and indexing
- Infometric studies
- Computer applications
- Historical studies

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- Social and economic aspects of librarianship
- Library and Information management and systems analysis
- Applications of techniques of library and information science to evaluate other disciplines.

The list could have been more specific. Though not much revered, the report rightly lays emphasis on standards in research. It uncompromisingly asks for a clear declaration from Ph.D. candidates that the "work is based on the discovery of new facts by the candidate or the new relations of facts ... and how the work tends to the general advancement of knowledge" (UGC 1992, 107). While it is normally expected of every completed piece of research, yet it rarely happens. The evaluation process, however formal, is easily manipulated without qualms. Examiners are obliging on a reciprocal basis. In a small profession like ours this interplay of mutual usability comes in easily. It is often said jocularly (but understood seriously) that the degree is recommended more for the supervisor than for the candidate. And above all, we must admit that the library profession has failed to lure the best brains and even more to retain them. Mediocrity thrives; hypocrisy reigns. But this is not to overlook the genuine research and researchers.

Apart from not so relevant topics, theses have contributed little towards pushing the frontiers of knowledge; few are models of methodology. Indian library research seems to have no moorings in the prevailing realities. Topics are ideal, superficial and bookish. Even experienced librarians keen on earning the Ph.D. degree rarely come with an important problem for research. The supervisor who shies from controversial topics usually suggests the topic. Criticising individuals in formal black-and-white mode or exposing harmful tendencies of a class are not for them. Even a mild and healthy criticism is not tolerated in India. Feudal norms still lie deep in the Indian social ethos.

In addition, there is a dire paucity of data archives and reference works. Collecting data and information is considered a satisfactory end to the job – the goal of the research exercise. It is very difficult to collect data by questionnaire in a vast country like India. Each researcher has a bag full of woeful tales to tell. Library associations at all levels seem to have washed their hands of the research responsibility. These do not even collect and compile statistics of the professional activities pertaining to their areas. Their libraries are poor. They have no research budget. For quite a time professionals have been talking, writing and conferencing about library education and research in India. Every year the Indian Association of Teachers of Library and Information Science (IATLIS) holds a seminar on topics of library education and research. That it is the most popular topic with the teachers and librarians can be gauged from the fact that the FID/ET seminar was the largest of all the 49th FID (1998) pre-conference seminars held in India.

The literature on library education and research is enormous, though repetitive and inflated. We have given lip service to the change of curricula and the raising of standards of research. But the needed change has not come through. The blame is wholly put on the lack of infrastructure and unavailability of funds.

That is not the entire reason. The lack of effective collective efforts to safeguard the standards seems no less major cause.

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The Contributions Made by Research

Contrary to expectations, dissertations are not fountainheads of the rest of the literature to grow and mature. These primary sources of information are distanced from relevance. The National Social Science Documentation Centre (NASSDOC, New Delhi) systematically procures one copy of each research dissertation in social sciences to preserve and make them available to researchers for consultation within the premises of its library. Retrospective bibliographies of LIS dissertations in India are available (Satija 1989, 71–78). The latest information on theses awarded, Ph.D. degrees and Ph.D. research in progress is available in the featured column of the weekly University News (1962+) of the Association of Indian Universities, New Delhi. It is a major source to keep track of the dissertations awarded Ph.D. degrees by Indian universities in all disciplines.

In spite of availability, other researchers do not adequately use these dissertations; nor are these works cited or quoted by teachers or textbook writers. Working librarians rarely use research results to solve their professional problems. There is no precedent of a library inviting a library school to do research on a problem confronting them. (Conversely there seems inborn animosity and mistrust between them). At the risk of calling attention to a red herring, it is worthwhile to have this idea corroborated from a veteran library leader. Professor P.N. Kaula (1992, 9) candidly observed:

> That LIS departments have little or no understanding and cooperation with the central library ... The problem is more psychological than academic ... Much harm has been done to the teaching of library science by the disharmony ....

Librarians go in for local, ad hoc and pro-tem solutions for their practical problems. Researchers consult a teacher or a fellow researcher for a topic of research rather than a practitioner. It is not only true in India but elsewhere too (Prytherch 1997). Thus research has become divorced from reality – a theoretical exercise at best. This seems a universal phenomenon in our profession. Carl Keren (1984, 137) doubting the value of research in information science daringly suggests that "It would be worthwhile to find out how much of it has really contributed to our body of knowledge and to the methods used by practitioners." He himself understands that "We will probably be rather disappointed". American teacher Margaret Steig (1992, 98) endorses this notion:

> Research done by library and information science educators seems to receive little respect from professionals, and if they do not find it of value one has to wonder who will.

She further quotes (p. 98) the famous Conant report to prove her point:

> Library educators seldom produce well-researched literary products ... This is where the library schools most fail the profession.

This is a time to pause and think, why? If we fail the practitioners and the scholars alike, whom do we serve then?

Summary

1. A report is a very formal document that is written for a variety of purposes in the sciences, social sciences, engineering and business disciplines. Generally, findings pertaining to a given or specific task are written up into a report.
2. Bibliometrics is a type of research method used in library and information science. It utilizes quantitative analysis and statistics to describe patterns of publication within a given field or body of literature.
3. The three most commonly used laws in bibliometrics are: Lotka's law of scientific productivity, Bradford's law of scatter, and Zipf's law of word occurrence.
4. Professional higher education in library and information science (LIS) in India, now nine decades old, is centred in universities. Exceptions are two national institutes, namely, the Documentation Research and Training Centre (DRTC) in Bangalore, and the education section of the Indian National Scientific Documentation Centre (INSDOC) in New Delhi.
5. The roots of research in our profession are not very deep. Research in library science is a twentieth century occurrence ushered in by the library school of the University of Chicago in mid-1920s. The visionary efforts of the Chicago School bore abundant fruit and offered leadership to the world in library science research.
6. The credit for the formal institution of the doctoral degree programme in library science in India goes undeniably to Dr. S.R. Ranganathan (1892–1972). In 1951, he started one at the University of Delhi surmounting many difficulties and facing personal ridicule.

Review Questions

1. What is the meaning and significance of report in research?
2. Discuss the types of research.
3. What is the standard structure of a report?
4. How is report written?
5. What are the fundamental weaknesses of a report writing?
6. How is final touch given to a report?
7. How is longitudinal survey conducted in the research of LIS?
8. Discuss the historical approach of research for library science.
9. Why is discourse analysis applied in the research of library science?

Further Readings

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