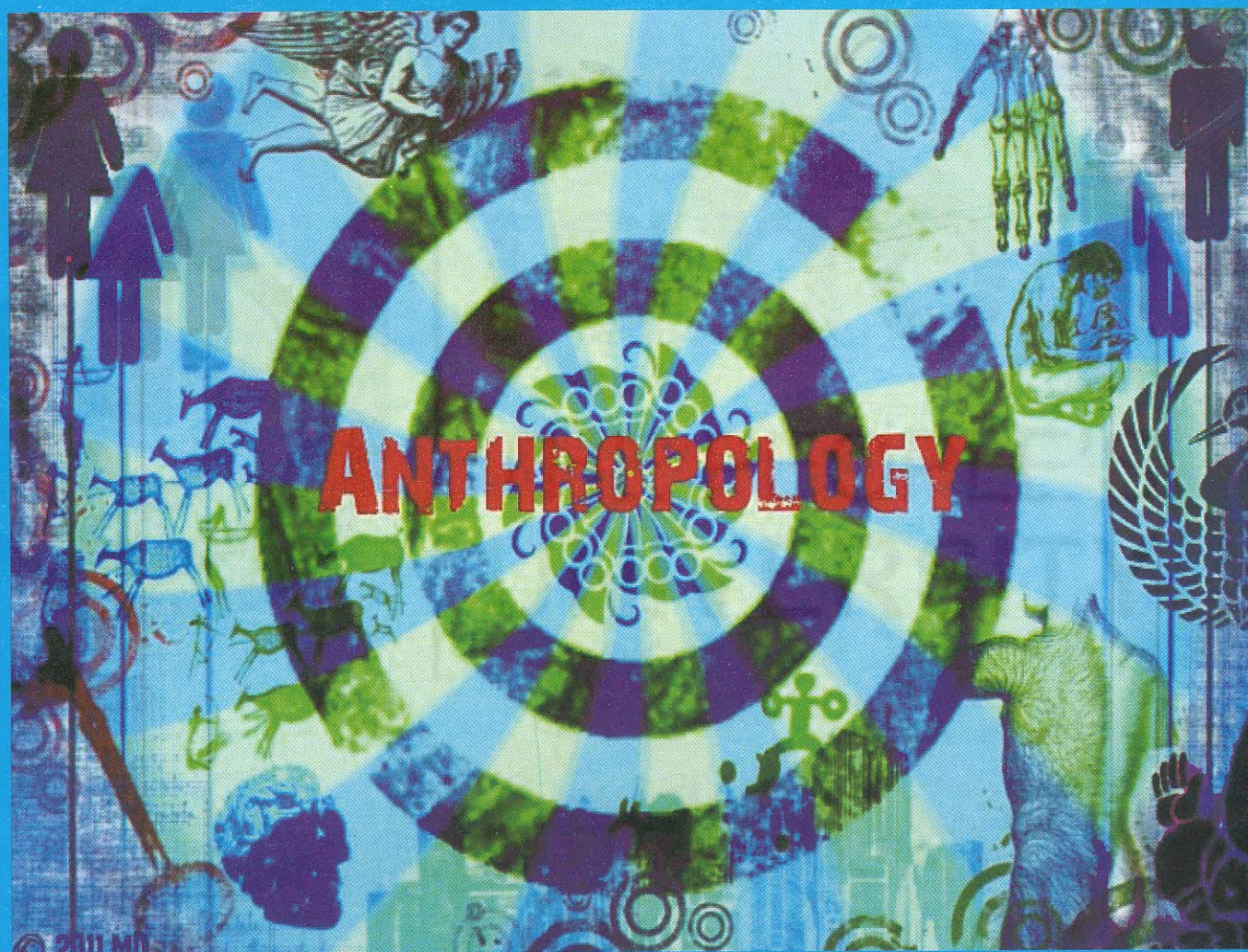




“ शिक्षा मानव को बन्धनों से मुक्त करती है और आज के युग में तो यह लोकतंत्र की भावना का आधार भी है। जन्म तथा अन्य कारणों से उत्पन्न जाति एवं वर्गगत विषमताओं को दूर करते हुए मनुष्य को इन सबसे ऊपर उठाती है।”

- इन्दिरा गांधी



Education is a liberating force, and in our age it is also a democratising force, cutting across the barriers of caste and class, smoothing out inequalities imposed by birth and other circumstances"

- Indira Gandhi

Block

3

RESEARCH DESIGN

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BLOCK 3 RESEARCH DESIGN

Introduction

Early anthropologists carried out fieldwork in exotic communities and conducted their studies by living among the people, on the basis of which they produced massive ethnographies. But, present day anthropologists are interested more in finding out answers to specific research questions. They carry out their studies with a master plan called as research design. A research design is an effectively structured statement about the plan required to achieve the desired goals or objectives. It is like a blue print indicating the course of action to be taken for achieving the research goals. The starting point for a research design is identification of the broad research area, followed by a definition or formulation of the precise research problem. This is followed by the adoption of relevant research strategy. The formulation and statement of research problem is preceded by a systematic survey of available literature in the area of study, and on the specific topic. Review of literature leads to an understanding of the research carried out so far, the methodologies followed, the nature of findings, and their inadequacies. This helps in fine tuning the objectives of the research study being contemplated. **Unit 1** of this Block deals with literature review and statement of problem. Various components of research design such as concepts, variables, hypothesis need to be clear and precise to facilitate a smooth execution of research strategy. The term science comes from the Latin word 'scientia' which means knowing. Broadly speaking, science is nothing but objective and systematic knowledge. Theories are the building blocks of this science, offering explanations for scientific phenomena. **Unit 2** of this Block deals with theory, hypothesis and related aspects. Different types of research problems require different ordering of research operations. In other words, different types of research problems involve different strategies or research designs. Those who want to describe a society, an event or any other unit follow what is called as a descriptive research design. Descriptive research design is meant for providing accurate description of the phenomenon. Those who want to gain familiarity with an unknown society or problem may follow an exploratory type of research design. Exploratory research design aims at obtaining new insights, so that a more precise research problem can be formulated for further advancement of knowledge. Both exploratory and descriptive designs are accorded lower status when compared to experimental research design, which is considered as more scientific. Generally experimental research design entails manipulation of variables and observing their effects. Experimental research design follows a structured procedure to test a causal hypothesis. This involves comparison between experimental groups where there is manipulation of variables (certain changes taking place) and with a control group where there is no manipulation of variables (similar changes not taking place). A well conceived research design is a must for obtaining funding for research, as funding agencies are interested not only in the relevance of the research for their needs, but also on clearly spelt out time and cost budgeting. **Unit 3** of this block deals with characteristics of a good research design and different types of research designs.

UNIT 1 REVIEW OF LITERATURE AND STATEMENT OF RESEARCH PROBLEM

Contents

- 1.1 Introduction
- 1.2 Survey of the Literature
- 1.3 Steps to Conduct a Literature Review
- 1.4 Searching for Existing Literature
- 1.5 Reasons for Writing a Literature Review
- 1.6 Statement of a Research Problem
- 1.7 Components in a Research Problem
- 1.8 Focus of Selection
- 1.9 Sources of Selecting a Research Problem
- 1.10 Necessity of Defining a Research Problem
- 1.11 Techniques Involved in Defining a Research Problem
- 1.12 Conditions Conducive to Formulation of a Research Problem
- 1.13 Operationalising Concepts
- 1.14 Summary
- References
- Suggested Reading
- Sample Questions

Learning Objectives



After reading this unit you will:

- know that literature provides help in the form of studies that are closely related and comparable to the study being conducted;
- learn that it relates the study to the larger ongoing dialogue in literature about the topic;
- be provided with an understanding about the framework for establishing the importance of the study as well as the benchmark for comparing the results with other studies;
- learn in totality the introduction to literature review, steps in conducting a literature review and reasons for writing the literature review; and
- comprehend the statement of a research problem, components in research problem, techniques involved and conditions conducive to formulation of research problem in detail.

1.1 INTRODUCTION

We start this unit with an introduction about literature review and how it is vital to research work. Literature reviews help researchers limit the scope of their inquiry, and they convey the importance of studying a topic to the researcher. The review of literature is a task that continues throughout the duration of the thesis. Since a thesis aims to be a contribution to knowledge, a careful check should be made that the proposed study has not previously been carried out. Although completely new and original problems are rare, a previous study should not be exactly replicated unless the techniques used had been faulty or line findings and conclusions doubtful or unless some new sources of information had been discovered to throw new light on the problem. A good test is whether the problem still requires solution.

The literature review in a research study accomplishes several purposes. It shares with the researcher the results of other studies that are closely related to the study being reported. It relates a study to the larger ongoing dialogue in the literature about a topic, filling in gaps and extending earlier studies (Creswell, 2003). It provides a frame-work for establishing the importance of the study as well as a benchmark for comparing the results of study with other findings. All or some of these reasons may be the foundation for writing the scholarly literature into a study.

Once a topic has been decided upon, it is essential to review relevant material which has a bearing on the topic. This review of the literature is included in the final written thesis as a key section or chapter. It is necessary to show how the problem under investigation relates to previous research studies. In some subject areas it is important to locate the problem within a theoretical framework and in such cases the underlying theory needs to be reviewed as well.

1.2 SURVEY OF THE LITERATURE

One of the simplest ways that we can devise to economise effort in an inquiry is to review and build upon the work already done by others. In exploratory studies, the focus of review is on hypotheses that may serve as leads for further investigation. Hypotheses may have been explicitly stated by previous workers, the task then is to gather various hypotheses that have been put forward, to evaluate their usefulness as a basis for further research, and to consider whether they suggest new hypotheses. More frequently, however, an exploratory study is concerned with an area in which hypotheses have not yet been formulated; the task then is to review the available material with sensitivity to the hypotheses that may be derived from it.

It is useful in initially surveying a field to work from the general to the specific or to work from tertiary and secondary sources of information to primary sources.

Primary sources

Primary sources of information include first-hand accounts of experimentation and investigation (articles in professional journals, monographs, doctoral theses, interviews, and questionnaires), original works (letters, diaries, eyewitness accounts, poems, novels, autobiographies) and reports (proceedings of Parliament, court testimony, reports of governmental departments and agencies, annual reports, minutes).

Secondary sources

Secondary sources of information are summaries of information gathered from primary sources. These include translations, summaries and reviews of research (for example, encyclopedia articles), abstracts, guide books and other publications containing factual information, commentaries and so on.

Tertiary sources

Textbooks are usually examples of tertiary sources of information since these are generally compiled from secondary sources. The reliability of sources of information is generally a function of the number of hands through which the information has passed. Tertiary sources of information can be useful in providing an overview of broad summary of field. They may even be acceptable as references because some textbooks become acknowledged as authoritative. For certain types of research, the original source material may be lost or inaccessible and heavy reliance must therefore be made on secondary sources. However, there is no substitute for consulting primary sources if they are available and postgraduate work in most subject areas demands it (Anderson et al. 1971).

It is important to learn how primary sources are used in qualitative, quantitative and mixed methods of research. In qualitative approach, the investigator or the researcher looks for literature which contain information from the participant's or the respondent's perspective and not from the investigator's. It is found that one of the basic reasons for taking up a qualitative study is because it is exploratory. This also suggests that not much data can be found in literature on the theme or the population being researched and the investigator prefers to gather knowledge based on the ideas and thoughts expressed by the participants.

In qualitative research the literature consulted differs significantly. While working on theoretically focused ethnographies and critical ethnographies, literature based on critical theory and cultural concepts are referred and these are introduced by the researchers at an early stage of fieldwork, i.e. while designing the framework. However in grounded theory studies, where the researcher does not enter the field with a hypothesis, literature does not play an important role in building the initial ground for enquiry.

On the other hand, in quantitative research literature is used substantially before venturing out to the field, so as to give a sense of direction to design research questions and hypotheses. Here literature helps in introducing the problem of study or also to introduce in detail the existing literature connected to the study. This section is usually named 'related literature', 'review of literature' etc. Moreover, literature is also included at the end of the research in order to compare the findings with the existing ones. In quantitative enquiry literature is thus logically used as an outline for research queries and hypotheses.

A separate section on the 'review of the literature' deserves special mention because it is a popular form for writing literature into a study. This literature review might take several different forms, and little consensus exists about a preferable form. Cooper (1984) suggests that literature reviews can be integrative; with researchers summarizing broad themes in the literature (cf. Creswell, 2003).

When the researcher uses both or either a qualitative or a quantitative approach in the use of literature then it is called a mixed method study. The literature depends on the kind of mixed methods model/design being used.

1.3 STEPS TO CONDUCT A LITERATURE REVIEW

Regardless of whether the researcher writes the literature into a qualitative, quantitative, or a mixed methods study, several steps are useful in conducting a literature review. A literature review for a proposal or a research study means locating and summarizing the studies about a topic. Often these summaries are research studies (because a researcher is conducting a research study), but they may also include conceptual articles or thought pieces that provide frameworks for thinking about topics. There is not one way to conduct a literature review, but many scholars proceed in a systematic fashion to capture, evaluate, and summarize it.

Step 1: One should begin by identifying key words useful in locating materials in an academic library.

Step 2: With these key words in mind, the researcher should go to the library and begin searching the library catalog for holdings (i.e. journals and books)

Step 3: The researcher should try to locate journal articles and books because they are easy to locate and obtain.

Step 4: Using this initial group of articles he/she should try to identify the article or chapter will make a useful contribution to understanding of the literature.

Step 5: After identifying useful literature, the researcher should begin designing the literature map.

Step 6: At the same time s/he should organise the literature into a literature map and include precise references to the literature using an appropriate style.

Step 7: After summarizing the literature, s/he should assemble the literature review, categorically, thematically and conceptually.

To build on key points in these process steps, the researcher should consider techniques useful in accessing the literature quickly through databases (Creswell, 2003).

1.4 SEARCHING FOR EXISTING LITERATURE

The first thing to do after a researcher gets an idea for a piece of research, is to find out what has been done. In the jargon of library science, a documentation resource is anything that helps the researcher to find literature – published or unpublished. There are three main documentation resources: people, review articles and bibliographic search tools (Bernard, 1995). Usually the researcher knows a few initial references when s/he begins her/his research. The bibliographies in these references will usually provide the researcher with a raft for further relevant references.

Activity

Organise a "Review of the Literature" for a quantitative study and follow the model for delimiting the literature to reflect the variables in the study. As an alternative, organise a review of literature for a qualitative study and include it in an introduction as a rationale for the research problem in the study.

The researcher should start library research with an index or abstract. Many libraries have both print and electronic versions of frequently used indexes. Advantage of print indexes is that they are organised under controlled headings. The headings bring together all material on the subject and typically include cross-references, which can help in identifying related topics. Database now available in libraries provide an opportunity for researchers to access thousands of journals, conference papers, and materials quickly.

Libraries generally group their online indexes by subject. The frequently used indexes in the social sciences are the Sociological Abstracts (SA), Social Sciences Index (SSI), Social Sciences Citation Index (SSCI), Annual Review of Anthropology, Science Citation Index (SCI), Arts and Humanities Citation Index (A & HCI), Anthropological Index (AI), Abstracts in Anthropology (AIA), The International Bibliography of Social and Cultural Anthropology (IBSCA), The Catalog of the Peabody Museum, Library and Anthropological Literature (AL), Geographical Abstracts (GA). Many of the documentation resources are available in CD-ROM also.

The electronic version can facilitate a search in several ways. Electronic indexes are more dynamic than print resources, allowing the researcher to search more than one term at a time within a long span of years, and s/he can usually get a printed copy of the citations. It is often possible to save, download, and e-mail an abstract, a citation list, and even entire articles. As with conducting Web searches, the values of these resources depend on the researcher's ability to identify relevant terms.

Nowadays, online bibliographical databases that are accessible on the internet are an invaluable source of references. For all online databases the researcher shall work out some good keywords that can be entered into the search engines and which will allow the researcher to identify suitable references. The researcher should explore the existing literature to identify the following issues.

- What is already known about this area?
- What concepts and theories are relevant to this area?
- What research methods and research strategies have been employed in studying this area?
- Are there any significant controversies?
- Are there any inconsistencies in findings related to this area?
- Are there any unanswered research questions in this area?

This last issue points to the possibility that the researcher will be able to revise and refine research questions in the process of reviewing the literature (Bryman, 2004).

Now the question arises why does a researcher need to review the existing literature? The most obvious reason is that s/he wants to know what is already known about her/his area of interest so that s/he does not simply 'reinvent the wheel'. Beyond this, using the existing literature on a topic is a means of development and argument about the significance of research and where it leads.

1.5 REASONS FOR WRITING A LITERATURE REVIEW

Bryman (2004) mentions the following as a list of reasons for writing a literature review:

- Need to know what is already known in connection with the research area because the researcher does not want to be accused of reinventing the wheel.
- Can learn from other researchers' mistakes and avoid making the same ones.
- Can learn about different theoretical and methodological approaches in research area.
- Help to develop an analytical framework.
- To consider the inclusion of variables in the research that the researcher might not otherwise have thought about.
- Suggest further research questions.
- Help with the interpretation of her/his research findings.
- Gives research pegs on which to hang research findings.

Activity

Develop a visual map of the literature related to the topic. Include in the map the proposed study, and draw lines from the proposed study to other categories of studies so that a reader can easily see how the study will extend existing literature.

1.6 STATEMENT OF A RESEARCH PROBLEM

In the research process, the first and foremost step happens to be the selection and proper definition a research problem. We talk of a research problem or hypothesis in case of descriptive or hypothesis testing research studies. Exploratory or formulative research studies do not start with a problem or hypothesis, their problem is to find a problem or the hypothesis to be tested (Kothari, 2004). A researcher must find the problem and formulate it so that it becomes susceptible to research. There may be persons interested in undertaking research, but a question which needs careful consideration is how to select a research problem. It is not easy to select a problem because many considerations weigh in this regard. The most important being, that the problem should be researchable as well as manageable. A researcher might identify the area of her/his general interest but that does not in any way become a problem of

research, for e.g. a student of anthropology might feel interested in tribal studies which could be an area of general interest but out of this s/he will have to pick up a theme of research which is of interest to her/him for her/his study.

Identifying a research problem is indicating a specific area of answering some research questions. A person interested in undertaking research in social sciences will be concerned with selecting the problem which interests him, which appears problematic to him, or which he thinks need to be investigated for better understanding of society. Initially, the researcher may have a diffused notion of particular aspects of the problem to be analysed, but by reading more literature on the subject and by thinking more and more on it, s/he comes to have a fairly clear idea of what the issue is and comes to formulate a specific research problem (Ahuja, 2007). To define a problem correctly, a researcher must know: what a problem is.

1.7 COMPONENTS IN A RESEARCH PROBLEM

A research problem, in general, refers to some difficulty which a researcher experiences in the context of either theoretical or practical and wants to obtain a solution for the same. Usually we say that a research problem does exist if the following conditions are met with:

- i) There must be an individual (or a group or an organisation), to whom the problem can be attributed. The individual or the organisation, as the case may be, occupies an environment, which is defined by values of the uncontrolled variables.
- ii) There must be at least two courses of action to be pursued. A course of action is defined by one or more values of the controlled variables.
- iii) There must be at least two possible outcomes of the course of action, of which one should be preferable to the other. This means that there must be at least one outcome that the researcher wants, i.e., an objective.
- iv) The courses of action available must provide some chance of obtaining the objective, but they cannot provide the same chance, otherwise the choice would not matter. In simple words, we can say that the choices must have unequal efficiencies for the desired outcomes.

An individual or a group of persons can be said to have a problem which can be technically described as a researcher problem, if they (individual or the group), having one or more desired outcomes, are confronted with two or more courses of action that have some but not equal efficiency for the desired objective(s) and are in doubt about which course of action is the best (Kothari, 2004).

In every research, there are four components, each having its own interest in research. These four components are: researcher (who conducts the study); research sponsor (who pays for the research), research participant (who replies to questions), and research consumer (who uses the findings of the researcher). The researcher's interest may be: advancement of knowledge, filling up a gap in knowledge, academic curiosity of some observed phenomenon, problem solving, testing a hypothesis, theory construction, getting status and recognition, getting money, replication of some previous research, and so on. The sponsor's interests may be: policy framing, programme evaluation, encouraging academic

interests, getting innovative ideas for growth of his concern, solving problem in his establishment, and the like. The participants' (workers, students, villagers, slum-dwellers, alcoholics, criminals, women, etc.) interests may be: cooperating with the researcher to the extent of finding solution for solving their problems or just understanding society and social phenomena. The research consumer's (entrepreneurs, government, policy planners, etc.) interests may be: solving a problem, future planning, etc. (Ahuja, 2007).

For a researcher one thing which must be clearly understood before finishing a research proposal is as to who is the consumer of researcher. Such a consumer can be an individual himself, a group of researchers, an industry or a group of industries, etc. Each research consumer has certain objects to achieve through research. It is sure and certain that consumer of research has a problem which he wants to get solved. It is also usually found that he has some alternatives before him and through his research, he will like to find the best. If there is no doubt about something, then there can be no problem as well. All alternatives are linked with efficiency. Research consumer sometimes can also get the research done purely for the sake of collecting information and it is this information which determines relative efficiency of alternatives means. In fact consumer is the most important consideration in formulation of a research proposal. It is the consumer for whom the report is to be finally prepared and consumed. It is again the consumer who will place funds at the disposal of the researcher and if the consumer is society then the problem will be investigated by the state.

According to Merfon (cf. Hans Raj, 1979) there are three important components in the progressive formulation of a problem in social research namely: what one wants to know, why one wants to know and possible answers to questions. In other words first a question arises, and then the why of the question arises, followed by possible answers.

The questions can revolve around such problems e.g. whether the alleged social facts are actually facts or not, and unless that is established and understood, the whole basis will be wrong and everything will go wrong with subsequent findings. It will have to be established that social facts are not what these sometimes appear to be. Sometimes these prove wrong as well. Questions which aim at finding out whether facts, are facts or not are called fact finding questions.

Then another set of questions can be those questions which draw direct attention of the researchers to find out uniformities of relations between classes of social variables. Such types of questions are usually derived from a general theoretical orientation rather than a definite theory. The questions differ both in scope as well as degree of specificity.

There can be questions which can be addressed to a variety of institutional spheres. But each question has its own value in so far as augmenting of knowledge is concerned. These questions originate from different sources and can be thus:

- Descriptive facts;
- Dealing with adequacy of concepts;
- Relating to empirical generalisation;

- Dealing with observed patterns of social organisation and their consequences.

After this comes the rationale of the question i.e. why at all a question is worth putting forward i.e., how the answer to a question is likely to contribute either to theory or practice. In other words it is imperative to find out whether the question is consequential or trivial. It is this rationale which turns out those questions which are considered unimportant or insignificant. Only such questions need be answered which are considered relevant to other ideas and facts in the discipline on the one hand and help people in achieving practical values on the other. Usually such questions help in improving theoretical system. Theoretically a question may also draw attention on certain inconsistencies on commonly accepted ideas or findings and also help in drawing a conclusion whether such inconsistencies are real or seemingly real. These in turn lead to posing new problems for research and also set the stage for instituting new problems. These help in locating deviant cases and when it is uniformly interpreted, helps in improving the rule.

Questions assume a very serious significance and importance when a particular discipline is evolving itself. Then the problems which had hitherto been neglected come to the forefront. Range of problems to be investigated very much increases. New concepts originate and are differentiated from each other.

The questions of a research problem can be both diffused as well as specific. In a diffused form a question may specify the pertinent variables of a class and problem may not be fully instituted (Hans Raj, 1979).

1.8 FOCUS OF SELECTION

Once the research topic is selected, it becomes necessary to select specific aspects for analysis. Four such aspects which need attention are:

Selecting units of analysis

The cases selected for study by the researchers depend on the theme of study and the objectives of research. The units of analysis could be: individuals, groups of people, social structures, social systems, social positions, office holders, organisations, social relationships, etc. For example, for studying cyclones, one has to visit those coastal areas in selected states (like Andhra Pradesh, Orissa) where cyclones are frequent and government has to spend millions of rupees for rehabilitating the victims. Similarly, for studying drug abuse, one may focus on students in schools, colleges, universities or slum dwellers or industrial workers; or truck drivers, rickshaw and auto-rickshaw drivers, or rag-pickers, or villagers in selected areas.

In these examples, it is the purpose of study which dictates what or who is to be studied, i.e., what is to be the appropriate unit of analysis. Identifying units of analysis is difficult when aggregate information is involved and people are scattered in different geographical areas.

Selecting variables

Variables to be analysed in research may vary from case to case because of difference in research questions. Even the research questions may vary from one study to another on the same theme.

Thus, explanatory variables (selected for analysis) have to be identified before undertaking research so that extraneous variables may be ignored/isolated. Similarly, independent variable in one study may be dependent in other study. In relation to specific independent and dependent variables, the antecedent and intervening variables may also be identified in the research. A variable is intervening if it is in effect of the independent variable occurs prior in time to both the independent and dependent variables. Thus, efficient research depends upon identifying potentially relevant extraneous variables in order to control as many variables as is feasible.

Selecting anticipated relationship for research

After identifying units of analysis and variables in the problem selected for research, it is equally important to select the specific relationship which are believed to exist among the phenomenon. The research is, therefore focused on testing what particular relationships are anticipated. Research cannot be conducted in a haphazard way in which any variable or relationship may be taken for analysis. Depending on the goals of study, it has to be decided in advance which relationships are to be observed and which ones are to be ignored and how to interpret them. Each analysis must have some guiding orientation. Since all researchers carry expectations about the nature of what is being investigated, it is necessary that anticipated relationship should always be identified.

Stating hypothesis

After selecting the problem of research and anticipating some relationship between certain variables, direct or inverse, the researcher may start his research work either only with a vague notion of the problem or may be motivated to follow some specific direction. Some start with formulating and giving statements of a tentative nature regarding the relationship of phenomenon under study with some specific variables. Whether these are scientifically maintainable or not will depend on the data collected. Testing of hypothesis will provide a definite direction to the research.

1.9 SOURCES OF SELECTING A RESEARCH PROBLEM

The ideas to decide a topic of research and to formulate relevant hypotheses stem from varied sources. These are:

- Research conducted by others. Exposure to professional seminars and conferences also sometimes throws ideas for new research.
- Reviewing literature and getting ideas from books and articles. Questions which either others have posed or which arise in the course of one's reading could become research questions.
- Experience, i.e., one's own life experience in professional work or from general life experience.
- Government priorities: Various government organisations also publicise research topics, e.g., Government of India circulates a list of various topics in which it feels the necessity of research.

- Prevalent theories: There are some popular theories (but not scientific ones) prevalent in society. These need to be tested by a variety of specific hypotheses to determine in what context/conditions they may or may not hold. In this way, popular theories as well as scientific theories can give ideas about research problems.
- Imagination: Sometimes, the mass media provides an ever-growing potential source for research problem.
- Some observed phenomenon, e.g., adult child interaction, shop keepers and customer interaction, interaction of members of two parties belonging to two different factions (Ahuja, 2007).

1.10 NECESSITY OF DEFINING A RESEARCH PROBLEM

Defining a research problem properly and clearly is a crucial part of a research study. The research problem should be defined in a systematic manner, giving due weightage to all relating points. A problem clearly stated is a problem half solved. This statement signifies the need for defining a research problem. The problem to be investigated should be defined unambiguously as that will help to discriminate relevant data from the irrelevant ones. A proper definition of research problem will enable the researcher to be on track. Questions like: What data are to be collected? What characteristics of data are relevant and need to be studied? What relations are to be explored? What techniques are to be used for the purpose? and similar other questions crop to in the mind of the researcher who can well plan his strategy and find answers to all such questions only when the research problem has been well defined. Thus, defining a research problem properly is a prerequisite for any study and is a step of the highest importance. In fact, formulation of a problem is often more essential than its solution. It is only on careful detailing the research problem that we can work out the research design and can smoothly carry on all the consequential steps involved while doing research.

1.11 TECHNIQUES INVOLVED IN DEFINING A RESEARCH PROBLEM

Defining a problem involves the task of laying down boundaries within which a researcher shall study the problem with a pre-determined objective in view. How to define a research problem is undoubtedly a difficult task. However, it is a task that must be tackled intelligently to avoid the perplexity encountered in a research operation. The usual approach is that the researcher should himself pose a question and set-up techniques and procedures for throwing light on the question concerned for formulating or defining the research problem. But such an approach generally does not produce definitive results because the question phrased in such a fashion is usually in broad general terms and as such may not be in a form suitable for testing.

i) Statement of the problem in generic terms

To begin with the problem should be described in a generic sense which should be guided by some pragmatic issue or any intellectual interest. For this, the

investigator must engage herself/himself meticulously in the subject so that a problem may be rationally posed. For this, a preliminary pilot study or a pilot survey is of much help by which some observation of the field situation can be done. Once this is done, the investigator can state the problem to be studied. At this stage he can also take the help of the research guide/supervisor to create the research problem. Mostly the guide states the problem in general terms. From this the investigator may narrow down the problem to a specific theme which can be operational. Sometimes when a researcher is working for an organisation, then according to the mandate of the authority, the problem can be specified accordingly. An ambiguity that arises when the problem remains general can be resolved by rationalising over the problem. Finally the viability of a specific answer should be taken into view while stating a problem.

ii) Understanding the nature of the problem

To contemplate upon the problem at hand it is best to discuss it with those who first came up with the problem to understand its objectives. If the investigator designed the problem herself/himself, then s/he should again reflect about the points which encouraged her/him to propose a general statement related to the problem. To understand the nature of the problem better, the researcher should deliberate with experts who possess good knowledge about the problem. Moreover the researcher should also find out if the problem to be studied is suitable to the environment in which s/he plans to conduct research.

iii) Surveying the available literature

It is pertinent to go through all available literature connected to the problem before the research problem is defined. The investigator should be well aware of the existing theories which can be used in the field and are found in reports, records and any other literature. Before getting down to her/his own problem, s/he should invest enough time to examine earlier research on related problems. This helps in finding out data for future operational purposes. Knowledge of available data helps in narrowing down the problem. This furthers the selection of techniques to be used. This also helps to know if there are inconsistencies in the theories, if the relevant existing theories to the problem under study have gaps with each other or whether these theories are not in sync with future theoretical anticipations. These concerns allow the researcher to progress in the enrichment of knowledge. Thus inquiry of existing and connected problems helps in signifying the kind of issues that may be faced in the study proposed along with shortcomings of the analytical kind. Sometimes such studies also imply beneficial and also new lines of methodology to the researcher's own problem.

iv) Developing the ideas through discussions

Discussion concerning any problem, with her/his colleagues and others who have enough experience in the same area or in working on similar problems, often produces useful information. Various new ideas can be developed through such exercises. This is also known as an experience survey. People with rich experience are in a position to enlighten the researcher on different aspects of his proposed study and their advice and comments are usually invaluable to the researcher.

v) Rephrasing the research problem

Lastly the researcher should rearticulate the research problem into functional

plan. After all the above discussed points are taken into consideration, then formulation of an operational proposition is not a tough task. Rephrasing assists in the development of useful hypotheses.

In addition to what has been stated above, the following points should also be observed while defining a research problem:

- a) Technical terms and words or phrases, with special meanings used in the statement of the problem, should be clearly defined.
- b) Basic assumptions or postulates, if any, relating to the research problem should be clearly stated.
- c) A straight forward statement of the value of the investigation (i.e., the criteria for the selection of the problem) should be provided.
- d) The suitability of the time-period and the sources of data available should also be considered by the researcher in defining the problem.
- e) The scope of the investigation or the limits within which the problem is to be studied should be mentioned explicitly in defining a research problem (Kothari, 2004).

1.12 CONDITIONS CONDUCTIVE TO FORMULATION OF A RESEARCH PROBLEM

Of course it is difficult to lay down any specific conditions conducive to the formulation of a research problem but some such important conditions are:

- The researcher must be well aware of the area in which s/he is going to research.
- S/he should be well conversant with different theories in the field.
- S/he should have full knowledge of the findings of the studies of others in the field and also the reports and available records. S/he should equally be aware of inconsistent theories and abridged gaps.
- S/he should seek enlightenment from experienced persons including administrators, researchers and others.
- Another conducive factor is that the researcher should have a critical, curious and an imaginative frame of mind.

A critical unbiased mind with the desire to answer 'why' and 'how' of a problem, can be conducive to the formulation of a research problem (Hans Raj, 1979).

Operationalising concepts

Once the problem is selected and conceptualised, it is to be followed by the operationalisation process. Conceptualisation and operationalisation are intimately linked. Conceptualisation is the refinement and specification of abstract concepts and operationalisation is precisely defining what is meant by the concept. This may involve breaking it down into sub-concepts, termed components (as done with alienation) or establishing concretely measurable characteristics or indicators of the concept, e.g., indicators of 'inequality' like income, health, education, etc.

Clarifying the problem means specifying the areas to be selected for observations/study. For example, when we have to study “role of media on health”, the two concepts which need to be operationalised here are: media and health.

Thus, the operationalising concept exhibits to what extent the researcher is willing to combine measurable attributes in fairly gross categories. Operationalisation also includes factors like determining range of variation, etc. In operationalising concepts, ‘content’ may be given greater importance than ‘criteria’. For example, absenteeism may be operationalised as “habitually staying away from the place of work without prior sanction of leave” or “failure to be present for regular duty without good reason” (Ahuja, 2007).

1.13 OPERATIONALISING CONCEPTS

There is a difference between organisational and individual research. When we talk of organisational research it refers to large scale research work in which some information is collected for the purpose of promoting knowledge or for the sake of promoting organisational interests by collecting information for others. Usually in organisational research it is implied that vast resources shall be available. On the other hand when we talk of individual, we mean a type of research in which an individual is interested in the problems which s/he wants to research. It is her/his inner and internal urge which compels her/him to study the problem. It is again for her/him to ensure that the resources will be available for her/his research. But in individual research no vast resources are expected to be utilised. The problem to be researched is expected to be comparatively simpler.

Determinants of individual research

The factors which determine individual research are primarily subject, investigator and coverage.

Subject: Selection of research problem is in no way easy in the case of individual research. While selecting a problem, some basic factors to be taken care of are:

- a) The researcher shall always have to see that the problem has a purpose.
- b) Another factor which counts in individual research is whether it is practicable to study the problem, collect data and get it analysed in a systematic way. From the practicability viewpoint it shall have to be seen whether the society in general and the people of the area in which research is to be conducted, shall be prepared to divulge the sort of information desired to be collected.
- c) Since in individual research both financial and manual resources are very limited, therefore, it is in the interests of the individual that he should pick up such a problem which has contemporary social importance.
- d) A researchable problem for an individual can be either factual or policy problem. It is always better, at least in the beginning of the research, that only such a subject should be picked up which are more factual in character rather than those with philosophical assets.
- e) Still another determinant can be that the individual should pick up only such problems, results of which can be verified, rather than the one where

the results cannot be verified and subjected to criticism. Though in socio-economic research usually it is difficult to verify the results, yet it is desirable that only such problems which are verifiable are picked up.

The investigator: Howsoever good a problem it might be, it cannot be successfully researched, particularly in the case of individual research, until and unless the investigator is particularly good. An individual is to research a problem and success of the problem of research will ultimately depend on her/his experience, resources and technical ability.

Coverage: It is always desirable in the case of individual research that only limited area should be covered and there should be concentration on problem of research. It is only then that in depth study will be possible. It will also then be possible to integrate some enquiries with the help of good investigators.

Starting point of a research problem: Of course, it is not easy to select a research problem for a study but once the problem has been selected a question arises as to how to start and when. It is better that before a starting is made, there should be careful planning about succeeding stages. There should be clear ideas of broad perspectives and general view of the problem as a whole. To be clear it is better if essential plan of approach is clearly put down in writing and the tentative plan is chalked out. It is at this state that real objective of the enquiry is determined and statement of the problem in its true perspective understood. It is thereafter essential that time and energy in the collection of data can be saved. There should be precise but clear definition of the problem and it is better if proper splitting of the problem is done in order of their importance and relationship with the main problem. A clear idea should be gathered of the factors which are likely to influence the study.

There should also be clear idea about the procedure of work and it should be related to time and cost factors. The guiding principles in planning the procedure can be as follows:

- Type of investigation should be clearly determined i.e. how the facts should be collected. Some projects are of experimental nature while others are of bibliographical, while still other projects deal with personal enquiries and others are based on participant observation. But in so far as planning procedure is concerned, in all the cases it is essential that it should be decided how extensive the study would be, whether the enquiry will be elaborate or partial and what the urgency of that problem is.
- Then it should be clearly understood at this stage as to what the problem itself requires in relation to the present project to the work done by others and needs and desires of the subject sponsors.
- No doubt while starting work, experience should be given due consideration but giving too much weight to that is bound to influence the study and its conclusions, therefore, resources should be better guided for starting a problem (Hans Raj, 1979).

1.14 SUMMARY

Let us summarize what we have learnt here about both literature review and statement of a research problem. In literature review, before searching the literature, identify the topic using such strategies as drafting a brief title or

stating the central research question is to be addressed. The researcher should also consider whether this topic can and should be researched by reviewing whether there is access to participants and resources and whether the topic will add to social science knowledge, be of interest to others, and be consistent with personal goals.

Researchers use the scholarly literature in a study to present results of similar studies, or relate the present study to the ongoing dialogue in the literature, and to provide a framework for comparing results of a study with other studies. For qualitative, quantitative, and mixed methods designs, the literature serves different purposes. In qualitative research, literature helps substantiate the research problem, but it does not constrain the views of the participants. A popular approach is to include more literature at the end of a qualitative study than at the beginning. In quantitative research, literature not only helps to substantiate the problem but also suggests possible questions or hypotheses that need to be addressed. A separate 'literature review' section is typically found in quantitative studies. In mixed methods research, the use of literature will depend on the type of strategy of inquiry and the weight given to qualitative or quantitative research in the study.

When conducting a literature review, at first the researcher should identify key words for searching the literature, and then search the library resource, relying on computerised databases in the library and for fields of study. One can then locate articles or books based on a priority of searching first for journal articles and then books. After this, identifying references helps to make a contribution to literature review. One should group these studies into a literature map that shows the major categories of studies and positions.

To summarize the basic notes of a research problem, we can conclude by saying that the task of defining a research problem, very often, follows a sequential pattern – the problem is stated in a general way, the ambiguities are resolved, thinking and rethinking process results in a more specific formulation for the problem so that it may be a realistic one in terms of the available data and is also analytically meaningful. All this results in a well defined research problem that is not only meaningful from an operational point of view, but is equally capable of paving the way for the development of a working hypotheses and for means of solving the problem itself.

It may, thus, be said that the selection of the research problem has three main components: determining the core area of research, identifying the range of alternatives from which choices are made, and the context in which these choices are made, i.e., the factors that influence the choices.

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Suggested Reading

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Sample Questions

- 1) Write a brief note on importance of review of literature.
- 2) What are the steps involved in conducting a review of literature.
- 3) Write a review of literature on a topic of your interest from various journals and books available.
- 4) How is a research problem defined? Describe the techniques in defining it.
- 5) How is a research problem formulated and designed? Describe in detail.

UNIT 2 THEORY

Contents

- 2.1 Introduction: Scientific Method
- 2.2 The Variable
- 2.3 Theory
- 2.4 Hypothesis
- 2.5 Testing Hypotheses
- 2.6 Research Questions
- 2.7 Conceptual Models
- 2.8 Summary
- References
- Suggested Reading
- Sample Questions

Learning Objectives



After covering this unit, you should be able to understand how:

- science, theory and hypothesis are interconnected, especially in relation to anthropology;
- the idea of theory is a basic building block of science;
- hypotheses are built up from theories or how they eventually end up as being theory;
- such hypotheses are tested; and
- models are used as stages for putting together possible concepts, variables, hypotheses and theories.

2.1 INTRODUCTION: SCIENTIFIC METHOD

The scientific method is the process by which the collectivity of scientists attempts to create an accurate representation of reality over a period of time. This representation should be reliable, consistent and non-arbitrary. In other words, others, with a little bit of effort, should be able to see reality as the scientists see it.

However, what often happens is that personal and cultural views colour and change our view of reality. They influence our perceptions as well as our interpretations of reality. Once these mistaken assumptions build up, they are then logically assimilated by the human mind. People give long explanations which show why they see these mistaken representations of reality. These mistaken representations maybe called bias or prejudice. Using standard procedures and rules often minimises these influences when theories are built up.

A scientific method begins by observing and describing a phenomenon or a group of phenomena. Based on this a hypothesis is proposed to explain this phenomenon. This hypothesis may take the form of a causal phenomenon or mechanism or even a mathematical relationship. It explains why events happen. Using this hypothesis, one may then attempt to check if all phenomena of the same class may have the same explanation. If one is confident enough, one may even predict the phenomenon. These predictions may often be at the level of indicating the range of observed quantitative data. After this stage, many experimenters test out this hypothesis under different conditions to see if it is still valid. If all these stages are passed, then this hypothesis may be taken to be a theory or a law of nature. If it does not work out, then it should be modified or rejected. If it can predict future events then the hypothesis is said to be very powerful. People have often claimed that scientific theories can never be proved; they could only be disproved. This is part of the organised skepticism of science, which refuses to accept anything without having empirical data or proof. Scientists live with the idea that a future observation will possibly disprove their theories.

Hence we note from here that experimental tests could confirm, disprove, or modify the hypothesis. Even if such a hypothesis is elegant and philosophically very firm, if it does not conform to the data observed it should be given up or modified. For a scientific discipline, then, experimentation has been said to be very important. This automatically means that the hypothesis should be testable. Those which cannot be tested have no place in science. Sometimes, it has been found that a theory which has been proved to be wrong was still suitable under certain conditions. Hence, certain theories or hypotheses can have limited viability.

The Oxford English Dictionary defines science as “a branch of study which is concerned either with a connected body of demonstrated truths or with observed facts systematically classified and more or less colligated by being brought under general laws, and which includes trustworthy methods for the discovery of new truth within its own domain”.

On the other hand we see that, the scientific method is defined by the Webster's Seventh Collegiate Dictionary as “principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses”.

For us, in terms of anthropology, science is a method of approach or a mode of analysis that helps scientists to form propositions in the form of “if..., then...” to the empirical world around them. This would be a statement like, “if certain economic conditions exist and there is scarcity of food and water, then riots may ensue.” It may form general ideas, but gradual and systematic collection of data or facts could lead to the formation of a particular theory.

Mostly, the inductive method is used in science but in some cases it was found to be suitable to use the deductive method. In fact, there is enough argument to show that both are used in science. In anthropology, both of these are used to good effect.

Science is too large and abstract as a term for it to be used in research as a scientific method. In order to make it more palatable, certain assumptions are necessary before we can begin our work as scientists. These assumptions are

about the universe, reality and its relationship with human beings. Some of them might make you laugh with their simplicity. These assumptions are:

1) The world exists

This statement has been most contentious, especially among philosophers. One group, called the Idealists, had claimed that the world was merely an idea in the mind of human beings. If you stop looking at the world, then it might disappear! The other group, called Materialists, believed that no matter what you did the world remained the same. It existed and human beings came into a ready world. Since, science was heavily influenced by religion in the past, Berkeley had commented that he believed that the world was an idea and it did not disappear when one did not look at it because God was still looking at it! The current day practice in science is the belief that the world really does exist. However, the action of human beings can modify it to a large extent and changing viewpoints and perspectives see only certain sections of this complex world. Without this strong foundation no understanding could exist, leave alone science.

2) We can know the world

In spite of reality being so big, there being universes of matter of different kinds, different kinds of reality, so many galaxies existing, the tiny speck in this reality which is what human beings are, could actually note, observe, see and understand this world. This is crucial if we are ever to believe ourselves capable of understanding reality.

3) We know the world through our senses

This is sometimes known as the phenomenological background of science, after the work of the philosopher Maurice Merleau-Ponty. It means that the understanding of reality can be done through our five senses. It does not require extra senses. Also, even if we use equipment to observe reality, this equipment can be read through our senses. Without this, scientific observation could not be done with any degree of certainty.

4) Phenomena are related causally

What we often do when we put together a simple hypothesis is to link together two variables. We say that an independent variable causes changes in a dependent variable. Of course, this can become more complex. More than one independent variable may cause changes in one dependent variable. Sometimes, one independent variable may cause changes in more than one dependent variable. Often, though, many independent variables may cause changes in more than one dependent variable, along with many intervening variables. Thus, without this assumption, no hypotheses or theories can be formulated regarding events in reality.

These assumptions cannot be empirically proved by any other means than by using one of the other assumptions stated above. This is why these assumptions are believed to be true. Based on these assumptions, the scientific method becomes a practical possibility.

2.2 THE VARIABLE

Research problems are conceptualised as a first step in the research design. These conceptualisations represent reality in the abstract. While moving from

the conceptual to the empirical level, concepts are converted into variables. This is done by mapping them onto a set of values.

For a research to work, it is very important to know about these variables. These can be related to a theory. A theory may be seen as a tentative relationship between two or more variables. Thus, a variable is an empirical property that takes two or more values or it is a concept that has more than one value, state, category or condition. A variable with only two values is known as a dichotomous variable.

Objects are never variable. However, some characteristics of objects could be variable. A hypothesis is more specific about the nature of relationships between variables because an operational definition of the variables must be provided so that a scientific test may be conducted. For the purposes of the research process distinctions between dependent, independent, discrete, continuous, qualitative and quantitative variables become a necessity.

The variables that a researcher wishes to explain are regarded as dependent variables and are also termed as criterion variables. The variable expected to explain the change in the dependent variable is referred to as an independent variable or predictor variable. The independent variable is the explanatory variable. It is the presumed cause of changes in the values of the dependent variable. The dependent variable is the expected outcome of the independent variable. The function of control variables in empirical research is to reduce the risk of attributing explanatory power to independent variables that, in fact, is not responsible for the occurrence of variation in the dependent variables.

Mathematically, $y = f(x)$;

Where, y = dependent variable, and

x = independent variable.

y is a function of x or that x (independent variable) yields y (dependent variable).

Thus, independent variables produce dependent variables. These variables are interchangeable as there is no permanent dependent or permanent independent variable. The variable has a cause and a subsequent effect. There are also intervening variables.

Variables can have three types of relationships among them. A positive relationship is one where an increase in one variable leads to an increase in the other variable. A negative relationship is one where an increase in one variable leads to decrease in the other variable. Finally, a zero relationship is one which shows no significant relationship between the two variables.

Such distinction between the dependent and the independent variables is analytical and relates only to the research purpose. In the empirical world variables are neither dependent nor independent; the researcher decides how to view them. Moreover, his decision is based on his research objective.

Most of the phenomena investigated by social scientists require the assessment of the effects of several independent variables in one or more dependent variables. This is because one independent variable usually explains only a certain amount of variation in the dependent variable and more independent variables have to be introduced in order to explain the variation.

When there is no clear-cut demarcation between two or more variables, then they are known as continuous variables. When there is a clear-cut demarcation between two or more variables then they are known as discontinuous or discrete variables.

Quantitative variables refer to two or more mutually exclusive categories which explicitly vary in degree. Qualitative variables refer to a classification into two or more mutually exclusive categories which may not show any variation in degree, i.e., it cannot be placed into a particular order.

2.3 THEORY

From the facts which have been observed by the scientist, we can establish a tentative theory by looking for the interrelationships between facts. This is the inductive method. This is just one approach. Another way would be to have a basic theory and then to use this theory to predict facts. These facts may then be confirmed through experiments.

A theory has often been said to be something that is speculative or a calculated guess. For instance, one may see a number of suicides occurring in a particular society and decide to research on the background reasons for such an event. Based on one's instincts and knowledge, one may speculate or guess that the suicides of students are caused by high expectations from parents and the society-at-large. This 'idea' or guess may then be tested using a research methodology best suited to it. A theory remains speculative unless scientific methods are used to prove it. A theory may be said to be a statement which explains the occurrence or existence of certain facts or phenomena. It is thus a system of explanations. Theory is often confused with speculation, and thus a theory remains speculation until it is proved. When this proof is made, theory becomes fact. Facts are thought to be definite, certain, without question, and their meaning to be self-evident. Scientists, however, regard a fact as an empirically verifiable observation and a theory as a relationship between facts. It explains relationships and underlying principles which characterise a particular phenomenon. Theory is thus the major orientation of science. It summarises empirical generalisations. It conceptualises, systematises, classifies and gives the interrelationships between different phenomena.

A scientific theory or law represents a hypothesis or a group of related hypotheses, which have been confirmed by repeated experimental tests. Scientific theories and laws which have been universally accepted become part of our understanding of the universe. They become the basis for exploring lesser known areas in the field of study.

Thus, the field worker in anthropology cannot function without a consistent theory of his field of study. Today, many parallel theories may be used by a researcher during data collection, which are checked to see which of these various possibilities more accurately describe reality. The theory used must be sound, articulate and geared to current problems and interests, even if it is mainly unanalyzed and implicit common sense.

It can be said that the facts of science are the product of observations that are not random, but meaningful, i.e., they are theoretically relevant. The infinity of possible procedures, objects for observation, the substantial progressive ways to make those observations, etc. would effectively prohibit any way to

increase the overall content of knowledge from one generation to the next. Without some system, some ordering principles, in short, without theory, science could yield no predictions. Without prediction there would be no control over the material world.

Thus, we cannot think of facts and theory as being opposed. Rather, they are interrelated in many complex ways. The development of science can be considered as a constant interplay between theory and fact. Facts can also be said to construct theory. They clarify and redefine the theory. They may help to initiate theories. They may lead to the reformulation of the existing theory. They may also cause the rejection of theories that do not fit the facts. They may change the focus and the orientation of theory.

Now that we see that the mythical or popular dichotomy between facts and theory do not exist, we can take them together and see how close they are to each other. Facts and theory stimulate each other. Facts also take their ultimate meaning from theories which summarise them, classify them, predict them, point them out and define them.

To be neutral and value-free a social scientist must be truly objective. To be objective a scientist has to judge the truth impartially, without being biased by any person, group or community. He must see facts in theory and theories in facts. Thus, if it is firmly believed that it is not a single fact but a collection of facts that may ultimately lead to some sense in the chaos, then an advance has been made towards a further understanding of the scientific process. In the words of W.I. Thomas, "The scientific value of a fact depends on its connection with other facts, and in this connection the most common-place facts are often precisely the most valuable ones, while a fact that strikes the imagination or stirs the moral feelings may be either isolated or exceptional, or so simple as to involve hardly any problem".

Theories are often not easily thrown away. New discoveries are often seen with a view to supporting the existing theory. After repeated experimental tests, the new phenomenon does not fit even modified existing theories, is a new theory proposed. Scientific theories that create a worldview are sometimes known as a scientific paradigm (Kuhn, 1969). Changes happen gradually as more and more research does not fit the existing theory. After some time, enough scientists believe that a change is necessary thus creating the background for a 'scientific revolution' that changes a paradigm.

Observation in science may be said to be a component of the theory which also contains the hypothesis that it aims to prove or disprove. Therefore, observation is by itself not neutral. It could only be neutral if it were independent of the theory. Thomas Kuhn claimed that it was not possible to isolate the theory being tested from the influence of the theory within which the observations were grounded. This was because observations belonged to a particular paradigm and it was impossible to evaluate competing paradigms in an independent manner. A paradigm was a logically consistent idea or 'picture' of the world. It was useless to pit competing paradigms together. Hence, it was only useful to select a paradigm that promised to give us more problem-solving ability.

For Kuhn, the choice of a paradigm was sustained by logical processes but not ultimately determined by them. A consensus of scientists accepted one paradigm

over another. Hence, acceptance or rejection of some paradigm was a social rather than a logical process. Thus, scientific theories depend on observations as well as on paradigms. Coherence of these approaches and a healthy criticism are different approaches used by scientists to raise science from its foundational grounding on merely observation.

As we proceed to study these theories, it becomes clear that any set of empirical observations can be made to fit any theory, provided the theory has been suitably modified to add ad hoc hypotheses, or temporary hypotheses. This is called the Quine-Duhem thesis. This was accepted by Karl Popper. Karl Popper believed in the idea of falsification of a theory through observation. However, the idea of a simplistic or naïve falsification entailed that if anything did not fit then the theory would be rejected. Popper believed in a more complex method. He thought that theories needed to be tested and the rule of 'survival of the fittest' was needed to see which theoretical premise fitted the observational conditions best. Without creating testable predictions, no hypothesis could claim to be a scientific method.

W.V.O. Quine developed an approach which stated that empirical data was not enough to make a statement about theory. This was called confirmation holism. A theory could always be made to fit with the data available. This problem does not mean that all theories are of equal value. A personal choice is made by the scientist to choose one theory over another. Specialists of the philosophy of science insist that observations in science should be inter-subjective. In such cases, there is generally no argument about what is being observed between any two observers. This is more difficult in the case of social or mental phenomena than for physical phenomena. The most difficult would be matters relating to theology or ethics.

The scientific method may be one way of demarcating what is to be considered as a science and what is not. If we are not able to distinguish between what is science and what is not, then we cannot find out what is science and what is pseudo-science, as well as who are scientists and who are not, somewhat like Paul Feyerabend's tirade against method. For Kuhn, a paradigm is created and shared by the members of a scientific community. Similarly, a paradigm defines who belongs to the scientific community. So science, for Kuhn, is in the manner of functioning of communities. Feyerabend and other post-modernists argued that there was not enough difference between the social practices of science and those of other disciplines to separate them. So, though social factors are important, they are not different to separate scientists from others. Science is a social construct but perhaps reality may not be such a social construct. This ongoing debate and the idea that neither positivist, nor empiricist and certainly not the falsificationist kind of logic satisfies the idea of what is being practiced as science.

The scientific method helps us to find solutions to everyday problems along with solving issues relating to philosophy or even the nature of the universe. The scientific method works best when the conditions can be limited or one can account for the extraneous factors. It also works better when one may be able to conduct the experiment repeatedly making controlled changes in it. This is often not possible in the anthropological context. In such cases, the results might be dependent on the history of a situation or the social interactions between people.

It is in this context, that anthropological approaches to research have been questioned by those following the scientific method. They claim that social theory was no different from 'folk psychology'. This is not entirely true because, after all, social theory is also based on social research which is, in turn, based on observation. It also refers to other social theories and other types of social theorising. Also, it has a particular set of procedures and an ethical code.

Social scientific theorising should be based on social research that is systematic and follows precise methods that are logically consistent, transparent and open to scrutiny and criticism. It should be non-discriminatory and non-exploitative to its subjects. It should neither directly or indirectly discriminate against its subjects, physically or mentally harm them, nor exploit them for personal profit. The research should be made public in print and be open to critique for both its procedures and its findings. It should be independent and be free from direct or indirect censorship. Social theorising is a fact of modern life, where people often act on the basis of such theories. This is how people make sense of their own world. Worldviews, identities and lives are constructed through social theories. This theorising is done through understanding that there is historical and cultural specificity of knowledge, and that knowledge and truth are contingent and open to revision. This means that nothing should be taken for granted and one should opt for a critical stance. Thus, knowledge and action go together and how people think about something changes how people act towards it.

2.4 HYPOTHESIS

Facts are dependent upon a theoretical framework for their meaning. They are also statements of relationships between concepts. Theory serves to order and give meaning to facts. Theory can give direction to the search for facts. A hypothesis states what is being looked for.

When facts are assembled, ordered, and seen in a relationship, they constitute a theory. The various factors in a theory may be logically analyzed, and relationships other than those stated in the theory can be deduced. At this point there is no knowledge as to whether such deductions are correct. The formulation of the deduction, however, constitutes a hypothesis; if verified it becomes part of a future theoretical construction. It is thus clear that the relation between theory and hypothesis is very close indeed. In the words of William H. George, "In practice a theory is an elaborate hypothesis which deals with more types of facts than does the simple hypothesis".

While it is true that the two can never be satisfactorily separated, it is useful to think of them as two aspects of the way by which science adds to knowledge. Thus a theory states a logical relationship between facts. From this theory other propositions can be deduced that should be true, if the first relationship holds. These deduced propositions are hypotheses.

A hypothesis looks forward. It is a proposition which can be put to a test to determine its validity. It may seem contrary to, or it may be in accord with, common sense. It may prove to be correct or incorrect. In any event, it leads to an empirical test. Whatever be the outcome, the hypothesis is a question put in such a way that an answer of some kind can be forthcoming.

Every worthwhile theory permits the formulation of additional hypotheses. These, when tested are either proved or disproved. This in turn constitutes further tests of the original theory. In either case they may be of use to the existing theory and may lead to the possibility of the formulation of still more hypotheses. Such a simple outline, however, fails to indicate that the formulation of useful hypotheses is one of the most difficult steps in the scientific method.

A hypothesis is empirically amenable to testing. The concepts used in its formulation should be empirically defined. In other words, concepts should be defined theoretically as well as experimentally. A hypothesis should be specific avoiding hazy probabilities. It should also have a firm theoretical basis or orientation. All these factors ensure that the hypothesis becomes ultimately predictable of further facts. As in the case of concepts, the variables used in the formulation of the hypothesis should be clearly defined. It is preferable for the hypothesis to be specific rather than generalised. A generalised hypothesis should be fragmented into smaller specific hypotheses. A hypothesis should give an indication of the techniques to work it out.

There are two ways of working with a hypothesis. According to Robert Merton and others, a hypothesis must be preconceived preparatory to going to the field. The disadvantage of this process is that the researcher becomes theoretically biased. On the other hand, the researcher has a clear idea of what he has to do.

George Dalton and others have suggested that a hypothesis should be formulated in the field. This helps to give a fresh approach to any problem. Experimental research designs essentially require a hypothesis testing approach (both kinds of processes given above) while in ethnographic description, it is better to take no hypothesis to the field (the latter approach). Hence, an anthropologist enters the field with a fairly comprehensive idea of the kind of things to find out and how to go about doing so.

Observations in science seem to be like existential statements, often stating that some particular instance of the phenomenon being studied has certain characteristics. Causal explanations, like hypotheses, seem like universal statements where every instance of a phenomenon has some particular characteristics. To deduce a universal statement from particular statements of observation would not be valid. This is known as the problem of induction. Solutions to this problem include falsifiability and Bayesian inference. Bayesian inference uses statistical probability. It uses a small amount of data to show how whether a hypothesis may be considered true or not. Falsifiability is the way modern science works. A theory or a hypothesis is constructed in such a way that it may be proved or disproved. By this method one may check after an experiment whether the theory or hypothesis is true or false. In other words, every theory in science is falsifiable through experimentation.

In conclusion, then, a hypothesis is a question which is put to the empirical world in such a form that an answer may be obtained. It is clear that the formulation of a hypothesis does not occur automatically but is usually preceded by many false starts, evaluational propositions, vague statements, etc. Hypotheses may be developed at different levels of concreteness, from fairly common-sense statements to the relationships between complex, abstract variables. Making hypotheses is a creative act, but such acts can be studied. From such studies it becomes apparent that hypotheses come from many sources – from the general emphases of our culture to the most individual of experiences.

A hypothesis is sometimes said to be a limited statement regarding the cause and effect relationships in specific situations. It refers to the state of knowledge of the scientist before the experimental work has been performed and perhaps even before new phenomena have been predicted.

There are different kinds of hypotheses. An inductive hypothesis keeps adding more and more data until by the very analysis of all this data some kind of generalisation can be achieved. This is the way science is supposed to work. For instance, one may collect detailed ethnographic data on one community and then attempt to see how this data may fit into a number of theoretical ideas or issues over the years. The work of Victor Turner, who has worked on the symbolism of the Ndembu of Africa, would fit into this kind of perspective. On the other hand, a deductive hypothesis is derived by having a theory or a hypothesis and then working to either prove or disprove it. It has now been found out that science works by using both the inductive and deductive approaches. Intuitive, deductive methods and common-sense are used to find out new areas that may be researched while induction is used once a group of relevant hypotheses to be used for the experiment have been decided.

A non-directional hypothesis just attempts to check if there is a difference between two sets of variables. This could be used as an exploratory kind of research method where one is exploring the real reasons or causes for a particular phenomenon happening. This is the pattern of research seen in the work of Napoleon Chagnon while studying the Yanomamo at the border of Venezuela. He began by checking out a series of variables to see what could be the cultural reasons for the warring and violence among the community. Then he tested out the preliminary list of possible variables to find out exact causes, to fine tune them and to figure out details. A directional hypothesis gives a clear indication of the exact direction of the relationship or difference between two sets of variables. Studies on the utilisation of health services in remote and rural regions of India by anthropologists use this method to find out which reasons lead to better or poorer healthcare services in a particular community. A null hypothesis states that there is no relationship or difference between two sets of variables. This can frequently happen to any scientist and serves to give support to the idea that other sets of variables need to be used to gain fruitful research. Sometimes, this may be bolstered by using statistical analysis.

2.5 TESTING HYPOTHESES

The scientific method is calculated to minimise bias in the outcome of an experiment. While testing hypotheses, a scientist may have a preference for one outcome or the other. The scientific method attempts to ensure that this does not affect the outcome of the experiment. One of the mistakes often committed by scientists is to believe that the hypothesis is an explanation of the phenomenon, even without any scientific tests being conducted. It seems sometimes that common sense and logic is all that is required. Another fallacy is to ignore data that does not support the hypothesis. Though the hypothesis is open to be proved or disproved, the scientist may feel some pressure to prejudge the outcome. Thus, it is important to ensure that all data is handled equally. The errors accumulated in quantitative form should be checked and assessed since it may hide new data or even give wrong results.

Useful hypotheses enable predictions by deductive reasoning which can be experimentally assessed. Predictions are experimental designs with a currently

unknown outcome. To test a prediction, an experiment is designed. Unlike classical laboratory-based sciences, experiments must be designed differently for observation-based fields of science like anthropology. Cultural artifacts affect us greatly regarding the way in which the world functions and is perceived by us. This is known as the Sapir-Whorf hypothesis and is a major theory used by many anthropologists.

A hypothesis is thus a proposition that can be put to the test to determine its validity. They can be tested using four different kinds of tests. These are true experiments, quasi-experiments, natural experiments and naturalistic experiments. True experiments normally have an experimental group (also called treatment group, intervention group or stimulus group) and a control group. The two groups should be equivalent and so individuals should be randomly assigned to each group. The groups must be tested on a set of variables first. This is called a pre-test. Then the intervention or independent variable is inserted. After this, the dependent variables are measured again. This is called the post-test. Such true experiments may be conducted in the laboratory or field context.

For instance, during a clinical testing for a particular drug, the medicine may be administered to a particular group to see if it has any effect. If, say, the medicine is a putative cure for hypertension, then ideally hypertensives have to be selected. This would be an experimental group. Another, identical, group would be selected to give a placebo or a sugared pill or a 'blank' capsule. This is to ensure that just the giving of the medicine does not cause a psychosomatic cure since the person believes that it will cure and this gives a boost to the immune system. Thus, without this control group, if psychosomatic cures occur, one would believe almost anything to be a cure since such persons would be cured by the belief in the drug than the drug itself. This has now become standard operating procedure for all scientific experiments. The initial period of the experiment where both the groups would be ill with hypertension could be called time T1. In time T2, both the groups are given drugs. The experimental group is given the true drug while the control group is given a placebo. In time T3, the effects of these drugs are observed and the changes between the hypertensives, if any, between time T1 and time T3 are noted. These would thus form the results of the experimental study.

Like the experimental research design, all classical research designs have the primary objective of showing causation. Thus, the factors in an experimental research design are:

- i) Experimental Group
- ii) Control Group
- iii) Manipulation

Since the time factor is so important:

Time	T1	T2	T3
Experimental Group	Y1	X is introduced	Y2
Control Group	Y1	No X	Y1

where, X = a variable

Y = the group/s being studied.

Here, the difference between the two ($Y_2 - Y_1$) gives us an idea of the change that has taken place in the community due to the introduction of the variable X. The study includes conditions within the group/community before and after the change. In such studies, a number of singular problems arise. Some of these problems are:

1) The Problem of Equivalence

No two communities or groups have exactly the same culture. For the purpose of a scientific study, however, significant similarities are required. Three ways may be used to combat this problem:

- The groups or communities may be chosen randomly in order to reduce bias.
- The groups or communities may be chosen by deliberately matching criteria in order to get similar groups.
- The study may be replicated in order to reinforce or contradict the conclusions arrived at earlier.

It must be remembered, however, that human beings often show remarkable dissimilarities even within the same culture.

2) The Selection of the Variable

The variable selected may not be the one causing the change. In order to combat this it would be necessary to replicate the study, taking a control group in each case.

To deal with this issue of finding true experimental groups in real life, quasi-experimental groups are used. In this case individuals are not assigned to the two groups, mostly because in real-life situations they cannot be. This is also called a common-sense experimental study design.

Here, two groups are taken. One is known as the quasi-experimental group. The other is known as the quasi-control group. This is done because the experiment is not strictly a controllable one since not one but many variables are manipulated at the same time. For instance, after initial surveys in a village one may select two groups from the village as targets for conducting an experiment. The two groups cannot be truly said to be kept within laboratory conditions. They are free but the researcher stays on and studies them as an observer. These two groups may be said to be quasi-experimental/quasi-control groups. In one case, say, while studying the attitude and behavior to certain medical services introduced, the group may be targeted with a slew of advice from local doctors as well as by distributing pamphlets. This would be the quasi-experimental group. In the other case, no such information would be given to the quasi-control group. One could then monitor their visits and interaction with the local health centre or the district hospital to see if the information given has any effect or not.

Time	T1	T2	T3
Quasi-Experimental Group	Y1	X is introduced	Y2
Quasi-Control Group	Y1	No X	Y1

Natural experiments, on the other hand are going on around us all the time. One cannot truly conduct them. Such experiments are only evaluated. They include types like the Before-and-After Research Design.

Here, there is no control group. A pre-test is carried out on a group and then a post-test is carried out on the same group. The differences between the two form the result. In between the two tests is often an event. This event may be an election, a development programme, a construction project, etc. It may be represented as:

Time	T1	T2	T3
Experimental Group	Y1	X is introduced	Y2

Such studies are frequently carried out in factories in order to find ways to increase production.

Other such studies may include the survey design or the static group study design.

Here, no manipulation is carried out. The data is divided into two groups – one with a high value of variable x and the other with a low value of variable x. For instance, the study may be done using the data from a community keeping two groups in mind, one having a high income and the other having a low income, and then noting the differences in them. This type of design is used mainly for descriptive studies.

Time	T1
Experimental Group	Y(High) Y(Low)

One other type of research testing would involve cases where sudden or catastrophic events occur. There can be no pre-test studies in such cases and only post-test studies can be conducted after the event. These are known as one shot case study designs.

Activity

You have gone to a rural society in India. What kind of testing would you do to ensure that your hypothesis has a fair and true opportunity for finding out its relationship to reality? Which kind of study would you conduct and why?

In this case, only the experimental group is present. There are no pre-test studies. Only the post-test studies are carried out after a certain event has occurred. The information may be gathered from government records or by a reconstruction of the past by informants.

Time	T1	T2	T3
Experimental Group		An event occurs	Y2

A classic example of this was F.G. Bailey's study of an Indian village in Orissa called Bisipara. Since it was initially not a longitudinal study and was confined only to a short slice of time it may also be called a Synchronic Study. Bailey went on to study the village in more detail over decades and thus this was no longer a synchronic study, but initially this was what he began with. Of course,

in 2011, researchers are being appointed from India to restudy the village with some help from F.G. Bailey. Thus Bailey's study attempted to study the impact of social change in the village by understanding what had happened in the past and how this had changed in the present. He had initially conducted no pre-test studies and was only conducting post-test studies.

On the other hand, Raymond Firth studied the Tikopians twice. The first time was in 1949 and the second time was in 1952. This can be said to be a synchronic study conducted twice, or a kind of a restudy, and is hence known as a Dual Synchronic Study. This kind of a restudy is different since it attempts to note the effect on the structure of the community and attempts to note changes in society at the organisational level. A simple restudy would just study changes and list them without this kind of a theoretical outlook.

Finally, naturalistic experiments contrive to collect experimental data under natural conditions.

2.6 RESEARCH QUESTIONS

Before any research is undertaken, it is important to first formulate a problem. This problem is generally restricted to the researcher's own body of knowledge. Then, taking the problem as a basis, the analysis and identification of variables is done and the dependent and independent variables are recognised. Based on the above, the hypothesis is formulated. These were called by Malinowski 'foreshadowed problems' in 1922.

Initially, an idea emerges in the researcher's mind regarding the problem or research questions that need to be answered. These may emerge from the research activity itself. However, it may also be derived from one's personal or professional experience. These problems may also come to be known through technical and non-technical literature. Also, some problems may be suggested or assigned by an advisor or mentor (Corbin and Strauss, 2008).

Initial aimless interviews and data collected often guide the researcher to interesting areas for doing research within the ambit of one's field. Relevant concerns may emerge from what the respondents say.

One's personal and professional life often throws in a huge number of problems for new research areas if the researcher is alert. Often such problems selected by the researcher make the researcher more seriously motivated.

A good literature search on a matter of interest is usually most likely to throw up areas of interest and lacunae in previous research which might be used fruitfully. Reading in detail may also stimulate interest in an area previously of little interest to the researcher.

In case the problem has been suggested by the supervisor or mentor, it may not always be to the liking of the researcher. Often students may get caught up in institutional ongoing projects and research work or the long-term research profile of the institution to which they have become affiliated. As a result many things and background information may already be available to the student. Sometimes casual and offhand remarks may lead to useful and interesting research avenues. Often such established areas could be rich sources of funding for the institute, rather than other areas of work.

Based on this problem a research question must be put together. Asking the question correctly is very important since only then may we get significant answers. Quantitative research questions tend to be very narrow and focused while qualitative research questions are much broader in scope. However, in either case, they are specific and narrow enough to give a focused answer. For qualitative inquiry, a broad spectrum of possibilities should be checked. Such studies may not necessarily be confined to individuals but may include, families, groups, associations, organisations, industries, and so on.

Activity

How would you go about selecting a research question? Select one and indicate the hypothesis you would use to test it.

Sometimes a well-developed theory is enough to set the backdrop for some hypotheses that stretch the limits of the theory, prove it further, modify it or even change it. Most ethnographic research is more concerned with descriptions and explanations of events than with testing hypotheses. Often, reflection gives many more insights than does detailed data collection without much thought. Sometimes lack of available data is enough to initiate research. These research questions must be focused using the idea of a research methodology to focus the research problem in such a way that they can resolve it by actively collecting and analyzing data. Some research problems may be topical while others may be general. Thus problems may vary in the degree of abstraction (Hammersley and Atkinson, 2006).

2.7 CONCEPTUAL MODELS

A theory may be defined as “a coherent set of general propositions, used as principles of explanation of the amount of the apparent relationships of certain observed phenomena”. For Hawking (1988), a good theory satisfies two requirements. It should accurately describe a large class of observations on the basis of a model that contained only a few arbitrary elements. It should also make definite predictions about the result of future observations.

Sometimes, competing theories are put together to give a more complete explanation for some phenomena. Even if the results of experiments agree many times, sometimes it may not agree. Thus, theories should be objective, verifiable, falsifiable and be able to understand, explain and predict phenomena.

Theories may be classified by their scope as being micro or macro theories. They may be dealing with some function as in statics or dynamics or structure or process. They may be structured as logical interrelations or a loosely defined set of propositions. It may have a low or high level of theorising.

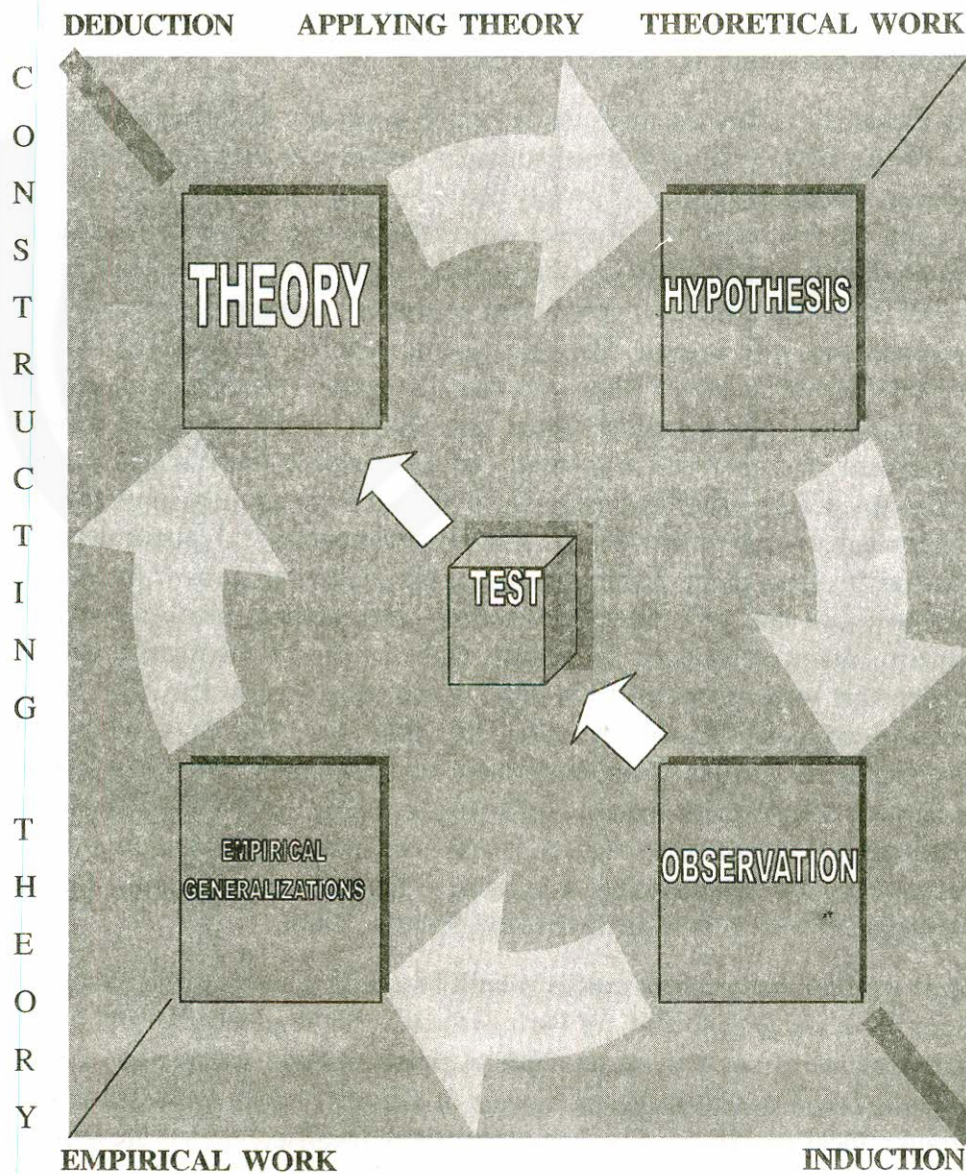
In a high level of theorising we would include theoretical systems with a combination of taxonomies and conceptual frameworks. At the level of conceptual framework it would include descriptive categories in a structure that provide explanations and predictions. Taxonomically it would include a system of categories where the relation among categories could be described. There would be an ad hoc classificatory system where empirical observations could be organised and summarised in categories.

A proposition would be a statement which is concerned with the relationship between concepts. It would assert a universal connection and logical linkage

between concepts. Propositions would be at a higher level of abstraction than concepts. Hypotheses would be propositions which are empirically testable. They would usually be concerned with the relationship between variables.

A model is said to be a hypothesis which has at least some limited validity.

A low level of theorising would involve the making of a model. This would be as closely related to the idea of theory as a systematic conceptual organisation is the notion of a model. A model should be viewed as a likeness of something. They are like a visual representation of the structure and features of the real building. A model could also be a scaled down version of a physical artifact. In the social sciences, models usually consist of symbols rather than physical matter. The characteristics of some empirical phenomena, including their components, are represented in logical arrangements among concepts. A model is thus an abstraction from reality that serves the purpose of ordering and simplifying our view of reality while still representing its essential characteristics.



Initially, anthropologists made uni-thematic models based on the theories of classical evolutionism and diffusionism, between 1855 and 1897. These models were very simple and included one or a very few basic elements. For instance,

classical evolutionism was often visualised as being like a ladder going from simple to complex or from the most primitive to the most modern. Classical evolutionism and diffusionism, according to Perry (1927), were deductive models while diffusionism, according to Rivers (1914), was based on deductive as well as inductive approaches (Reader, 1969).

The first poly-thematic model of society was built by Malinowski in 1922 and continued till 1945. These models included many more new approaches which were included within a general model with complex inter-linkages between them. By then, other newer models were being proposed that wanted to look at aspects of social change. Some of these newer models incorporated these ideas of function as proposed by Malinowski. So, it was felt by many to be redundant to use his theoretical approach separately as functionalism, since the idea of function was already a part of many other approaches (Reader, 1969).

In 1952, the functional biological model was used by A.R. Radcliffe-Brown to form a structural-functional one (1939-1952). The functional interdependence of the parts of a social system was maintained from Durkheim in 1919. There has been a change over the years of going from closed systems concept of society to one which has been more open.

For Claude Lévi-Strauss, mechanical models of society like marriage laws are usually found by looking at the ethnographic information and the cultural logic whereas statistical models of society could be seen by looking at the average of social interactions in any sphere of society like kinship relations or exchanges. Finding a 'true' model based on ethnography seems to be a genuine problem. A model of social structure would thus consist of a model that exhibits the characteristics of a system. Thus, a structure consists of a model which has several elements, none of whom can change without effecting changes in the other elements. For any given model, one should be able to order a series of transformations that result in creating a group of models of the same type. This will enable us to predict how the model will react if one or more of its elements suffer changes or are modified. The model that is constructed should also make intelligible all the observed facts regarding the phenomenon. Levi-Strauss also distinguished not only between observing and creating models as well as experimenting on models, he thought that one should distinguish between models that were conscious from those which were unconscious. The models people consciously think about as they live within society are conscious models. The models that people do not think about but are implicit or covertly apparent to analysts or only a few members of society as being the underlying structures of society are unconscious models. Usually the unconscious models are more accurate but are difficult to reach because of the many conscious models used by people in society to hide them (Lévi-Strauss, 1968).

Thus we find that an ideal model is built based on the normative relations in society. An idealised model, for Firth, is the way the researcher wishes to view the elements of society. Nadel tried to create an empirical model of social analysis based on the idealised models of Edmund Leach and Claude Lévi-Strauss. Ideal models are based on observation. Idealised models are based on deduction. Leach in 1954 also created an idealised model. Empirical models are also based on observation resulting in second-level generalisations. The use of analogies may convert models into symbolic ones. The use of metaphor may convert them into verbal models. According to Durkheim, ideational models deal with the ideological and value aspects of society. It is a congregation

of the highest social values. They are required to maintain all the elements of the model at the same ideational logical level so that it could be structured. Also, it is required to explain the normative force of society admittedly felt by its members. Finally, it serves to separate sociology from individual psychology (Reader, 1969).

Polythematic inductive models were made by Gluckman, Mitchell and Epstein relating to conflict theories between 1942 till 1961. Ideal theories were made by Gluckman in 1955 and Role-Structure theory by Nadel in 1957 (Reader, 1969).

A model thus serves to make description and visualisation of reality or of real problems simpler. It provides general interrelation or explanation of as wide a range of facts as possible in terms of the minimal number of interconnected general propositions or symbols with simple, few and general propositions or axioms that are fully acceptable. It indicates fruitful possibilities for further theorising, problem-finding and experimentation within the field covered by the model. Thus, it promotes further hypotheses. Finally, it predicts what would be the outcome of certain combinations of circumstances or variables which are comprised by the model, as in applied anthropology. Thus, the original idea of the model may be best seen in the representational model which may also be pictorial in which case it is called a pictorial representational model (Reader, 1969). For Example: 1855-1897- Uni-thematic models like Classical evolutionism; 1939-1952- Radcliffe-Brown's idea of structural-functionalism; Lèvi-Strauss' mechanical models and statistical models; Idealised model by Firth; Ideational model by Durkheim; Empirical model by S.F. Nadel; Verbal models used by Clifford Geertz etc.

Today, many kinds of models, especially statistical ones, may be driven by computers. Other complicated models may reflect some parts of reality and are called computer simulations. These are being increasingly used today for a variety of purposes and a large number of websites are available which help one to structure and create one. Though they are not very easy and require a lot of time, GIS is increasingly being used to map out different kinds of social behavior and impact assessment in anthropological researches.

Further, such satellite-based accurate maps are now overlaid with layers of data regarding infrastructure and social relations that can help to create better and more realistic models. Others who are not anthropologists are also using some of these techniques. These include the use of ethnographic decision-making models.

Also, simulation models use data from ethnography to check and tell the researcher the exact kind of theory they should be applying or in what category the data should be classified. Such successful models can predict trends in divination in Africa, types of migration over a twenty year period in a Turkish village as well as various kinship structures that are likely to be found. Simulation models may be used to explore interconnections between data when the data set is too large for a total meaningful analysis. Such simulation models may help to generate behaviours, and such results may again be used to generate higher order results. Thus, one may make useful statements regarding reality by using such models.

In fact, earlier, it had been argued that social behavior could not yield testable results. Formally proved models may not yet exist, but some results may be

tested by using such simulation models. Such models may also predict outcomes, which were thought to be an impossible goal in the social sciences. Hence, simulation models are used in anthropology to model not only ordinary analytic models which have logical or mathematical operations on variables, but may also represent a very large array of variables and operations in a holistic manner, sometimes showing aspects of whole systems. It is oriented towards explaining and describing processes as well as for exploration and experimentation. They derive their results from one or more processes.

Simulations can be analytical models but they can also be informal models defined partly as formal models also. They can be used to model small-scale as well as large-scale systems. These processes may be real or hypothetical/artefactual. Sometimes simulations may be seen as a method that produces data for analysis, i.e., it has a pre-analytic bias. However, computer simulation models may use analytic models which are applied to the model-generated data. Sometimes simulations are used when no other solution seems to apply. Thus, simulation models are not very different from other models. They differ in what is done to the model. They show the behavior, instances or applications of the model. They do not show true solutions.

2.8 SUMMARY

Thus, we may see that anthropologists use many ways of understanding reality. One basic way of looking at science is a research process which uncovers newer areas of reality to human understanding. One kind of worldview is looking at the world through a theoretical insight. Theories often give a firm insight into reality which has stood the test of time and many experiments. Based on these theories, new hypotheses are often created that forever test and recreate the boundaries of the theories that we use today. Often intermediate models of reality are created aided by metaphors and analogies, which are called models. These models show to what extent the theory or hypothesis may be right and where it may deviate from reality. Sometimes models are used where the theory is contested and there is no firm ground on which to base one's observations. One danger would be to see such ideas, theories, hypotheses and models as being reality. They are only our approximations and we should remain skeptical if we are to create and accept better representations of reality.

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Sample Questions

- 1) Explain how the basic assumptions of science are important for developing theory in anthropology.
- 2) What are the conditions under which hypotheses are set up? How are they linked to theory?

UNIT 3 RESEARCH DESIGN

Contents

- 3.1 Introduction
- 3.2 Characteristics of a Good Research Design
- 3.3 Types of Research Designs
 - 3.3.1 Exploratory Research Design
 - 3.3.2 Descriptive/Diagnostic Research Design
 - 3.3.3 Experimental Research Design
 - 3.3.4 Quasi-Experimental Research Design
 - 3.3.5 Cross-sectional Research Design
 - 3.3.6 The Longitudinal Research Design
 - 3.3.7 Case Study Design
 - 3.3.8 Comparative Research Design
- 3.4 Evaluation Research
- 3.5 Summary
 - References
 - Suggested Reading
 - Sample Questions

Learning Objectives



After going through this unit, you will be able to:

- learn how research requires a strategy to be conducted well;
- know how to design the research;
- learn how to collect data through scientific and appropriate means;
- know the characteristics and types of research design; and
- learn evaluation of research.

3.1 INTRODUCTION

We begin the lesson with an introduction to the unit, where we talk about what research design entails. Research design is planning a strategy for conducting research. It plans to: what is to be observed, how is it to be observed, when/where is it to be observed, why is it to be observed, how to record observations, how to analyse/interpret observations, and how to generalise. Research design is, thus, a detailed plan of how the goals of research will be achieved. In fact, research design is the conceptual structure within which research is conducted; it constitutes the blueprint of the collection, measurement and analysis of data. Black and Champion (1976) have given three important functions of research design. They are:

- a) It provides the blueprint for research.
- b) It limits the boundaries of research activity.
- c) It enables investigation to anticipate potential problems.

So we see that, research design is needed because it facilitates the smooth sailing of research operations thereby making research as efficient as possible yielding information with minimal expenditure of effort, time and money.

Ahuja (2007) explains that the research designing proceeds in eight phases as under:

- 1) **Stating the problem**, i.e., to show the type of research it will be, and to what extent will it contribute to the academics and understanding of society.
- 2) **Review of other studies**, i.e., going through the findings, hypotheses or theories developed by other scholars in one's own discipline or other disciplines.
- 3) **Operationalising concepts**, i.e., giving specific meanings to the terms used.
- 4) **Identifying variables of the study**, i.e., pointing out key variables (see BOX) in the study and methods of measurement.
- 5) **Fixing sample**, i.e., deciding the numbers of subjects from whom the data is to be collected and how these subjects are to be chosen.
- 6) **Specifying tools of study**, i.e., whether data are to be obtained through questionnaires, schedule, interview or observation. Whether it will be case study, survey study, field study or experimental study.
- 7) **Designing the kind of analysis**, i.e., whether quantitative or qualitative analysis for the study.
- 8) **Fixing time-schedule and budget**, i.e., how much time and budget is to be devoted to the study.

BOX

Variables: A variable is a characteristic that takes on two or more values. It is something that varies. It can be classified into two types: independent and dependent variables. An independent variable is the presumed cause of the dependent variable– the presumed effect. When we say, A causes B, it means A is the independent variable and B is the dependent variable. The independent variable, thus, is one which explains or accounts for variations in the dependent variable. A dependent variable is one which changes in relationship to changes in another variable. An independent variable is one whose change results in the change in another variable. In a controlled experiment, the independent variable is the experimental variable, i.e., one which is withheld from the control group.

3.2 CHARACTERISTICS OF A GOOD RESEARCH DESIGN

We need to learn how a research design can be well made. If a research design possesses qualities like being flexible, suitable, applicable, resourceful, reasonable etc., then it can be defined as a good research design. A good research design is one which decreases bias and increases dependability of the data collected and investigated. It also generates complete information and allows a chance to reflect on many different features.

A research design appropriate for a particular research problem, usually involves the consideration of the following factors:

- 1) The means of obtaining information;
- 2) The availability and skills of the researcher and his/her staff;
- 3) the objective of the problem to be studied;
- 4) The nature of the problem to be studied; and
- 5) The availability of time and money for the research work.

3.3 TYPES OF RESEARCH DESIGNS

In the sub-sections below, we elucidate the different types of research designs to comprehend the matter more clearly.

3.3.1 Exploratory Research Design

Exploratory research studies are also known as formulative research studies. Such studies are needed to formulate a problem which helps in better investigation or helps in developing functional hypotheses. Such studies promote the discovery of notions and perceptions. Therefore the research design created in such a context had to be accommodating enough to allow the prospect to consider various features of a problem under investigation. Since as already discussed in Unit 1, a research problem changes from its general form at the initial stage to a more concrete form eventually, the research design has to be highly flexible. In such studies, the following three methods in relation to a research design are viewed. They are: (a) the survey of concerning literature; (b) the experience survey, and (c) the analysis of 'insight-stimulating' examples.

- a) **The survey of relevant literature:** Literature review as discussed in Unit 1 helps in formulating a research problem and developing hypotheses. Hypotheses can either be reviewed from earlier works or their validity can be appraised for future research. The investigator also has to see if the present hypotheses can reveal a new hypothesis. Thus the researcher should evaluate and construct her/his hypotheses on earlier work done by others and if such a situation is not possible, then earlier published material is to be reviewed to build a new hypothesis from scratch.

It is in fact the bibliographical study which aids the researcher to formulate the problem accurately. It is essential for the researcher to use notions and theories built in various research settings to the thematic area s/he is working. Creative writing can also be looked into to devise hypotheses.

- b) **The experience survey:** In exploratory studies it is also essential that those persons should be surveyed who have already done some work in the field under study. These people have the knowledge to guide and explain practical difficulties. These might be the persons who might be senior officials, social workers and professionals, having a lot of untapped material at their disposal on the one hand and opportunity of viewing the problem from different angles on the other. They also know policy implications of a problem. They have insight and are in close contact with the people of an area knowing their habits, limitations and also possess the methods of approaching them. The administrators have real advantage of viewing the

problem from close quarters and can definitely provide fruitful clues for solving many such problems which otherwise appear to be difficult. The specialist in their own turn have rich experience which can help the social scientists in gaining experience and knowing about influences operating in the situation which they are going to study. It is therefore, always desirable in an exploratory study that the specialists, professionals, administrators and researchers as well as officials should be surveyed before any hypothesis is formulated.

An important thing which ought to be kept in mind in this regard is that there are many people in every country who have rich and firsthand knowledge of a particular problem proposed to be studied, but their work may not be available in a published form. These people are store houses of knowledge. It is essential and rather very pertinent that such people be identified and a close liaison should be established with them so that this important source is not lost and fullest advantage of it is taken.

- c) **Analysis of 'insight-stimulating':** Another rewarding method for preparing hypotheses for scientific enquiry or research is the analysis of 'insight-stimulating' examples. This is most suited in situations where there is little or no experience to assist as a guide. Selected instances of the problem in which the researcher is interested is rigorously studied. For this, existing record if any are examined, unstructured interviews are conducted or other available approaches are used. The investigator's assertiveness, the passion towards the study and the capacity of the researcher to bring together varied information into a single significant interpretation are the key features by which this method becomes an apt process to evoke discernment.

3.3.2 Descriptive/Diagnostic Research Design

Descriptive research studies are those studies which are interested in explaining the features of a particular individual, or of a group, while diagnostic research studies ascertain the frequency with which something comes up or its relationship with something else. The studies concerning whether certain variables are connected are examples of diagnostic research studies. As against this, studies concerned with specific predictions, with narration of facts and characteristics concerning individual, group or situation are all examples of descriptive research studies. Most of the social research comes under this category. From the point of view of the research design, the descriptive as well as diagnostic studies share mutual needs and as such these two types of research studies may be clubbed together.

The research design should be created in such a way that it allows means for shielding against bias and should induce maximum reliability. There should also be enough concern for the efficient conclusion of the research study.

The design for such studies should be exact and thorough and not malleable. It should concentrate on the following:

- a) Devising the objective of the study (what the study is about and why it is being devised?)
- b) Designing the methods of the data collection (what techniques of accumulating information will be adopted?)

- c) Selecting the sample (how much material will be required?)
- d) Collecting the data (where can the needed data be found and with what time period should the data be connected?)
- e) Managing and evaluating the data.
- f) Reporting the outcome.

In a descriptive and diagnostic investigation the first step that needs to be taken into consideration is to identify the objectives. This is to be done with adequate exactness so that the data collected are applicable. After this the methods for collecting the data are to be selected. Usually in descriptive and diagnostic studies the researcher first makes a sample study. Based on the analysis of the sample study s/he makes statements about the population. Such a sample obviously has to be designed as well.

A researcher has to accumulate the following qualities to collect authentic and useful data. S/he should be honest and should work without prejudice. Her/his level of dedication towards collecting data should be viewed in terms of completeness, comprehensibility, consistency and dependability.

3.3.3 Experimental Research Design

Experiments of the true kind in the field are not very popular in anthropology though they are employed in connected sciences like social psychology and organisational studies. It is also sometimes used by researchers in studying social policy to calculate the effect of new policies or new reforms.

The classical experimental design is also often referred to as the randomized experiment. Two groups are established and it is this that forms the experimental manipulation and therefore, the independent variable. The experimental group receives the experimental treatment but the control group does not receive any experimental treatment. Some experimental designs of this kind are:

- a) **After-only experiment:** We carry out experiments of this kind under such social conditions which are not at all under the control of physical or natural conditions. There are two types of groups which are chosen for the study. The group in which experiment is carried is called the experiment group, whereas the other is called the control group. The control here is taken in the sense that extra influences are prevented or checked to the extent possible. The experiment is carried out with the help of some determined methods and the results are measured. Comparative study is made from the results of observation and the measurement of the two groups. The changes that are caused in the experimental groups are recognized and accepted as the results of the variable that are responsible for the changes. As already pointed in this type of experiment both these groups are similar to each other in all respects, which of course is not possible in some other research. Since the differences are bound to be there, therefore it is difficult to identify if such differences are basic to the group or due to the programme of experimentation. It is also usually difficult to find out, if the changes are due to experiment or some external factors and these have become major difficulties of this type of experimentation, which becomes increasingly difficult to solve.

- b) **Before-after experiment:** In this type of experimental research design certain groups are selected and before any experiment is actually carried out observations are made about these groups. Observations are also made after the experiment has been carried out and differences are observed. It is then believed that differences between the two are on account of implementation of the programme. In this type of experimentation, it is not necessary that both the groups must be made either equivalent or similar.

It is however, in the interest of the experimentation that the dependent variables should be measured for matching the cases in experimental and controlled groups. It will then be possible to know that after experimentation what the incidence of change in the dependent variables is and to evaluate the effects of experimental or independent variables. In this study, one group may be used before measure, serving as a control but though before measure control group may be one yet after measure experiment may be on a different group which is assumed to be an equivalent group. Before and after measures may be taken both on experimental group and on one control group. In this type of experimentation there might be the involvement of two or more groups. Such experimentation can be with single group, with one control group, with two controlled groups, or even with three groups.

One great difficulty of this system is, groups are studied under two situations namely before experimentation and after experimentation but it does not take into consideration external factors which might influence the study in between these periods of experimentation.

- c) **Ex-post facto experiment:** In anthropological research, there are many problems which can be studied only with the help of adequate historical background e.g. why revolutions take place in a particular country and the conditions for another revolution being ripe in that or in any other country etc. The researcher will have to depend at the past experience because it will be difficult for him to organise another revolution for his study and dependence on historical background can be possible only on the basis of ex-post facto experiment.

In this type of experiment, the researcher is required to select two or more groups for his study. Out of these two groups in one group the event has already taken place and the other is free from the happening of that event e.g. the investigator can pick up for his study two states, which are similar in nature and also similar in almost all other respects. But in spite of this, in one country revolution has already taken place, while in the other revolution has not taken place. With this study he can find out why at all, revolution took place in one and did not take place in another country. In this way an investigator proceeds from the present to the past and can also look to the future influence if any. One can also find out and establish that present is the result of the past.

3.3.4 Quasi-Experimental Research Design

This is a study which possesses certain characteristics of the experimental design but do not include most of the internal validity necessities. However many writers have emphasised about the use of this quasi-experimental design. For example, a number of quasi-experiments have been recognised by Cook and Campbell (1979). Mention may be made of a quasi- experiment which is

designated as a natural experiment. These experiments are conducted in such a way that a social setting is manipulated in a way that the alteration that occurs if any, seem as if it is a natural change taking place in the social organisation. In such an experiment random assignment of subjects to experimental and control group is not possible. This absence of random assignment creates doubts about the validity of such experiments. But since the results of such natural interventions in social life are not artificial, the studies are still viewed to be persuasive. Being natural, their ecological validity also is quite strong. Though many writers discredit the usability of natural experiments as there is no control group or occasion for comparison, but sometimes a single group natural experiment does turn out to be significantly outstanding. Thus experimental designs including quasi experimental designs have been especially noticeable in evaluation research enquiries.

3.3.5 Cross-sectional Research Design

When data is collected on more than one case simultaneously, i.e., at the same point of time, it is said to involve a cross-sectional design. This is used to collect a body of quantitative and quantifiable data with two or more variables. They are then scrutinized to identify connectivity patterns.

Researchers who employ a cross-sectional design are concerned with variation or differentiation. This might in relation to people, organisations, families, nations, states etc. It is only when more than one case is examined can we get variation. Usually it is found that more than two cases are studied to understand variation. This is done as more the cases, more variation is to be seen; distinction between cases, easier to make etc.

Since simultaneous data is collected in cross-sectional research design in order to build maximum variables, the problem of ambiguity about the direction of causal influence is faced. Even when a researcher finds a relationship between two variables, s/he is still not sure whether they exhibit a causal relationship as the features of an experimental design are absent. At most in many cases the variables seem related. Having said this, it is not always necessary that a causal inference would not be present in a cross-sectional research design.

3.3.6 The Longitudinal Research Design

A distinct type of research design is the longitudinal research design. In this design, the time and cost involved is quite high. Due to this reason, it is a comparatively less-used design in social research. It can be called an extension of survey research as it includes the self-completion questionnaire or structured interview styled within the context of a cross-sectional research design. However the longitudinal research design is different from a cross-sectional research design in terms of reliability, replication and validity. But as the longitudinal research design gives some awareness into the time order of variables, thus it is able to permit causal inferences to be made.

In this type of research design a sample is surveyed and is surveyed again on at least one more occasion. It is common to distinguish two types of longitudinal design: the panel study and the cohort study. In the panel study, a sample, often a randomly selected national one is the focus of data collection on at least two (and often more) occasions. Data may be collected from different types of cases within a panel study framework like, people, households, organisations, schools, and so on.

The cohort study selects either an entire cohort of people or a randomly selected sample of them as the focus of data collection. The cohort is made up of people who share certain characteristics, such as all being born in the same week or having certain experiences, such as being unemployed or getting married on a certain day or in the same week. Panel and cohort studies share similar features. They are both concerned with illuminating social change and improving the understanding of causal influences over time.

Panel and cohort designs differ in important respects too. A panel study that takes place over many years can distinguish between age effects (the impact of the ageing process on individuals) and cohort effects (effects due to being born at a similar time), because its members will have been born at different times. A cohort study, however, can only distinguish ageing effects, since all members of the sample will be born at more or less the same time. Also, a panel study, especially one that operates at the household level, needs rules to inform how to handle new entrants to households (for example, as a result of marriage break-up or children leaving home).

3.3.7 Case Study Design

The case study design involves the comprehensive and severe examination of a single case. Such a case is studied within a community or an organisation. Therefore the stress is on the complete concentration of the setting through the case. It is a fact that the case study design is associated with qualitative methods like unstructured interviews and participant observation. These methods are definitely beneficial in the creation of a rigorous and meticulous analysis of a case. Yin (1984) identifies three kinds of cases:

- **The critical case:** the researcher is ready with a clearly defined hypothesis to study such a case. Such a study gives a better perception of the conditions in which the hypothesis may or may not hold.
- **The unique case:** The unique case is, as Yin observes, a common focus in clinical studies. Margaret Mead's (1928) well-known study, *'Coming of Age in Samoa'* seems to have been motivated by her belief that the country represented a unique case. She argued that, unlike most other societies, Somoan youth do not suffer a period of anxiety and stress in adolescence. The factors associated with this relatively trouble-free period in their lives were of interest to her, since they might contain lessons for the Western youth.
- **The revelatory case:** The basis for the revelatory case exists 'when an investigator has an opportunity to observe and analyse a phenomenon previously inaccessible to scientific investigation' (Yin, 1984: 44).

Many case studies take place on what might be called the exemplifying case; cases are often chosen not because they are extreme or unusual in some way but because they will provide a suitable context for certain research questions to be answered. As such, they allow the researcher to examine key social process.

3.3.8 Comparative Research Design

It is worth distinguishing one further kind of design i.e., the comparative design. This design entails the study using more or less identical methods of two contrasting cases. It embodies the logic of comparison in that it implies that we can understand social phenomena better when they are compared in relation to two or more meaningfully contrasting cases or situations. The comparative

design may be realised in the context of either quantitative or qualitative research.

Cross-cultural research also entails its share of problems. They are usually the: management and arrangement of funds; evidence to be comparable keeping in view data-collection methods while using existing data, like official statistics or survey data for secondary analysis; warranting that the use of data-collection instruments (like interview schedules) in the collection of new information should not weaken real comparability; making sure that the samples of participants or institutions are corresponding. However further problems arise with the last point, when national and cultural contexts are depicted insensitively.

The comparative study is much similar to cross-sectional research design as both have to be reliable, valid, replicable and general. Two or more cross-sectional research studies can also be viewed as a comparative study. This too is carried almost at the same point of time.

Thus the comparative design can be viewed as a hybrid in both qualitative and quantitative study, where in the first one it is an extension of a case study design and in the latter it is an extension of a cross-sectional design. It also contains particular characteristics which are similar to experiment and quasi-experiment designs, as they too depend on the capability to duplicate a comparison.

Activity

Select any two type of research design and write a comparative note of the two.

3.4 EVALUATION RESEARCH

We now try to learn how evaluation research is executed. Evaluation research consists of the application of social research methods for the purpose of assessing social intervention programmes and policies. Evaluation researchers apply the same repertoire of methods as basic researchers do to address the same fundamental issues— the issues of research design, internal validity, measurement, and external validity. What differentiates evaluation research from basic social research is the social context in which the methods are applied. Evaluation is the crucial phase in the process of rational decision making or problem solving. First a problem is identified; second, options for its solution are considered; third, one or more options is implemented; fourth, the implemented options are evaluated; and finally, a decision is made about whether the options is worth adopting. As the term is used in social research, however, evaluation research usually pertains to the analysis of social programmes instituted by federal, state, and local Governments to help solve social problems. Evaluation studies have been used to investigate literally thousands of problems and intervention strategies (Singleton and Straits, 2005).

Evaluation research, as its name implies, is concerned with the evaluation of such occurrences as social and organisational programmes or interventions. The essential question that is typically asked by such studies is: has the intervention (e.g. a new policy initiative or an organisational change) achieved its anticipated goals? A typical design may have one group that is exposed to

the treatment, that is the new initiative, and a control group that is not. Since it is often not feasible or ethical to randomly assign research participants to the two groups, such studies are usually quasi-experimental. The use of the principles of experimental design is fairly entrenched in evaluation research, but other approaches have emerged in recent years. Approaches to evaluation based on qualitative research have emerged. While there are differences of opinion about how qualitative evaluation should be carried out, the different views typically coalesce around a recognition of the importance of an in-depth understanding of the context in which an intervention occurs and the diverse viewpoints of the stakeholders (Greene 1994, 2000).

There are many different types of evaluations depending on the purpose of evaluation. Perhaps the most important basic distinction in evaluation types is between formative and summative evaluation. Formative evaluations strengthen or improve the research being carried out, while summative evaluations, in contrast, examine the effects or outcomes of some research.

Formative evaluation involves quite a few evaluation categories. They are:

- **Needs assessment:** This decides who requires the research, how big the requirement is, and what might work to meet the requirement.
- **Evaluability assessment:** This determines whether an evaluation is viable and how investors can contribute to design its utility.
- **Structured conceptualization:** This helps stakeholders describe the programme or technology, the target population, and the potential results.
- **Implementation evaluation:** This supervises the reliability of the research.
- **Process evaluation:** This examines the procedures of producing the programme or technology, including alternative delivery processes.

Summative evaluation is further subdivided into:

- **Outcome evaluations:** This researches whether the programme or technology can cause verifiable effects on particularly distinctive target consequences.
- **Impact evaluation:** This is wider and evaluates the complete effects which are intended or unintended of the programme or technology as a whole.
- **Cost-effectiveness and cost-benefit analysis:** These address queries related to efficacy by regulating results in terms of their costs and values.
- **Secondary analysis:** This reappraises prevailing data to tackle new questions or to use methods not used earlier.
- **Meta-analysis:** This combines the outcome approximates from various enquiries to reach at an overall or concise conclusion on an evaluation query.

The selection of the problem, thus, is to be evaluated on the following bases:

- Is the topic worth investigating, i.e., will it benefit the researcher/consumer?
- Has it any academic/professional/practical importance?
- Is data collection/reliable information possible from respondents?

- Is it feasible in terms of time/money?
- Will it enable to develop hypotheses or a theory?

Hillway has maintained that criteria for the selection of a problem should be: (1) is the problem significant? (2) Has it any value for undertaking research? (3) Is it too broad in scope? (4) Is data collection feasible? (5) Has it already been studied? If yes, with what results, i.e., is the problem original or not? (cf. Mannheim, 1977)

Manheim (1977:113-117) has explained the evaluation of a research problem on following bases:

- Is the topic worthwhile? (i) How will it benefit consumer/researcher/participant in terms of money/time/energy spent? (ii) What will be its academic/ professional/practical worth? e.g., voluntary retirement scheme for industrial workers of government employees.
- Is it feasible? (i) Is sufficient time available? (ii) Is budget adequate? (iii) Will respondents give required information? (iv) Will information be reliable? (v) Will investigators be objective? (vi) Can the findings of a small sample be warranted for broader generalization? (vii) Will the study encounter opposition from any source?
- Will any personal factors affect the research? In short, the important factors that affect the selection of the topic are: researcher's interest, research questions and objectives, research model, research values, unit(s) of analysis and time- schedule. Regardless of whether the researcher writes the literature into a qualitative, quantitative, or a mixed methods study, several steps are useful in conducting a literature review.

3.5 SUMMARY

There are several research designs and the researcher must decide in advance for the collection and analysis of data as to which design would prove to be more appropriate for her/his research. S/he must give due importance to various points such as the type of universe and its nature, the objective of her/his study, the resource list or the sampling frame, desired standard of accuracy and the like when taking a decision in respect of the design for her/his research. From the lesson above a learner can elucidate that there are different kinds of research designs which make research possible and feasible. In anthropology a researcher creates and uses these designs according to the need of her/his enquiry. The research design assists the investigation in being pragmatic and scientific.

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Sample Questions

- 1) What are the characteristic of a good research design?
- 2) Discuss the types of research design in detail with examples.
- 3) Write an exhaustive note on evaluation research.

NOTES

Research design is a plan or blueprint that guides the researcher in the collection, measurement, and analysis of data. It is a systematic and logical arrangement of methods and procedures for the collection and analysis of data for the purpose of testing hypotheses or answering research questions.

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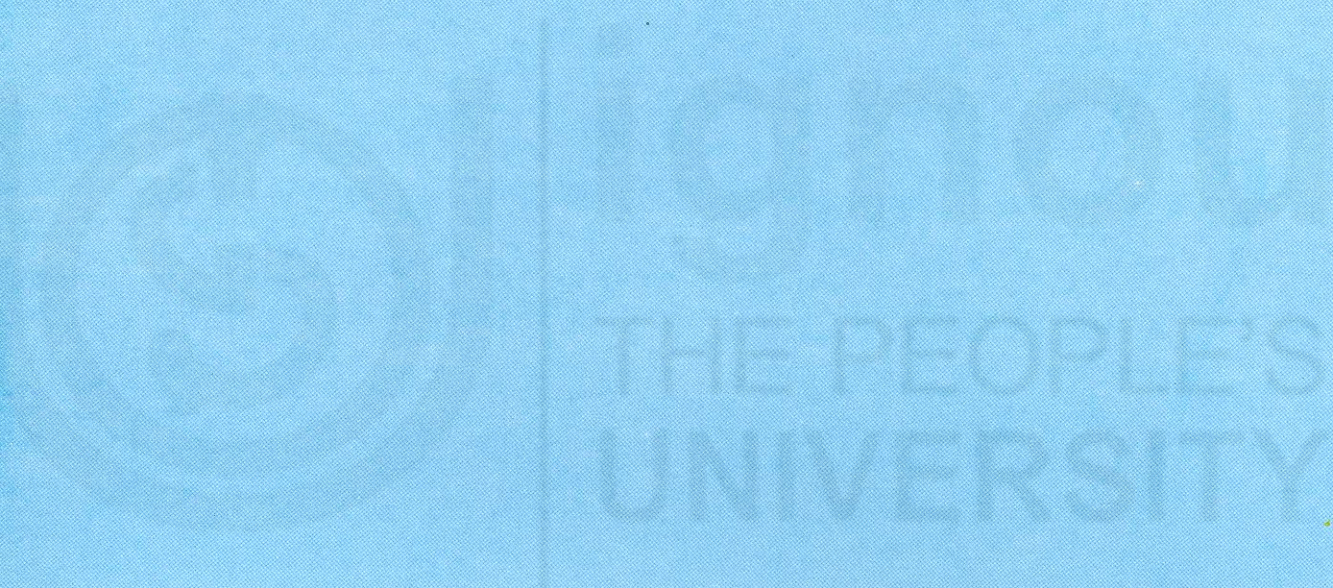
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