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CENTRE FOR DISTANCE AND ONLINE EDUCATION
UTKAL UNIVERSITY

C.D.O.E

BACHELOR OF ARTS IN EDUCATION

SEMESTER–III

CORE-6 EDUCATIONAL RESEARCH

BLOCK:1,2,3,4 **CREDIT: 6**

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We wish you happy reading.

DIRECTOR

EDU CORE- VI EDUCATIONAL RESEARCH

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EDU CORE- VI EDUCATIONAL RESEARCH

Contents

UNIT 1 MEANING, OBJECTIVES, MOTIVATION, NATURE OF RESEARCH

STRUCTURE

INTRODUCTION

Research is a part of any systematic knowledge. It has occupied the realm of human understanding in some form or the other from times immemorial. The thirst for new areas of knowledge and the human urge for solutions to the problems have developed a faculty for search and research and re-research in him/her. Research has now become an integral part of all the areas of human activity. Research in common parlance refers to a search for knowledge. It is an endeavour to discover answers to problems (of intellectual and practical nature) through the application of scientific methods. Research, thus, is essentially a systematic inquiry seeking facts (truths) through objective, verifiable methods in order to discover the relationship among them and to deduce from them broad conclusions. It is thus a method of critical thinking. It is imperative that any type of organisation in the globalised environment needs systematic supply of information coupled with tools of analysis for making sound decisions which involve minimum risk. In this Unit, we will discuss at length the meaning, objectives, motivation and significance of research and the research process.

LEARNING OBJECTIVES

After studying this Unit, you should be able to:

- Explain the meaning and importance of research;
- State the motivation of research;

- Describe the nature of research.

MEANING OF RESEARCH

Research in common parlance refers to a search for knowledge. Once can also define research as a scientific and systematic search for pertinent information on a specific topic. In fact, research is an art of scientific investigation. The Advanced Learner's Dictionary of Current English lays down the meaning of research as "a careful investigation or inquiry especially through search for new facts in any branch of knowledge." Some people consider research as a movement, a movement from the known to the unknown. It is actually a voyage of discovery. We all possess the vital instinct of inquisitiveness for, when the unknown confronts us, we wonder and our inquisitiveness makes us probe and attain full and fuller understanding of the unknown. This inquisitiveness is the mother of all knowledge and the method, which man employs for obtaining the knowledge of whatever the unknown, can be termed as research. Research is an academic activity and as such the term should be used in a technical sense. According to Clifford Woody research comprises defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organising and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis.

The Random House Dictionary of the English language defines the term „Research" as a diligent and systematic inquiry or investigation into a subject in order to discover or revise facts, theories, and applications, etc. This definition explains that research involves acquisition of knowledge. Research means search for truth. Truth means the quality of being in agreement with reality or facts. It also means an established or verified fact. To do research is to get nearer to truth, to understand the reality. Research is the pursuit of truth with the help of study, observation, comparison and experimentation. In other words, the search for knowledge through objective and systematic method of finding solution to a problem/answer to a question is research. There is no guarantee that the researcher will always come out with a solution or answer. Even then, to put it in Karl Pearson's words "there is no short cut to truth… no way to gain knowledge of the universe except through the gate way of scientific method". Let us see some definitions of Research:

L.V. Redman and A.V.H. Mary in their book on "The Romance of Research" defined research as "a systematized effort to gain new knowledge"

"Research is a scientific and systematic search for pertinent information on a specific topic" (C.R. Kothari, Research Methodology - Methods and Techniques)

"A careful investigation or inquiry especially through search for new facts in any branch of knowledge" (Advanced learners Dictionary of current English).

Research refers to a process of enunciating the problem, formulating a hypothesis, collecting the facts or data, analyzing the same, and reaching certain conclusions either in the form of solution to the problem enunciated or in certain generalizations for some theoretical formulation.

D. Slazenger and M. Stephenson in the Encyclopedia of Social Sciences defined research as: "Manipulation of things, concepts or symbols for the purpose of generalizing and to extend, correct or verify knowledge, whether that knowledge aids in the construction of a theory or in the practice of an art".

Research is, thus, an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison and experiment. In short, the search for knowledge through objective and systematic method of finding solution to a problem is research. The systematic approach concerning generalization and the formulation of a theory is also research. As such the term „research" refers to the systematic method consisting of enunciating the problem, formulating a hypothesis, collecting the facts or data, analyzing the facts and reaching certain conclusions either in the form of solutions(s) towards the concerned problem or in certain generalizations for some theoretical formulation.

To understand the term „research" clearly and comprehensively let us analyze the above definition.

i) Research is manipulation of things, concepts or symbols

- manipulation means purposeful handling,
- things means objects like balls, rats, vaccine,
- Concepts mean the terms designating the things and their perceptions about which science tries to make sense. Examples: velocity, acceleration, wealth, income.
- Symbols may be signs indicating +, –, †, ×, x, σ, Σ, etc.
- Manipulation of a ball or vaccine means when the ball is kept on different degrees of incline how and at what speed does it move? When the vaccine is used, not used, used with different gaps, and used in different quantities (doses) what are the effects?

ii) Manipulation is for the purpose of generalizing

The purpose of research is to arrive at generalization i.e., to arrive at statements of generality, so that prediction becomes easy. Generalization or conclusion of an enquiry tells us to expect something in a class of things under a class of conditions.

Examples: Debt repayment capacity of farmers will be decreased during drought years.

When price increases demand falls.

Advertisement has a favorable impact on sales.

iii) The purpose of research (or generalization) is to extend, correct or verify knowledge

Generalization has in turn certain effects on the established corpus or body of knowledge. It may extend or enlarge the boundaries of existing knowledge by removing inconsistencies if any. It may correct the existing knowledge by pointing out errors if any. It may invalidate or discard the existing knowledge which is also no small achievement. It may verify and confirm the existing knowledge which also gives added strength to the existing knowledge. It may also point out the gaps in the existing corpus of knowledge requiring attempts to bridge these gaps.

iv) This knowledge may be used for construction of a theory or practice of an art

The extended, corrected or verified knowledge has two possible uses to which persons may put it.

a) May be used for theory building so as to form a more abstract conceptual system. E.g. theory of relativity, theory of full employment, theory of wage.

b) May be used for some practical or utilitarian goal.

E.g. „Salesmanship and advertisement increase sales" is the generalization. From this, if sales have to be increased, use salesmanship and advertisement for increasing sales.

Theory and practice are not two independent things. They are interdependent. Theory gives quality and effectiveness to practice. Practice in turn may enlarge or correct or confirm or even reject theory.

OBJECTIVES OF RESEARCH

The purpose of research is to discover answers to questions through the application of scientific procedures. The main aim of research is to find out the truth which is hidden and which has not been discovered as yet. Though each research study has its own specific purpose, we may think of research objectives as falling into a number of following broad groupings:

1. To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory or formulative research studies);
2. To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as descriptive research studies.
3. To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies).
4. To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis-testing research studies)

Check Your Progress Exercise 1.1

Note:

I. Write your answer in the space given below.

II. Compare your answer with the one given at the end of this Unit

Q.1 What is research? What is the need and purpose of research?

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MOTIVATION

P.V. Young has mentioned four motivating factors of social research.

1. Curiosity about Unknown In her own words, "Curiosity is an intrinsic trait of human mind and a compelling drive in the exploration of man"s surroundings." It is a natural instinct in the mankind. Even a small child is curious about the unknown objects that he notices around him and tries to understand them in his own ways. The same curiosity drives a scientist to explore unknown factors working behind the social phenomena. When he observes various social activities of man so complex and varied, he simply marvels at their nature and tries to understand them in their true significance.

2. Desire to Understand the Cause and Effect of Widespread Social Problems According to P.V. Young, "The search for cause and effect relationship has been more relentless than almost any other scientific effort upon which human energies have been spent." More and more research is undertaken to dispel doubts and uncertainties which result from inadequate conceptions of underlying factors shaping social processes. People want not only an account of events but also want to know how they happened.

3. Appearance of Novel and Unanticipated Situations Man is often faced with many acute and difficult social problems. An ordinary person reacts emotionally to these, but a social scientist sets down dispassionately to find out their cause and thus evolves a lasting solution to such intricate problems. In quite a large number of cases such problems have inspired the social scientist to go into their detail and study the basic factors causing these problems.

4. Desire to discover new and test old scientific procedure as an efficient way to gain useful and fundamental knowledge. Such research is not in fact a research in social phenomena, but a research in techniques or methods used in social research. A

Number of such researches has been made to evolve better and most refined techniques for dealing with social problems. Of late there has been growing emphasis upon the use of quantitative or statistical methods in the social research in order to make it more definite and mathematically precise.

As it has been mentioned earlier, knowledge is the primary and powerful resource that can provide scope for material prosperity of a society. New knowledge can be acquired only with the pursuit of research to extend the frontiers of knowledge. To accentuate the value of research, particularly with reference to scientific, technological and societal knowledge in the Indian context, Pandit Jawaharlal Nehru eloquently articulated the Scientific Policy Resolution (SPR) of the Government of India in 1958.

SPR states, "the dominating feature of the contemporary world is the intense cultivation of science on a large scale and its application to meet a country's requirements. It is this which for the first time in man's history, has given the common man, in countries advanced in science, a standard of living and social and cultural amenities which were confined to a very small and privileged minority of the population. It is only through scientific approach and method and use of scientific knowledge that reasonable material and cultural amenities and services can be provided for every member of the community and it is out of the recognition of this possibility that the idea of the welfare state has grown."

The implications and policy directions of this farsighted SPR are quite clear, namely:

Recognition of the vital role of science and technology for socio-economic development is a fundamental approach. Another important point of note, particularly beginning from the middle of the last century, is the increasing emphasis on the organising principle for all socio-economic development as a mix of science, technology and societal knowledge (STSK). This mix is a complex and multidimensional process, involving science, technology and societal knowledge. Societal knowledge combines political, economic, sociological, demographic, occupational, health, legal, regulatory and environment information and knowledge to comprise a complete knowledge universe. Again development is not merely cultivating physical resources, but also very much on building up human resources. Any imbalance in these development approaches weakens the overall capacity of a State to transform itself into a welfare state.

As a result of this policy direction in India, in the last half a decade, a number of R & D complexes have been set up in science, technology, social sciences, and humanities. Educational and training institutions of higher learning, centers of advanced studies in many disciplines, acquisition and cultivation of technological and management skills through institutions of technology and management have also been established. Creation of learned societies and professional associations, publication of primary and secondary sources for dissemination of information and knowledge,

information systems and services through libraries and information centers, consultancy organizations to bridge research and industrial development, multimedia communication through Internet and websites, and many others are undoubtedly oriented towards building up our knowledge base. Research plays the vital role in this process.

For the business and industrial community world over, knowledge management has become a crucial area for combating competition. This is a big challenge, which has made them to invest very heavily on research on new knowledge creation. This trend is also visible in the Indian context although somewhat blurred at present.

Accessibility and availability of information and knowledge through Internet is another very important development, supporting research activities.

Thus the need for research is to build up an infrastructure for creating new knowledge to develop a knowledge reservoir. The application of this knowledge for socioeconomic and cultural development of a country to provide material wellbeing of societies is the purpose.

NATURE OF RESEARCH

Research, as explained earlier, is systematic and critical investigation of phenomena. It identifies the variables, collects and analyses data on such variables to find answers to certain crucial questions. These answers contribute further to increase human knowledge. Orderliness is the hallmark of research. Research has to have an organic unity. This becomes essential if the knowledge which accrues from research is to be verified; for, it must be verifiable by anybody who takes the trouble to do so. In fact, research is considered to be a formal, systematic, intensive process of carrying on the scientific method of analysis. It involves a more systematic structure of investigating, usually resulting in some sort of formal record of procedures and results or conclusions.

Characteristics of Research

The major characteristics of any research are; objectivity, precision, design and verifiability. Let us look at these attributes more closely:

Objectivity: Ideally, research is beyond the subjective bias of the researcher. The researcher makes deliberate efforts to eliminate personal preference resisting the temptation to seek only such data that supports his/her hypothesis. The emphasis is on testing, rather than proving the hypothesis. The researcher is willing to suspend personal judgement and permit the data and logic to lead independently to a sound conclusion. Objectivity is achieved through standardisation of research instruments, choosing appropriate research design and analytical tools and ensuring dependability of data.

Precision: Precision in scientific research is achieved through the uses of statistical methods and techniques. As such, research conclusions convey the exact meaning to the reader, e.g. measures of central tendency, variability, correlation, regression etc. are the most precise expression in quantitative research which explains or represents the truth. Precise language describes the study accurately so that the study may be replicated or the results correctly used.

Design: In a scientific research, the researcher has to have a much specified design of carrying out the investigation. This will imply that any scientific inquiry will, in general, undergo the following steps:

- defining of the problem,
- statement of the hypothesis,
- collection and analysis of data,
- testing and confirmation or rejection of hypothesis, and
- reporting of results.

Only if the research has been carried out by using a specified process, it can be replicated for verification.

Verifiability: This is an important characteristic of every research. Research methods and findings presented to the professional community for other researchers to analyse, confirm or reject them. Research is a social enterprise and its information is open for public scrutiny. This characteristic of research, i.e. verifiability, is related to the criteria of objectivity and precision. Only through further investigation or replication of studies can the results of a single study be confirmed or revised. Through this process, a body of new knowledge is developed and new questions identified.

Verifiability is achieved primarily through two different approaches: first, analysing the same data on the same sample through alternative analytical tools (statistical methods), second, replicating the study on a different sample.

SUMMARY

In this Unit, we have defined research is a part of any systematic knowledge. It is essentially a systematic investigation to discover answers to problems, seeking facts / truth. Any study to create new knowledge or aims to increase existing fund of knowledge, may it be through observation or by some other methods, is called research. Whereas the scientific research is a systematic and critical investigation about the natural phenomena to describe, explain and finally to understand the relations among them.

The major characteristics of any research are objectivity, precision, design and verifiability. Broadly, research studies are of two types; Fundamental or Basic Research and Applied Research. The major aim of Fundamental or Basic Research is to expand the frontiers of knowledge without any intention of practical application.

Applied research is directed towards the solution of an immediate, specific and practical problem.

GLOSSARY

Ascendant: A position of dominance, controlling influence, superiority or preeminence.

Concept: A general notion or idea of something formed by mentally combining all its characteristics or particulars.

Hypothesis: A proposition or set of propositions set forth as an explanation for the occurrence of some specified group of phenomena.

Research: Systematic inquiry into a subject in order to discover or revise facts, theories, etc.

Theory: A coherent group of general propositions used as principles of explanation for a class of phenomena.

Variable: The quality or quantity of a thing (abstract or concrete) that takes different values.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: Research is a conscious and planned, critical and exhaustive intellectual activity, devoted to investigation of a phenomenon with the objective of expanding the frontiers of existing stock of knowledge. Such a process of investigation becomes scientific when a designated set of methods or techniques are applied to secure measure, analyse and interpret data in a cycle of research ranging from the choice of a problem to the writing of the final report.

The need for research is to build up an infrastructure for creating new knowledge to develop a knowledge reservoir. The application of this knowledge for socioeconomic and cultural development of a country to provide material wellbeing of societies is the purpose.

EXERCISE

1. Discuss the meaning and importance of research.
2. What is research?
3. Explain the motivation of research?
4. Briefly explain the nature of research.

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UNIT- 2 TYPES OF RESEARCH (non-experimental research**)**

INTRODUCTION

Now you have a good idea about what research is, what are the bases for the conduction and experiment in tests, and how research process works? Now, it is time to turn to another related issue; how do social scientists actually perform the task of adding to our knowledge of human behaviour and relationship? There are a number of ways to investigate into the answer of research questions. The kind of methods researchers use depends on kind of questions they want to answer. This unit begins with discussion of two types of researches i.e. non-experimental researches and experimental researches. Non-experimental researches will cover various kinds of researches along with examples, namely; historical research, correlation research, qualitative research and ex-post facto researches. Further, you will learn about experimental researches which are conducted to establish the cause and effect relationship. This is followed by the details of main types of experimental researches i.e. true experimental researches and quasi experimental researches. Then, you will learn how true experimental researches differ from quasi experimental researches. We now need to enquire into various methods of psychological researches for obtaining data that may be used to arrive at an evidence report. Various kind of nonexperimental methods which are used to answer the questions, such as naturalistic observation, survey method, case study, content analysis, field studies are described. Finally, besides non-experimental methods, this unit will explain you the experimental methods i.e. laboratory experiment and field experiment.

LEARNING OBJECTIVES

After reading this unit, you will be able to:

- Explain the types of researches;
- Differentiate between experimental and non-experimental researches;
- Explain true experimental researches and quasi experimental researches;
- Describe advantages and disadvantages of each method which are used in psychological research;
- Differentiate laboratory experiments from field experiments;
- Explain the differences between basic and applied researches; and
- Identify experimental and non-experimental researches and methods.

TYPES OF RESEARCH

The types of research differ mostly on three dimensions:

1) The nature of the question asked;

2) The method used to answer it; and

3) The degree of precision the method brings to answering the questions.

One way in which these methods do not necessarily differ, however is in the content or the focus of the research. In other words, if you are interested in the effects of television viewing in children, your research can be non-experimental, wherein you survey watching habits. If experimental, you may expose children models to the TV and one group non-viewing of TV and look at the effect of the exposure on their behaviour. The most general way of classifying research is to divide it into fundamental or pure or basic research and applied research. A fundamental research is the formal and systematic process where the researcher aims to develop a theory or a model by identifying all the important variables in a situation and by discovering broad generalisations and principles about those variables. It utilizes a careful sample so that its conclusion can be generalised beyond the immediate situation. For example biological psychologists explore the links between brain and mind; developmental psychology studies our changing abilities from womb to tomb and the personality psychologists investigate our inner traits. Applied research, as its name implies, applies the theory or model developed through the fundamental research to the actual solution of the problems. Applied research tackles practical problems, as for example, industrial/ organisational psychologists study and advise on behaviour in the workplace. They use psychology concepts and methods to help organisations select and train employees. They boost morale of the employees and also their productivity. They design products and answer people's responses to them. Besides the fundamental research and the applied research another type of research has recently been popular in the fields of social psychology, industrial psychology, and education. This is known as „action research". In action research the researcher emphasises a problem which is immediate, urgent and has local applicability. Thus, the researcher here focuses upon the immediate consequences and applications of a problem and not upon general or universal application or upon the development of a theory or a model. A teacher may undertake a research to know the reasons underlying unhealthy classroom habits so that immediate outcome may benefit the local class- room students. There are number of researches, given here under:

Table 2.1Type of Research

Types of Research	
Non-Experimental	Experimental
Historical, Descriptive, Correlational, Qualitative , Ex-post facto	True experimental, Quasi experimental

NON-EXPERIMENTAL RESEARCH

A non-experimental research is one where independent variables cannot be manipulated. The researcher does not have complete control over the conditions of the non-experimental research studies. For example, if you want to survey the television-watching behaviour of adolescents, you could do so by having them maintain a diary in which they record what shows they watch and with whom. This descriptive study provides information about their television-watching habits but says

nothing about why they watch what they do. You are not in any way trying to have an impact on their television watching behaviour or investigate why they might watch particular shows. This is non-experimental in nature because no cause-and-effect relationships of any type are being hypothesized or investigated. Non-experimental or descriptive research describes the characteristics of an existing phenomenon. Census of any contrary, current unemployment rate of working single parents who have children under age 5 etc. are the examples of descriptive research. A second characteristic of non-experimental is that the data collection procedure often must forfeit some degree of control in return for obtaining the data. For example the researcher may decide to study public records that may be almost, but not exactly in the form we desire or researcher may have to keep a questionnaire start to help gain the cooperation of subjects.

Historical Research

Historical research relates past events to one another or to current events. Basically, historical research (or historiography) answers the question: what is the nature of events that have happened in the past? For example, one might want to examine trends in treatment of mental illness or how attitudes toward work and families have changed. All of these questions require the detective work of a historian, finding and collecting relevant data and then, just as with any other research endeavour, testing a hypothesis. In fact, like any other researcher, the historian collects data, analyses them, and then comes to conclusions about the tenability of the hypothesis. One significant difference between historical research and other types of research is the type of data collected and the method of collection. Researchers who do historical research often accomplish this goal through the use of primary sources (original documents or information from people who have personally experienced an event) and secondary sources (second hand documents or information from people who may have some knowledge about the event but did not experience it first hand). Even if these sources are readily available, however, one of the greatest challenges doing such research is in knowing how much faith the researcher can put on the accuracy of the sources. Examining the trends in achievement level of Indian children compared with American children is an example of historical research.

Descriptive Research

Descriptive research describes and interprets what is. It is concerned with conditions or relationships that exist, the practices that prevail, the beliefs or attitudes that are held, the processes that are going on; effects that are being felt or trends that are developments. The approach is directed towards identifying various characteristics of research problems and to create observations conducive to further research. Descriptive research describes characteristics of an existing phenomenon. Descriptive research provides a broad picture of a phenomenon you might be interested in exploring. Current employment rates, census of any country, number of working single parents are examples of descriptive research.

Correlational Research

Descriptive and historical research provides a picture of events that are currently happening or have occurred in the past. Researchers often want to go beyond mere description and begin discussing the relationship that certain events might have to one another. The most likely type of research to answer questions about the relationship among variables or events is called correlational events. Correlational research provides some indication as to how two or more things are related to one another or, in effect what they share or have in common or how well a specific outcome might be predicted by one or more pieces of information. Correlational research uses a numerical index called the correlation coefficient as a measure of the strength of this relationship. For example, if you are interested to find out the relationship between the number of hours spent in studying and their achievement, then you would be doing correlational research, because you are interested in the relationship between these two variables. If you are interested in finding out the best predictors of success in a school you would be doing a type of correlational research that includes prediction.

One of the most important points about correlational research is that it examines relationships between variables but in no way implies that one causes changes in the other. In other words, correlation and prediction examine associations but not causal relationships, wherein a change in one factor directly influences a change in another.

Qualitative Research

The general purpose of qualitative research methods is to examine human behaviour in the social, cultural, and political contexts in which they occur. This is done through a variety of tools, such as interviews, historical methods, case studies, and ethnography and usually results in qualitative (or non-numeric) primary data. In other words, the qualitative researcher is more (but not only) interested in the contents of an interviewee's speech than in the number of times (frequency) a particular comment is made. Qualitative research is relatively new to the social and behavioural sciences and, to a large extent its increasing popularity is due to a degree of dissatisfaction with other available research methods. Some social scientists view that the traditional experimental model is just too restrictive and narrow, prevent underlying and important factors and relationships from being revealed. But what's so valuable about this set of tools is that it allows you to answer a whole new set of questions in a whole new way.

Qualitative research is the interpretive study of a specific issue or a problem in which the researcher is central to the research process. It's a naturalistic inquiry, which unfolds in a non-manipulative fashion. It lacks the predetermined constraints on outcome variables. Qualitative methods yield data in the form of words than numbers. Qualitative studies provide rich description and explanation of processes in specific local contexts. They provide a feel of the processes by focusing on the chronological

flow or sequence of events leading to certain outcomes or consequences. The whole phenomenon is studied with a strategy of a detailed or elaborate (thick) description. Throughout the conduct of qualitative study interpretation and reflection on the part of researcher is required.

Qualitative data can come from a variety of sources and can take a variety of forms. The data may be used as a supplement to quantitative data or may be used in their own right. Qualitative data can be obtained through a variety of methods such as case studies, interviews, discourse analysis, narratives, and ethnography and participant observation.

Ex-post-facto Research

In this kind of research, the independent variable or variables have already occurred in which the researcher starts with observation of a dependent variable or variables. He then studies the independent variables in retrospect for their possible relations to and effects on the dependent variable or variables. The most important difference between experimental research and ex-post facto research is control. In the former, the investigator has a manipulative control on the independent variable, whereas in the latter this control is not possible, more than this, randomization is not possible. In the ex-post facto research, the researcher must take things as they are and try to collect data and analyse them in that context.

In an ideal social scientific research, the possibility of finding random samples of subjects and randomly assigning them to groups and treatment to group would always be possible. However, these possibilities do not exist in the real situation. The ex-post facto research could be of a large scale or a small scale. This type of research has three weaknesses:

- the inability to manipulate the independent variables,
- lack of power to randomize, and
- the risk of improper interpretation.

In other words, compared to experimental research, other things being equal, ex-post facto research lacks control. This lack is a basis for the third weakness: the risk of improper interpretation. Therefore, committing unequivocally to experimentation or to ex-post facto research may be poor policy; Ex-post facto research may not have particular hypothesis as a predicted relationship may be quite spurious. Therefore, expost facto research that is conducted without hypothesis, without predictions, research in which data are just collected and then interpreted is even more dangerous in its power to mislead.

Check Your Progress Exercise 2.1

Note:

I. Write your answer in the space given below.

II. Compare your answer with the one given at the end of this Unit.

In a naturalistic observation , the phenomenon in which the behaviour of thesubjects being observed changes because they are being watched is called:

a) Observer Bias
b) Participant Observation
c) Observer Effect
d) Representative Sampling

Fields experiments are concerned with:

a) casual relationships
b) direction of relationships
c) natural setting
d) all of these

Results are obtained under artificial conditions is a limitation of method:

a) observational
b) clinical
c) experimental
d) none

Which one is not the limitation of laboratory experiment:

a) artificial environment
b) lack of internal validity
c) study of all variables not possible
d) extraneous factors

Which one is not a non-experimental research

a) field study
b) field experiment
c) case study
d) survey

The investigator simply observes and records what happens in the natural environment in the:

a) naturalistic observation
b) the survey method
c) the clinical approach
d) experimental method

Results of which methods cannot be generalise to the population at large:

a) survey
b) experiment
c) case study
d) field study

EXPERIMENTAL RESEARCH

You already know that correlational research can help to establish the presence of a relationship among variables but does not provide any reason to believe that variables are causally related to one another. How does one find out if characteristics, behaviour, or events are related in such a way that the relationship is causal one? There are two types of research that can answer that question: true experimental research and quasi-experimental research.

True Experimental Research

In true experimental research, participants are assigned to groups based on some criterion, often called the treatment variable or treatment condition. For example, you want to compare effects of two different techniques for reducing obsessive compulsive disorder behaviour in adults. The first technique includes behavioural therapy and the second does not. Once adults are assigned to groups and the programs are completed, you will want to look for any differences between the two groups with regard to the effects of the therapy on the number of obsessive-compulsive behaviours. Because assignment to the groups is determined by the researcher, the researcher has given assignment to the groups as determined by the researcher, and thus the researcher has complete control over the factors to which the adults are exposed. This is the ideal model for establishing a cause and effect relationship because the researcher has clearly defined the possible cause and can keep very close tabs on what is happening. Most important, however is that the researcher has complete control over the treatment.

Quasi Experimental Research

In quasi-experimental study, the researcher does not have a such a high degree of control because people have already been indirectly assigned to those groups (e.g., social class, type of abuse, gender, type of injury) for which you are testing the effects. In these researches participants are pre-assigned to groups based on some predetermined characteristics or quality. Differences in gender, race, age, grade in school, neighbourhood of residence, type of job, and even experiences are examples. These groups‟ assignments have already taken place before the experiment begins, and the researcher has no control as to who is assigned to each group.

The most important use of the quasi experimental method occurs where researchers cannot, in good conscience, assign people to groups and test the effects of group membership on some other outcome. For example, researchers who are interested in the effects of parental unemployment on children could not very well encourage mothers or fathers to quit work. Rather, they would seek out families where parents are already unemployed and then conduct the research.

Quasi-experimental research is also called post hoc, or after-the-fact, research because the actual research takes place after the assignment of groups (e.g., employed

versus unemployed, malnourished versus non-malnourished, male versus female). Because assignment has already taken place, the researcher has a high degree, but not the highest degree, of control over the cause of whatever effects are being examined.

For the highest degree of control to occur, the true experimental model needs to be followed.

METHODS OF RESEARCH

Methods of research can be classified into two categories: Non-experimental methods and experimental methods.

Non-Experimental Methods

Naturalistic Observation

Sometimes all researchers need to know is what is happening to a group of animals or people. The best way to look at his behaviour of animals or people is to watch them behave in their normal environment. In naturalistic observation a scientist observes behaviour in real world settings and makes no effort to manipulate or control the situation. Researchers conduct naturalistic observation at homes, day-care canters and so on. For example, if someone wanted to know how adolescents behave with members of the opposite sex in a social setting the researcher might go the mall on a weekend night.

The most important advantage of naturalistic observation is that it allows researchers to get a realistic picture of how behaviour occurs because they are actually watching that behaviour. In many cases animals or people who know they are being watched will not behave normally anyway in a process called the observer effect so often the observer needs to remain hidden from view. In these cases researcher might use one way mirror, or they might actually become participant in the group. This technique is called participant observation.

One of the major disadvantages of the naturalistic observation is the possibility of observer bias. That happens when the person doing the observing has a particular opinion about what he or she is going to see or expects to see. Sometimes that person sees only those actions that supports that expectation and ignores actions that don't fit. Another disadvantage is that each naturalistic setting is unique and unlike any other. Observations that are made at one time in one setting may not hold true for another time even if the setting is similar because the conditions are not going to be exactly the same time after time, researchers don't have that kind of control over the natural world.

Archival Research

In this method the researchers do not actually collect data themselves but they obtain data from public records, archives and so on. The researches merely analyses the data

attempts to draw certain conclusions from them. The method can be valuable in many respects. For instance there is no other way to collect data on suicides and homicides. Archival Data are those that are present in existing records or archives. The researcher simply examines or selects the data for analysis. Archival research may already exist or logistics or ethics may make it infeasible to conduct an experiment relating the variables of interest. Archival research has limitations; First most archival data are collected for naturalistic reasons. Governments are private agencies collect the data for their own purpose and such data often do not suit the purposes of the scientist. Second because archival research is by nature carried out after the fact ruling out alternative hypotheses for particular observed correlations may be difficult. A researcher who relies on archival data is at the mercy of any biases that may have occurred in collecting the data. Police records are notoriously subject to bias. Many categories of crime are seldom reported to the police.

Content Analysis

Content analysis sometimes known as document analysis is a method of systematic, examination of communications or of current records or documents. Instead of questioning respondents according to some scale items or observing their behaviour directly the content – analyser takes the communications or documents prepared by the respondents and systematically find out the frequency or proportion of their appearances.

In content or documents analysis the primary sources of data are: letters, autobiographies, diaries, compositions, records, reports, printed forms, themes or other academic work, books, periodicals, bulletins or catalogues, syllabus, court decisions, pictures, films, cartoons etc. It is the obligation of the researchers to establish the trustworthiness of these data that have been drawn. Content analysis can also be used with responses of projective test with all kinds of verbal materials and with materials specially produced for research problems.

Merits and Demerits

- First content analysis is applicable to a wide variety of materials such as creativity, attitude, and ethnocentrisms, stereotypes, curriculum changes values, interest, religiosity, college budgets etc.
- Second content analysis can also be used to examine the effect of experimental manipulation upon the dependent variables. If the investigator wants to study the effect of practice upon the improvement of handwriting of children, content analysis may be of no less importance than any experimental design.
- Third content analysis is also used to validate other methods of observation. Suppose one wants to validate a self-disclosure inventory. It is expected that people in general would not like to give personal information against which the test can be validated. But subjects can be asked some projective-type of

questions and the responses can be content-analysed. Subsequently the test can be validated against the content- analysed response.

- Despite these merits content analysis should be used with caution because of the complexities involved.

Surveys

Survey methods are widely used gathering scientific information. It involves collection of data by asking questions and recording people's answers to them. They are used for various purposes on frequent goal of this kind of research is to estimate population characteristics. For example the goal of survey might be to determine the percentage of people who hold supporting or opposing positions on particular social issues, such as provision of reservation for women in job. The census and public opinion done by various agencies are good examples of surveys.

Surveys can also be used to test hypotheses about the relationships among variable. One may try to find out the effect of some event on people's behaviour. For example surveys have been conducted after the earth quack at Bhuj in Gujarat to find out the impact of earthquake on people's lives.

In undertaking surveys the researcher defines the study population and draws the sample. The sample must be representative of the population. Researcher use different procedures of sampling. They can use random sampling in which every member of the population has an equal and independent chance of being included in the sample. Usually the researcher use stratified random sampling in which two or more sub samples are represented according to some predetermined proportion as they exist in the population. Sometimes groups are selected by using clusters or groupings from a larger population. This is known as cluster sampling. The sample size is also determined because the ability to generalise depends on the sample size used in the survey.

Depending upon the ways of collecting data survey methods can be classified into different categories namely personal interview, mail questionnaire, telephone survey, internet survey, web survey, etc.

Advantages:

- Survey methods have wide scope. In other words through survey method a great deal of information can be obtained by studying the larger population
- It is more accurate. As Kerlinger (1986) has put it." The accuracy of properly drawn samples is frequently surprising, even to experts in the field. A sample of 600 to 700 individuals or families can give a remarkably accurate portrait of a community its values attitudes and beliefs.
- A survey method has been frequently used in almost all the social sciences. Hence the method has inter-disciplinary value. In fact such researches provide raw materials for a vast increasing "gross disciplinary research" (Cambell & Katona, 1953).

- Survey method is considered a very important and indispensable tool for studying social attitudes, beliefs, values etc. with accuracy at the economic rate.

Disadvantages:

- Survey methods remains at the surface and it does not penetrate into the depth of the problem being investigated.
- Survey methods are time consuming, and demand a good amount of expenditure.
- Although it is true that survey research is accurate, it is still subject to sampling errors. In survey research there is always the probability of one chances in a twenty or hundred with an error, more serious than minor fluctuation of a chance, may occur and distort the validity of the result obtained.
- Survey method demands expertise, research knowledge and sophistication on the part of the researcher. In other words the researcher must know the techniques of sampling, questionnaire construction, interviewing and analysis of data.

Field Studies

Field studies are ex-post scientific inquiries aimed at discovering the relations and interactions among sociological, psychological and educational variables in real social structures. In scientific studies, large or small, they systematically pursue relations and test hypotheses, that are ex-post facto, that are made in actual life situations, will be considered field ex-post factor, that are made in actual life situations, will be considered field studies. The investigator in a field stud looks at the social or institutional situation and then studies the relations among the attitudes, values, perceptions, and behaviours of individuals and groups in the situation. He ordinarily manipulates no independent variables.

Katz (1953) has divided field studies into two board types exploratory and hypothesis testing. The exploratory types seek what is, rather than predict relations to be found. They have three purposes: (1) to discover significant variables in the field situation, (2) to discover relations among variables (3) to lay a ground work for later, more systematic and rigorous testing of hypothesis.

It is well to recognise though that there are activities preliminary to hypothesis testing in scientific research. In order to achieve the desirable aim of hypothesis testing, preliminary methodological and measurement investigation must often be done. The second subtype of exploratory field studies, research aimed at discovering or uncovering the relations, is indispensable to scientific advancement in the social sciences.

The field studies are strong in realism, significance, strength of variables, theory orientation and heuristic quality. The realism of field studies is obvious. They are

highly heuristic. Any researcher knows that one of the research difficulties of the field studies is to keep himself contained within the limits of his problem. Hypothesis is frequently fling themselves at one. The field is rich in discovery potentiality. After starting to gather data, he might stumble upon many interesting notions that can reflect the course of investigation.

Despite these strengths, the field study is a scientific weakness of laboratory experiments. Its most serious weakness of course is its ex-post facto character. Another methodological weakness is lack of precision in the measurement of field variables. Other weakness of field studies are practical problems: feasibility, cost, sampling, and time. The field researcher therefore, needs to be salesman, administrator and entrepreneur as well as investigator.

Case Studies

The case study is one of the important types of non-experimental research. The case study is not a specific technique rather it is one way of organising social data for the purpose of viewing social reality. It tends to preserve the unitary character of a social object being studied. It tends to examine a social unit as a whole. The unit may be a person a family a social group a social institution or even a community (Goode & Hatt 1981, Best & Kahn 1992).

A case study may utilise interview, observation, and psychological tests. It is a valuable research strategy in the fields of clinical psychology and human development. Using case study a researcher is able to have an in-depth look at one person. Those unique aspects of a person's life which cannot be duplicated for practical or ethical reasons are captured by case study. With the help of case study you can try to understand fantasies hopes fears traumatic experiences upbringing or anything that helps to understand a person's mind and behaviour. Case studies provide a narrative or detailed description of the events that takes place in a person's life. Freud's insight that led to the development of psychoanalytic theory emerged from his observation and reflections on individual cases. It should be remembered that the person studied as a case is unique and our judgments are of unknown reliability. Case studies provide detailed in-depth depictions of people' lives but we need to exercise caution when generalizing from individual cases. They are like naturalistic observations and all one can do is to describe the course of events.

The problem of validity of single case study is very serious. It is therefore recommended that researchers should use objective measurement techniques multiple sources of information and frequent assessment of relevant variables. The uses of case study as a research strategy requires that the cases must be chosen that represent the variable in question and one must have sufficient access to the cases. Careful planning of data collection is very necessary. Throughout the data-collection process the investigator is required to maintain a chain of evidence linking the various data sources having bearing on the research questions.

Check Your Progress Exercise 2.2

Notes: I. Write your answer in the space given below. II. Compare your answer with the one given at the end of this Unit.

Q.8 True/False

a) Detailed and in-depth description of people lives can be obtained through survey methods. T/F

b) Census is an example of correlational research. T/F

c) Survey helps to understand population. T/F

d) A case study may utilise observation and interview. T/F

e) Observer bias is one of the important problems associated with survey method. T/F

f) Case study method is most useful in clinical setting. T/F

g) Opinion polls are the examples of survey methods. T/F

h) Social behaviour under the war condition can be studied by the field study method. T/F

i) Quasi-experimental research involves random assignment of subject to different groups. T/F

j) Descriptive research does not have the characteristics of manipulations. T/F

EXPERIMENTAL METHODS

Laboratory Experiments

As you know a laboratory experiment is one of the most powerful techniques for studying the relationships between variables under controlled condition. It may be defined as the study of a problem in a situation in which some variables are manipulated and some are controlled in order to have an effect upon the dependent variable. The variables which are manipulated are known as independent variables and the variables which are controlled, are known as extraneous or relevant variables. Thus in a laboratory experiment the effect of manipulation of an independent variable upon the dependent variable is observed under controlled conditions. Festinger & Katz (1953:137) have defined a laboratory experiment as "one in which the investigator creates a situation with the exact conditions he wants to have and in which the controls some, and manipulates other variables".

Kerlinger (1986), there are three main purposes of the laboratory experiment. First, a laboratory experiment purports to discover a relationship between the dependent variable and the independent variable under pure, uncontaminated and controlled conditions. When a particular relationship is discovered, the experimenter is better able to predict the dependent variable. Second, a laboratory experiment helps in testing the accuracy of predictions derived from theses or researches. Third, a laboratory experiment helps building the theoretical systems by refining theories and hypotheses and thus, provides a breeding ground for scientific evaluation of those theories and hypotheses.

A laboratory experiment has some strength and weakness you have already read in the previous unit II, you may refer this for the detailed thereof.

Field Experiment

A field experiment is very similar to a laboratory experiment. A field experiment may be defined as a study carried out in a more or less realistic situation or field where the experimenter successfully manipulates one or more independent variables under the maximum possible controlled conditions. Experimenter manipulates one or more independent variable in natural setting for determining their effect upon behaviour, the procedure is known as field experiment.

Field experiment has number of Strengths which are given below:

1) A field experiment deals with the realistic life situation. Hence it is more suited for studying social changes, social processes and social influence.

2) One principle of research is that the more realistic the situation, the stronger is effect of the variables under study. In a field experiment this principle is fully satisfied. Thus, one can say that in the field experiment, since it deals with a realistic situation, the variables have stronger and more obvious effects.

3) Is derived from the above two points. When variables are stronger because of more realistic situations, an experimenter can make better and sound generalisations on the basis of the obtained results. In other words, this tends to increase the external validity of the field experiment. For example, when one carried out a field experiment by taking small groups of workers from a factory, and reaches the conclusion that absenteeism among workers is primarily due to the poor financial incentive, this can be safely generalized with respect to the workers of other factories as well because the experiment has been carried on actual workers in a factory.

4) A field experiment is well-suited for testing a broad hypothesis and theories and for obtaining answers to practical questions.

The principles weaknesses of field experiments are as given below:

1) Since a field experiment is carried out in a realistic situation, there is always the possibility that the effect of independent variables is contaminated with uncontrolled environmental variables.

2) The unexpected noise and gathering may affect the dependent variable and thereby, contaminate the influence of the independent variable. In a laboratory experiment this problem does not arise because of the fully controlled laboratory situation. However, if the situation is somehow fully controlled in a field experiment, it would prove to be a more powerful tool than the laboratory experiment.

3) In many field situations the manipulation of independent variables may be difficult due to non-cooperation of subjects. Children are to be exposed to frustrating situations; they may not like it and may restrain their children from being exposed to field situation.

4) In a field experiment it is not possible to achieve a high degree of precision or accuracy because of some uncontrolled environment variables.

5) Field experiment requires that the investigator has high social skills to deal effectively with people in a field situation.

SUMMARY

Psychological researches have been classified depending upon the extent to which they satisfy requirement of a scientific procedure based on the purpose for which it is undertaken. There are two types of psychological researches – Non-experimental and experimental research. In non-experimental researches, the independent variable is not manipulated; the researcher does not have complete control over the conditions of the non-experimental research study. Non-experimental researches are covered descriptive, historical correlational, qualitative and ex- post facto research. Experimental researches are controlled manipulation of the variables that allows the researcher to determine the cause and effect relationship. The unit has described the two types of experimental research i.e. true experimental research and quasi experimental research. Moreover this unit has described the major methods of nonexperimental researches namely – naturalistic observation, case studies, content analysis, achieves, field studies etc. Finally two research method of the experimental research i.e. laboratory experiment and field experiment are highlighted.

Glossary

Archival Method:	study method that examines existing records to obtain date and test hypotheses.
Case Study:	Study of one individual in great detail
Correlational:	Examine the relationship between variables.
Descriptive:	Describe the characteristics of an existing phenomenon.
Ex-Post Facto Research:	investigator attempts to trace an effect which has already occurred to its probable causes
Field Experiment:	a study carried out in more or less realistic situation where the experimenters manipulate independent under the maximum possible control condition.
Historical:	Relate events that have occurred in the past to current events.
Laboratory Experiments:	the techniques for studying the relationship between the variables under control condition
Naturalistic Observation:	observational research of subjects in their natural environment carried out to disturb the subjects as little as possible.
Observer Bias:	tendency of observer to see what they expect to see.
Qualitative:	To examine human behaviour and the social cultural and political contexts within which it occurs.
Quasi Experimental:	To test for casual relationship without having full control.
Survey:	assessing public opinion or individual characteristics by the use of questionnaire and sampling methods.
True Experimental:	To test for true cause and effect relationship.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: (a) Observer bias

Answer to Q.2: (d) All of these

Answer to Q.3: (c) Experimental

Answer to Q.4: (a) artificial environment

Answer to Q.5: (b) Field experiment

Answer to Q.6: (a) Naturalistic observation

Answer to Q.7: (c) Case Study

Answer to Q.8: a) F, b) F, c) T, d) T, e) F, f) T, g) T, h) T, i) F, j) T

Exercise

1. Discuss the different types of research?
2. What is true experimental research?
3. Explain the differences between basic and applied researches.
4. Discuss the experimental and non-experimental research.

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UNIT 3 TYPES OF RESEARCH (Experimental Research)

INTRODUCTION

Now you have a good idea about what research is, what are the bases for the conduction and experiment in tests, and how research process works? Now, it is time to turn to another related issue; how do social scientists actually perform the task of adding to our knowledge of human behaviour and relationship? There are a number of ways to investigate into the answer of research questions. The kind of methods researchers use depends on kind of questions they want to answer. This unit begins with discussion of two types of researches i.e. non-experimental researches and experimental researches. Non-experimental researches will cover various kinds of researches along with examples, namely; historical research, correlation research, qualitative research and ex-post facto researches. Further, you will learn about experimental researches which are conducted to establish the cause and effect relationship. This is followed by the details of main types of experimental researches i.e. true experimental researches and quasi experimental researches. Then, you will learn how true experimental researches differ from quasi experimental researches. We now need to enquire into various methods of psychological researches for obtaining data that may be used to arrive at an evidence report. Various kind of nonexperimental methods which are used to answer the questions, such as naturalistic observation, survey method, case study, content analysis, field studies are described. Finally, besides non-experimental methods, this unit will explain you the experimental methods i.e. laboratory experiment and field experiment.

LEARNING OBJECTIVES

After reading this unit, you will be able to:

- Explain the types of researches;
- Differentiate between experimental and non-experimental researches;
- Explain true experimental researches and quasi experimental researches;
- Describe advantages and disadvantages of each method which are used in psychological research;
- Differentiate laboratory experiments from field experiments;
- Explain the differences between basic and applied researches; and
- Identify experimental and non-experimental researches and methods.

TYPES OF RESEARCH

The types of research differ mostly on three dimensions:

4) The nature of the question asked;

5) The method used to answer it; and

6) The degree of precision the method brings to answering the questions.

One way in which these methods do not necessarily differ, however is in the content or the focus of the research. In other words, if you are interested in the effects of television viewing in children, your research can be non-experimental, wherein you survey watching habits. If experimental, you may expose children models to the TV and one group non-viewing of TV and look at the effect of the exposure on their behaviour. The most general way of classifying research is to divide it into fundamental or pure or basic research and applied research. A fundamental research is the formal and systematic process where the researcher aims to develop a theory or a model by identifying all the important variables in a situation and by discovering broad generalisations and principles about those variables. It utilizes a careful sample so that its conclusion can be generalised beyond the immediate situation. For example biological psychologists explore the links between brain and mind; developmental psychology studies our changing abilities from womb to tomb and the personality psychologists investigate our inner traits. Applied research, as its name implies, applies the theory or model developed through the fundamental research to the actual solution of the problems. Applied research tackles practical problems, as for example, industrial/ organisational psychologists study and advise on behaviour in the workplace. They use psychology concepts and methods to help organisations select and train employees. They boost morale of the employees and also their productivity. They design products and answer people's responses to them. Besides the fundamental research and the applied research another type of research has recently been popular in the fields of social psychology, industrial psychology, and education. This is known as „action research". In action research the researcher emphasises a problem which is immediate, urgent and has local applicability. Thus, the researcher here focuses upon the immediate consequences and applications of a problem and not upon general or universal application or upon the development of a theory or a model. A teacher may undertake a research to know the reasons underlying unhealthy classroom habits so that immediate outcome may benefit the local class- room students. There are number of researches, given here under:

Table 2.1Type of Research

Types of Research	
Non-Experimental	Experimental
Historical, Descriptive, Correlational, Qualitative , Ex-post facto	True experimental, Quasi experimental

NON-EXPERIMENTAL RESEARCH

A non-experimental research is one where independent variables cannot be manipulated. The researcher does not have complete control over the conditions of the non-experimental research studies. For example, if you want to survey the television-watching behaviour of adolescents, you could do so by having them maintain a diary in which they record what shows they watch and with whom. This descriptive study provides information about their television-watching habits but says

nothing about why they watch what they do. You are not in any way trying to have an impact on their television watching behaviour or investigate why they might watch particular shows. This is non-experimental in nature because no cause-and-effect relationships of any type are being hypothesized or investigated. Non-experimental or descriptive research describes the characteristics of an existing phenomenon. Census of any contrary, current unemployment rate of working single parents who have children under age 5 etc. are the examples of descriptive research. A second characteristic of non-experimental is that the data collection procedure often must forfeit some degree of control in return for obtaining the data. For example the researcher may decide to study public records that may be almost, but not exactly in the form we desire or researcher may have to keep a questionnaire start to help gain the cooperation of subjects.

Historical Research

Historical research relates past events to one another or to current events. Basically, historical research (or historiography) answers the question: what is the nature of events that have happened in the past? For example, one might want to examine trends in treatment of mental illness or how attitudes toward work and families have changed. All of these questions require the detective work of a historian, finding and collecting relevant data and then, just as with any other research endeavour, testing a hypothesis. In fact, like any other researcher, the historian collects data, analyses them, and then comes to conclusions about the tenability of the hypothesis. One significant difference between historical research and other types of research is the type of data collected and the method of collection. Researchers who do historical research often accomplish this goal through the use of primary sources (original documents or information from people who have personally experienced an event) and secondary sources (second hand documents or information from people who may have some knowledge about the event but did not experience it first hand). Even if these sources are readily available, however, one of the greatest challenges doing such research is in knowing how much faith the researcher can put on the accuracy of the sources. Examining the trends in achievement level of Indian children compared with American children is an example of historical research.

Descriptive Research

Descriptive research describes and interprets what is. It is concerned with conditions or relationships that exist, the practices that prevail, the beliefs or attitudes that are held, the processes that are going on; effects that are being felt or trends that are developments. The approach is directed towards identifying various characteristics of research problems and to create observations conducive to further research. Descriptive research describes characteristics of an existing phenomenon. Descriptive research provides a broad picture of a phenomenon you might be interested in exploring. Current employment rates, census of any country, number of working single parents are examples of descriptive research.

Correlational Research

Descriptive and historical research provides a picture of events that are currently happening or have occurred in the past. Researchers often want to go beyond mere description and begin discussing the relationship that certain events might have to one another. The most likely type of research to answer questions about the relationship among variables or events is called correlational events. Correlational research provides some indication as to how two or more things are related to one another or, in effect what they share or have in common or how well a specific outcome might be predicted by one or more pieces of information. Correlational research uses a numerical index called the correlation coefficient as a measure of the strength of this relationship. For example, if you are interested to find out the relationship between the number of hours spent in studying and their achievement, then you would be doing correlational research, because you are interested in the relationship between these two variables. If you are interested in finding out the best predictors of success in a school you would be doing a type of correlational research that includes prediction.

One of the most important points about correlational research is that it examines relationships between variables but in no way implies that one causes changes in the other. In other words, correlation and prediction examine associations but not causal relationships, wherein a change in one factor directly influences a change in another.

Qualitative Research

The general purpose of qualitative research methods is to examine human behaviour in the social, cultural, and political contexts in which they occur. This is done through a variety of tools, such as interviews, historical methods, case studies, and ethnography and usually results in qualitative (or non-numeric) primary data. In other words, the qualitative researcher is more (but not only) interested in the contents of an interviewee's speech than in the number of times (frequency) a particular comment is made. Qualitative research is relatively new to the social and behavioural sciences and, to a large extent its increasing popularity is due to a degree of dissatisfaction with other available research methods. Some social scientists view that the traditional experimental model is just too restrictive and narrow, prevent underlying and important factors and relationships from being revealed. But what's so valuable about this set of tools is that it allows you to answer a whole new set of questions in a whole new way.

Qualitative research is the interpretive study of a specific issue or a problem in which the researcher is central to the research process. It's a naturalistic inquiry, which unfolds in a non-manipulative fashion. It lacks the predetermined constraints on outcome variables. Qualitative methods yield data in the form of words than numbers. Qualitative studies provide rich description and explanation of processes in specific local contexts. They provide a feel of the processes by focusing on the chronological

flow or sequence of events leading to certain outcomes or consequences. The whole phenomenon is studied with a strategy of a detailed or elaborate (thick) description. Throughout the conduct of qualitative study interpretation and reflection on the part of researcher is required.

Qualitative data can come from a variety of sources and can take a variety of forms. The data may be used as a supplement to quantitative data or may be used in their own right. Qualitative data can be obtained through a variety of methods such as case studies, interviews, discourse analysis, narratives, and ethnography and participant observation.

Ex-post-facto Research

In this kind of research, the independent variable or variables have already occurred in which the researcher starts with observation of a dependent variable or variables. He then studies the independent variables in retrospect for their possible relations to and effects on the dependent variable or variables. The most important difference between experimental research and ex-post facto research is control. In the former, the investigator has a manipulative control on the independent variable, whereas in the latter this control is not possible, more than this, randomization is not possible. In the ex-post facto research, the researcher must take things as they are and try to collect data and analyse them in that context.

In an ideal social scientific research, the possibility of finding random samples of subjects and randomly assigning them to groups and treatment to group would always be possible. However, these possibilities do not exist in the real situation. The ex-post facto research could be of a large scale or a small scale. This type of research has three weaknesses:

- the inability to manipulate the independent variables,
- lack of power to randomize, and
- the risk of improper interpretation.

In other words, compared to experimental research, other things being equal, ex-post facto research lacks control. This lack is a basis for the third weakness: the risk of improper interpretation. Therefore, committing unequivocally to experimentation or to ex-post facto research may be poor policy; Ex-post facto research may not have particular hypothesis as a predicted relationship may be quite spurious. Therefore, expost facto research that is conducted without hypothesis, without predictions, research in which data are just collected and then interpreted is even more dangerous in its power to mislead.

Check Your Progress Exercise 2.1

Note:

III. Write your answer in the space given below.

IV. Compare your answer with the one given at the end of this Unit.

In a naturalistic observation , the phenomenon in which the behaviour of thesubjects being observed changes because they are being watched is called:

a) Observer Bias
b) Participant Observation
d) Observer Effect
d) Representative Sampling

Fields experiments are concerned with:

a) casual relationships
b) direction of relationships
c) natural setting
d) all of these

Results are obtained under artificial conditions is a limitation of method:

e) observational
f) clinical
g) experimental
h) none

Which one is not the limitation of laboratory experiment:

e) artificial environment
f) lack of internal validity
g) study of all variables not possible
h) extraneous factors

Which one is not a non-experimental research

e) field study
f) field experiment
g) case study
h) survey

The investigator simply observes and records what happens in the natural environment in the:

a) naturalistic observation
b) the survey method
c) the clinical approach
d) experimental method

Results of which methods cannot be generalise to the population at large:

a) survey
b) experiment
c) case study
d) field study

EXPERIMENTAL RESEARCH

You already know that correlational research can help to establish the presence of a relationship among variables but does not provide any reason to believe that variables are causally related to one another. How does one find out if characteristics, behaviour, or events are related in such a way that the relationship is causal one? There are two types of research that can answer that question: true experimental research and quasi-experimental research.

True Experimental Research

In true experimental research, participants are assigned to groups based on some criterion, often called the treatment variable or treatment condition. For example, you want to compare effects of two different techniques for reducing obsessive compulsive disorder behaviour in adults. The first technique includes behavioural therapy and the second does not. Once adults are assigned to groups and the programs are completed, you will want to look for any differences between the two groups with regard to the effects of the therapy on the number of obsessive-compulsive behaviours. Because assignment to the groups is determined by the researcher, the researcher has given assignment to the groups as determined by the researcher, and thus the researcher has complete control over the factors to which the adults are exposed. This is the ideal model for establishing a cause and effect relationship because the researcher has clearly defined the possible cause and can keep very close tabs on what is happening. Most important, however is that the researcher has complete control over the treatment.

Quasi Experimental Research

In quasi-experimental study, the researcher does not have a such a high degree of control because people have already been indirectly assigned to those groups (e.g., social class, type of abuse, gender, type of injury) for which you are testing the effects. In these researches participants are pre-assigned to groups based on some predetermined characteristics or quality. Differences in gender, race, age, grade in school, neighbourhood of residence, type of job, and even experiences are examples. These groups‟ assignments have already taken place before the experiment begins, and the researcher has no control as to who is assigned to each group.

The most important use of the quasi experimental method occurs where researchers cannot, in good conscience, assign people to groups and test the effects of group membership on some other outcome. For example, researchers who are interested in the effects of parental unemployment on children could not very well encourage mothers or fathers to quit work. Rather, they would seek out families where parents are already unemployed and then conduct the research.

Quasi-experimental research is also called post hoc, or after-the-fact, research because the actual research takes place after the assignment of groups (e.g., employed

versus unemployed, malnourished versus non-malnourished, male versus female). Because assignment has already taken place, the researcher has a high degree, but not the highest degree, of control over the cause of whatever effects are being examined.

For the highest degree of control to occur, the true experimental model needs to be followed.

METHODS OF RESEARCH

Methods of research can be classified into two categories: Non-experimental methods and experimental methods.

Non-Experimental Methods

Naturalistic Observation

Sometimes all researchers need to know is what is happening to a group of animals or people. The best way to look at his behaviour of animals or people is to watch them behave in their normal environment. In naturalistic observation a scientist observes behaviour in real world settings and makes no effort to manipulate or control the situation. Researchers conduct naturalistic observation at homes, day-care canters and so on. For example, if someone wanted to know how adolescents behave with members of the opposite sex in a social setting the researcher might go the mall on a weekend night.

The most important advantage of naturalistic observation is that it allows researchers to get a realistic picture of how behaviour occurs because they are actually watching that behaviour. In many cases animals or people who know they are being watched will not behave normally anyway in a process called the observer effect so often the observer needs to remain hidden from view. In these cases researcher might use one way mirror, or they might actually become participant in the group. This technique is called participant observation.

One of the major disadvantages of the naturalistic observation is the possibility of observer bias. That happens when the person doing the observing has a particular opinion about what he or she is going to see or expects to see. Sometimes that person sees only those actions that supports that expectation and ignores actions that don't fit. Another disadvantage is that each naturalistic setting is unique and unlike any other. Observations that are made at one time in one setting may not hold true for another time even if the setting is similar because the conditions are not going to be exactly the same time after time, researchers don't have that kind of control over the natural world.

Archival Research

In this method the researchers do not actually collect data themselves but they obtain data from public records, archives and so on. The researches merely analyses the data

attempts to draw certain conclusions from them. The method can be valuable in many respects. For instance there is no other way to collect data on suicides and homicides. Archival Data are those that are present in existing records or archives. The researcher simply examines or selects the data for analysis. Archival research may already exist or logistics or ethics may make it infeasible to conduct an experiment relating the variables of interest. Archival research has limitations; First most archival data are collected for naturalistic reasons. Governments are private agencies collect the data for their own purpose and such data often do not suit the purposes of the scientist. Second because archival research is by nature carried out after the fact ruling out alternative hypotheses for particular observed correlations may be difficult. A researcher who relies on archival data is at the mercy of any biases that may have occurred in collecting the data. Police records are notoriously subject to bias. Many categories of crime are seldom reported to the police.

Content Analysis

Content analysis sometimes known as document analysis is a method of systematic, examination of communications or of current records or documents. Instead of questioning respondents according to some scale items or observing their behaviour directly the content – analyser takes the communications or documents prepared by the respondents and systematically find out the frequency or proportion of their appearances.

In content or documents analysis the primary sources of data are: letters, autobiographies, diaries, compositions, records, reports, printed forms, themes or other academic work, books, periodicals, bulletins or catalogues, syllabus, court decisions, pictures, films, cartoons etc. It is the obligation of the researchers to establish the trustworthiness of these data that have been drawn. Content analysis can also be used with responses of projective test with all kinds of verbal materials and with materials specially produced for research problems.

Merits and Demerits

- First content analysis is applicable to a wide variety of materials such as creativity, attitude, and ethnocentrisms, stereotypes, curriculum changes values, interest, religiosity, college budgets etc.
- Second content analysis can also be used to examine the effect of experimental manipulation upon the dependent variables. If the investigator wants to study the effect of practice upon the improvement of handwriting of children, content analysis may be of no less importance than any experimental design.
- Third content analysis is also used to validate other methods of observation. Suppose one wants to validate a self-disclosure inventory. It is expected that people in general would not like to give personal information against which the test can be validated. But subjects can be asked some projective-type of

questions and the responses can be content-analysed. Subsequently the test can be validated against the content- analysed response.

- Despite these merits content analysis should be used with caution because of the complexities involved.

Surveys

Survey methods are widely used gathering scientific information. It involves collection of data by asking questions and recording people's answers to them. They are used for various purposes on frequent goal of this kind of research is to estimate population characteristics. For example the goal of survey might be to determine the percentage of people who hold supporting or opposing positions on particular social issues, such as provision of reservation for women in job. The census and public opinion done by various agencies are good examples of surveys.

Surveys can also be used to test hypotheses about the relationships among variable. One may try to find out the effect of some event on people's behaviour. For example surveys have been conducted after the earth quack at Bhuj in Gujarat to find out the impact of earthquake on people's lives.

In undertaking surveys the researcher defines the study population and draws the sample. The sample must be representative of the population. Researcher use different procedures of sampling. They can use random sampling in which every member of the population has an equal and independent chance of being included in the sample. Usually the researcher use stratified random sampling in which two or more sub samples are represented according to some predetermined proportion as they exist in the population. Sometimes groups are selected by using clusters or groupings from a larger population. This is known as cluster sampling. The sample size is also determined because the ability to generalise depends on the sample size used in the survey.

Depending upon the ways of collecting data survey methods can be classified into different categories namely personal interview, mail questionnaire, telephone survey, internet survey, web survey, etc.

Advantages:

- Survey methods have wide scope. In other words through survey method a great deal of information can be obtained by studying the larger population
- It is more accurate. As Kerlinger (1986) has put it." The accuracy of properly drawn samples is frequently surprising, even to experts in the field. A sample of 600 to 700 individuals or families can give a remarkably accurate portrait of a community its values attitudes and beliefs.
- A survey method has been frequently used in almost all the social sciences. Hence the method has inter-disciplinary value. In fact such researches provide raw materials for a vast increasing "gross disciplinary research" (Cambell & Katona, 1953).

- Survey method is considered a very important and indispensable tool for studying social attitudes, beliefs, values etc. with accuracy at the economic rate.

Disadvantages:

- Survey methods remains at the surface and it does not penetrate into the depth of the problem being investigated.
- Survey methods are time consuming, and demand a good amount of expenditure.
- Although it is true that survey research is accurate, it is still subject to sampling errors. In survey research there is always the probability of one chances in a twenty or hundred with an error, more serious than minor fluctuation of a chance, may occur and distort the validity of the result obtained.
- Survey method demands expertise, research knowledge and sophistication on the part of the researcher. In other words the researcher must know the techniques of sampling, questionnaire construction, interviewing and analysis of data.

Field Studies

Field studies are ex-post scientific inquiries aimed at discovering the relations and interactions among sociological, psychological and educational variables in real social structures. In scientific studies, large or small, they systematically pursue relations and test hypotheses, that are ex-post facto, that are made in actual life situations, will be considered field ex-post factor, that are made in actual life situations, will be considered field studies. The investigator in a field stud looks at the social or institutional situation and then studies the relations among the attitudes, values, perceptions, and behaviours of individuals and groups in the situation. He ordinarily manipulates no independent variables.

Katz (1953) has divided field studies into two board types exploratory and hypothesis testing. The exploratory types seek what is, rather than predict relations to be found. They have three purposes: (1) to discover significant variables in the field situation, (2) to discover relations among variables (3) to lay a ground work for later, more systematic and rigorous testing of hypothesis.

It is well to recognise though that there are activities preliminary to hypothesis testing in scientific research. In order to achieve the desirable aim of hypothesis testing, preliminary methodological and measurement investigation must often be done. The second subtype of exploratory field studies, research aimed at discovering or uncovering the relations, is indispensable to scientific advancement in the social sciences.

The field studies are strong in realism, significance, strength of variables, theory orientation and heuristic quality. The realism of field studies is obvious. They are

highly heuristic. Any researcher knows that one of the research difficulties of the field studies is to keep himself contained within the limits of his problem. Hypothesis is frequently fling themselves at one. The field is rich in discovery potentiality. After starting to gather data, he might stumble upon many interesting notions that can reflect the course of investigation.

Despite these strengths, the field study is a scientific weakness of laboratory experiments. Its most serious weakness of course is its ex-post facto character. Another methodological weakness is lack of precision in the measurement of field variables. Other weakness of field studies are practical problems: feasibility, cost, sampling, and time. The field researcher therefore, needs to be salesman, administrator and entrepreneur as well as investigator.

Case Studies

The case study is one of the important types of non-experimental research. The case study is not a specific technique rather it is one way of organising social data for the purpose of viewing social reality. It tends to preserve the unitary character of a social object being studied. It tends to examine a social unit as a whole. The unit may be a person a family a social group a social institution or even a community (Goode & Hatt 1981, Best & Kahn 1992).

A case study may utilise interview, observation, and psychological tests. It is a valuable research strategy in the fields of clinical psychology and human development. Using case study a researcher is able to have an in-depth look at one person. Those unique aspects of a person's life which cannot be duplicated for practical or ethical reasons are captured by case study. With the help of case study you can try to understand fantasies hopes fears traumatic experiences upbringing or anything that helps to understand a person's mind and behaviour. Case studies provide a narrative or detailed description of the events that takes place in a person's life. Freud's insight that led to the development of psychoanalytic theory emerged from his observation and reflections on individual cases. It should be remembered that the person studied as a case is unique and our judgments are of unknown reliability. Case studies provide detailed in-depth depictions of people' lives but we need to exercise caution when generalizing from individual cases. They are like naturalistic observations and all one can do is to describe the course of events.

The problem of validity of single case study is very serious. It is therefore recommended that researchers should use objective measurement techniques multiple sources of information and frequent assessment of relevant variables. The uses of case study as a research strategy requires that the cases must be chosen that represent the variable in question and one must have sufficient access to the cases. Careful planning of data collection is very necessary. Throughout the data-collection process the investigator is required to maintain a chain of evidence linking the various data sources having bearing on the research questions.

Check Your Progress Exercise 2.2

Notes: I. Write your answer in the space given below. II. Compare your answer with the one given at the end of this Unit.

Q.8 True/False

i) Detailed and in-depth description of people lives can be obtained through survey methods. T/F

j) Census is an example of correlational research. T/F

k) Survey helps to understand population. T/F

l) A case study may utilise observation and interview. T/F

m) Observer bias is one of the important problems associated with survey method. T/F

n) Case study method is most useful in clinical setting. T/F

o) Opinion polls are the examples of survey methods. T/F

p) Social behaviour under the war condition can be studied by the field study method. T/F

i) Quasi-experimental research involves random assignment of subject to different groups. T/F

j) Descriptive research does not have the characteristics of manipulations. T/F

EXPERIMENTAL METHODS

Laboratory Experiments

As you know a laboratory experiment is one of the most powerful techniques for studying the relationships between variables under controlled condition. It may be defined as the study of a problem in a situation in which some variables are manipulated and some are controlled in order to have an effect upon the dependent variable. The variables which are manipulated are known as independent variables and the variables which are controlled, are known as extraneous or relevant variables. Thus in a laboratory experiment the effect of manipulation of an independent variable upon the dependent variable is observed under controlled conditions. Festinger & Katz (1953:137) have defined a laboratory experiment as "one in which the investigator creates a situation with the exact conditions he wants to have and in which the controls some, and manipulates other variables".

Kerlinger (1986), there are three main purposes of the laboratory experiment. First, a laboratory experiment purports to discover a relationship between the dependent variable and the independent variable under pure, uncontaminated and controlled conditions. When a particular relationship is discovered, the experimenter is better able to predict the dependent variable. Second, a laboratory experiment helps in testing the accuracy of predictions derived from theses or researches. Third, a laboratory experiment helps building the theoretical systems by refining theories and hypotheses and thus, provides a breeding ground for scientific evaluation of those theories and hypotheses.

A laboratory experiment has some strength and weakness you have already read in the previous unit II, you may refer this for the detailed thereof.

Field Experiment

A field experiment is very similar to a laboratory experiment. A field experiment may be defined as a study carried out in a more or less realistic situation or field where the experimenter successfully manipulates one or more independent variables under the maximum possible controlled conditions. Experimenter manipulates one or more independent variable in natural setting for determining their effect upon behaviour, the procedure is known as field experiment.

Field experiment has number of Strengths which are given below:

5) A field experiment deals with the realistic life situation. Hence it is more suited for studying social changes, social processes and social influence.

6) One principle of research is that the more realistic the situation, the stronger is effect of the variables under study. In a field experiment this principle is fully satisfied. Thus, one can say that in the field experiment, since it deals with a realistic situation, the variables have stronger and more obvious effects.

7) Is derived from the above two points. When variables are stronger because of more realistic situations, an experimenter can make better and sound generalisations on the basis of the obtained results. In other words, this tends to increase the external validity of the field experiment. For example, when one carried out a field experiment by taking small groups of workers from a factory, and reaches the conclusion that absenteeism among workers is primarily due to the poor financial incentive, this can be safely generalized with respect to the workers of other factories as well because the experiment has been carried on actual workers in a factory.

8) A field experiment is well-suited for testing a broad hypothesis and theories and for obtaining answers to practical questions.

The principles weaknesses of field experiments are as given below:

6) Since a field experiment is carried out in a realistic situation, there is always the possibility that the effect of independent variables is contaminated with uncontrolled environmental variables.

7) The unexpected noise and gathering may affect the dependent variable and thereby, contaminate the influence of the independent variable. In a laboratory experiment this problem does not arise because of the fully controlled laboratory situation. However, if the situation is somehow fully controlled in a field experiment, it would prove to be a more powerful tool than the laboratory experiment.

8) In many field situations the manipulation of independent variables may be difficult due to non-cooperation of subjects. Children are to be exposed to frustrating situations; they may not like it and may restrain their children from being exposed to field situation.

9) In a field experiment it is not possible to achieve a high degree of precision or accuracy because of some uncontrolled environment variables.

10) Field experiment requires that the investigator has high social skills to deal effectively with people in a field situation.

SUMMARY

Psychological researches have been classified depending upon the extent to which they satisfy requirement of a scientific procedure based on the purpose for which it is undertaken. There are two types of psychological researches – Non-experimental and experimental research. In non-experimental researches, the independent variable is not manipulated; the researcher does not have complete control over the conditions of the non-experimental research study. Non-experimental researches are covered descriptive, historical correlational, qualitative and ex- post facto research. Experimental researches are controlled manipulation of the variables that allows the researcher to determine the cause and effect relationship. The unit has described the two types of experimental research i.e. true experimental research and quasi experimental research. Moreover this unit has described the major methods of nonexperimental researches namely – naturalistic observation, case studies, content analysis, achieves, field studies etc. Finally two research method of the experimental research i.e. laboratory experiment and field experiment are highlighted.

Glossary

Archival Method:	study method that examines existing records to obtain date and test hypotheses.
Case Study:	Study of one individual in great detail
Correlational:	Examine the relationship between variables.
Descriptive:	Describe the characteristics of an existing phenomenon.
Ex-Post Facto Research:	investigator attempts to trace an effect which has already occurred to its probable causes
Field Experiment:	a study carried out in more or less realistic situation where the experimenters manipulate independent under the maximum possible control condition.
Historical:	Relate events that have occurred in the past to current events.
Laboratory Experiments:	the techniques for studying the relationship between the variables under control condition
Naturalistic Observation:	observational research of subjects in their natural environment carried out to disturb the subjects as little as possible.
Observer Bias:	tendency of observer to see what they expect to see.
Qualitative:	To examine human behaviour and the social cultural and political contexts within which it occurs.
Quasi Experimental:	To test for casual relationship without having full control.
Survey:	assessing public opinion or individual characteristics by the use of questionnaire and sampling methods.
True Experimental:	To test for true cause and effect relationship.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: (a) Observer bias

Answer to Q.2: (d) All of these

Answer to Q.3: (c) Experimental

Answer to Q.4: (a) artificial environment

Answer to Q.5: (b) Field experiment

Answer to Q.6: (a) Naturalistic observation

Answer to Q.7: (c) Case Study

Answer to Q.8: a) F, b) F, c) T, d) T, e) F, f) T, g) T, h) T, i) F, j) T

Exercise

1. Discuss the different types of research?
2. What is true experimental research?
3. Explain the differences between basic and applied researches.
4. Discuss the experimental and non-experimental research.

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UNIT 4 METHODS OF RESEARCH (Non-Experimental Methods)

INTRODUCTION

Now you have a good idea about what research is, what are the bases for the conduction and experiment in tests, and how research process works? Now, it is time to turn to another related issue; how do social scientists actually perform the task of adding to our knowledge of human behaviour and relationship? There are a number of ways to investigate into the answer of research questions. The kind of methods researchers use depends on kind of questions they want to answer. This unit begins with discussion of two types of researches i.e. non-experimental researches and experimental researches. Non-experimental researches will cover various kinds of researches along with examples, namely; historical research, correlation research, qualitative research and ex-post facto researches. Further, you will learn about experimental researches which are conducted to establish the cause and effect relationship. This is followed by the details of main types of experimental researches i.e. true experimental researches and quasi experimental researches. Then, you will learn how true experimental researches differ from quasi experimental researches. We now need to enquire into various methods of psychological researches for obtaining data that may be used to arrive at an evidence report. Various kind of nonexperimental methods which are used to answer the questions, such as naturalistic observation, survey method, case study, content analysis, field studies are described. Finally, besides non-experimental methods, this unit will explain you the experimental methods i.e. laboratory experiment and field experiment.

LEARNING OBJECTIVES

After reading this unit, you will be able to:

- Explain the types of researches;
- Differentiate between experimental and non-experimental researches;
- Explain true experimental researches and quasi experimental researches;
- Describe advantages and disadvantages of each method which are used in psychological research;
- Differentiate laboratory experiments from field experiments;
- Explain the differences between basic and applied researches; and
- Identify experimental and non-experimental researches and methods.

TYPES OF RESEARCH

The types of research differ mostly on three dimensions:

7) The nature of the question asked;

8) The method used to answer it; and

9) The degree of precision the method brings to answering the questions.

One way in which these methods do not necessarily differ, however is in the content or the focus of the research. In other words, if you are interested in the effects of television viewing in children, your research can be non-experimental, wherein you survey watching habits. If experimental, you may expose children models to the TV and one group non-viewing of TV and look at the effect of the exposure on their behaviour. The most general way of classifying research is to divide it into fundamental or pure or basic research and applied research. A fundamental research is the formal and systematic process where the researcher aims to develop a theory or a model by identifying all the important variables in a situation and by discovering broad generalisations and principles about those variables. It utilizes a careful sample so that its conclusion can be generalised beyond the immediate situation. For example biological psychologists explore the links between brain and mind; developmental psychology studies our changing abilities from womb to tomb and the personality psychologists investigate our inner traits. Applied research, as its name implies, applies the theory or model developed through the fundamental research to the actual solution of the problems. Applied research tackles practical problems, as for example, industrial/ organisational psychologists study and advise on behaviour in the workplace. They use psychology concepts and methods to help organisations select and train employees. They boost morale of the employees and also their productivity. They design products and answer people's responses to them. Besides the fundamental research and the applied research another type of research has recently been popular in the fields of social psychology, industrial psychology, and education. This is known as „action research". In action research the researcher emphasises a problem which is immediate, urgent and has local applicability. Thus, the researcher here focuses upon the immediate consequences and applications of a problem and not upon general or universal application or upon the development of a theory or a model. A teacher may undertake a research to know the reasons underlying unhealthy classroom habits so that immediate outcome may benefit the local class- room students. There are number of researches, given here under:

Table 2.1Type of Research

Types of Research	
Non-Experimental	Experimental
Historical, Descriptive, Correlational, Qualitative , Ex-post facto	True experimental, Quasi experimental

NON-EXPERIMENTAL RESEARCH

A non-experimental research is one where independent variables cannot be manipulated. The researcher does not have complete control over the conditions of the non-experimental research studies. For example, if you want to survey the television-watching behaviour of adolescents, you could do so by having them maintain a diary in which they record what shows they watch and with whom. This descriptive study provides information about their television-watching habits but says

nothing about why they watch what they do. You are not in any way trying to have an impact on their television watching behaviour or investigate why they might watch particular shows. This is non-experimental in nature because no cause-and-effect relationships of any type are being hypothesized or investigated. Non-experimental or descriptive research describes the characteristics of an existing phenomenon. Census of any contrary, current unemployment rate of working single parents who have children under age 5 etc. are the examples of descriptive research. A second characteristic of non-experimental is that the data collection procedure often must forfeit some degree of control in return for obtaining the data. For example the researcher may decide to study public records that may be almost, but not exactly in the form we desire or researcher may have to keep a questionnaire start to help gain the cooperation of subjects.

Historical Research

Historical research relates past events to one another or to current events. Basically, historical research (or historiography) answers the question: what is the nature of events that have happened in the past? For example, one might want to examine trends in treatment of mental illness or how attitudes toward work and families have changed. All of these questions require the detective work of a historian, finding and collecting relevant data and then, just as with any other research endeavour, testing a hypothesis. In fact, like any other researcher, the historian collects data, analyses them, and then comes to conclusions about the tenability of the hypothesis. One significant difference between historical research and other types of research is the type of data collected and the method of collection. Researchers who do historical research often accomplish this goal through the use of primary sources (original documents or information from people who have personally experienced an event) and secondary sources (second hand documents or information from people who may have some knowledge about the event but did not experience it first hand). Even if these sources are readily available, however, one of the greatest challenges doing such research is in knowing how much faith the researcher can put on the accuracy of the sources. Examining the trends in achievement level of Indian children compared with American children is an example of historical research.

Descriptive Research

Descriptive research describes and interprets what is. It is concerned with conditions or relationships that exist, the practices that prevail, the beliefs or attitudes that are held, the processes that are going on; effects that are being felt or trends that are developments. The approach is directed towards identifying various characteristics of research problems and to create observations conducive to further research. Descriptive research describes characteristics of an existing phenomenon. Descriptive research provides a broad picture of a phenomenon you might be interested in exploring. Current employment rates, census of any country, number of working single parents are examples of descriptive research.

Correlational Research

Descriptive and historical research provides a picture of events that are currently happening or have occurred in the past. Researchers often want to go beyond mere description and begin discussing the relationship that certain events might have to one another. The most likely type of research to answer questions about the relationship among variables or events is called correlational events. Correlational research provides some indication as to how two or more things are related to one another or, in effect what they share or have in common or how well a specific outcome might be predicted by one or more pieces of information. Correlational research uses a numerical index called the correlation coefficient as a measure of the strength of this relationship. For example, if you are interested to find out the relationship between the number of hours spent in studying and their achievement, then you would be doing correlational research, because you are interested in the relationship between these two variables. If you are interested in finding out the best predictors of success in a school you would be doing a type of correlational research that includes prediction.

One of the most important points about correlational research is that it examines relationships between variables but in no way implies that one causes changes in the other. In other words, correlation and prediction examine associations but not causal relationships, wherein a change in one factor directly influences a change in another.

Qualitative Research

The general purpose of qualitative research methods is to examine human behaviour in the social, cultural, and political contexts in which they occur. This is done through a variety of tools, such as interviews, historical methods, case studies, and ethnography and usually results in qualitative (or non-numeric) primary data. In other words, the qualitative researcher is more (but not only) interested in the contents of an interviewee's speech than in the number of times (frequency) a particular comment is made. Qualitative research is relatively new to the social and behavioural sciences and, to a large extent its increasing popularity is due to a degree of dissatisfaction with other available research methods. Some social scientists view that the traditional experimental model is just too restrictive and narrow, prevent underlying and important factors and relationships from being revealed. But what's so valuable about this set of tools is that it allows you to answer a whole new set of questions in a whole new way.

Qualitative research is the interpretive study of a specific issue or a problem in which the researcher is central to the research process. It's a naturalistic inquiry, which unfolds in a non-manipulative fashion. It lacks the predetermined constraints on outcome variables. Qualitative methods yield data in the form of words than numbers. Qualitative studies provide rich description and explanation of processes in specific local contexts. They provide a feel of the processes by focusing on the chronological

flow or sequence of events leading to certain outcomes or consequences. The whole phenomenon is studied with a strategy of a detailed or elaborate (thick) description. Throughout the conduct of qualitative study interpretation and reflection on the part of researcher is required.

Qualitative data can come from a variety of sources and can take a variety of forms. The data may be used as a supplement to quantitative data or may be used in their own right. Qualitative data can be obtained through a variety of methods such as case studies, interviews, discourse analysis, narratives, and ethnography and participant observation.

Ex-post-facto Research

In this kind of research, the independent variable or variables have already occurred in which the researcher starts with observation of a dependent variable or variables. He then studies the independent variables in retrospect for their possible relations to and effects on the dependent variable or variables. The most important difference between experimental research and ex-post facto research is control. In the former, the investigator has a manipulative control on the independent variable, whereas in the latter this control is not possible, more than this, randomization is not possible. In the ex-post facto research, the researcher must take things as they are and try to collect data and analyse them in that context.

In an ideal social scientific research, the possibility of finding random samples of subjects and randomly assigning them to groups and treatment to group would always be possible. However, these possibilities do not exist in the real situation. The ex-post facto research could be of a large scale or a small scale. This type of research has three weaknesses:

- the inability to manipulate the independent variables,
- lack of power to randomize, and
- the risk of improper interpretation.

In other words, compared to experimental research, other things being equal, ex-post facto research lacks control. This lack is a basis for the third weakness: the risk of improper interpretation. Therefore, committing unequivocally to experimentation or to ex-post facto research may be poor policy; Ex-post facto research may not have particular hypothesis as a predicted relationship may be quite spurious. Therefore, expost facto research that is conducted without hypothesis, without predictions, research in which data are just collected and then interpreted is even more dangerous in its power to mislead.

Check Your Progress Exercise 2.1

Note:

V. Write your answer in the space given below.

VI. Compare your answer with the one given at the end of this Unit.

In a naturalistic observation , the phenomenon in which the behaviour of thesubjects being observed changes because they are being watched is called:

a) Observer Bias
b) Participant Observation
e) Observer Effect
d) Representative Sampling

Fields experiments are concerned with:

a) casual relationships
b) direction of relationships
c) natural setting
d) all of these

Results are obtained under artificial conditions is a limitation of method:

i) observational
j) clinical
k) experimental
l) none

Which one is not the limitation of laboratory experiment:

i) artificial environment
j) lack of internal validity
k) study of all variables not possible
l) extraneous factors

Which one is not a non-experimental research

i) field study
j) field experiment
k) case study
l) survey

The investigator simply observes and records what happens in the natural environment in the:

a) naturalistic observation
b) the survey method
c) the clinical approach
d) experimental method

Results of which methods cannot be generalise to the population at large:

a) survey
b) experiment
c) case study
d) field study

EXPERIMENTAL RESEARCH

You already know that correlational research can help to establish the presence of a relationship among variables but does not provide any reason to believe that variables are causally related to one another. How does one find out if characteristics, behaviour, or events are related in such a way that the relationship is causal one? There are two types of research that can answer that question: true experimental research and quasi-experimental research.

True Experimental Research

In true experimental research, participants are assigned to groups based on some criterion, often called the treatment variable or treatment condition. For example, you want to compare effects of two different techniques for reducing obsessive compulsive disorder behaviour in adults. The first technique includes behavioural therapy and the second does not. Once adults are assigned to groups and the programs are completed, you will want to look for any differences between the two groups with regard to the effects of the therapy on the number of obsessive-compulsive behaviours. Because assignment to the groups is determined by the researcher, the researcher has given assignment to the groups as determined by the researcher, and thus the researcher has complete control over the factors to which the adults are exposed. This is the ideal model for establishing a cause and effect relationship because the researcher has clearly defined the possible cause and can keep very close tabs on what is happening. Most important, however is that the researcher has complete control over the treatment.

Quasi Experimental Research

In quasi-experimental study, the researcher does not have a such a high degree of control because people have already been indirectly assigned to those groups (e.g., social class, type of abuse, gender, type of injury) for which you are testing the effects. In these researches participants are pre-assigned to groups based on some predetermined characteristics or quality. Differences in gender, race, age, grade in school, neighbourhood of residence, type of job, and even experiences are examples. These groups‟ assignments have already taken place before the experiment begins, and the researcher has no control as to who is assigned to each group.

The most important use of the quasi experimental method occurs where researchers cannot, in good conscience, assign people to groups and test the effects of group membership on some other outcome. For example, researchers who are interested in the effects of parental unemployment on children could not very well encourage mothers or fathers to quit work. Rather, they would seek out families where parents are already unemployed and then conduct the research.

Quasi-experimental research is also called post hoc, or after-the-fact, research because the actual research takes place after the assignment of groups (e.g., employed

versus unemployed, malnourished versus non-malnourished, male versus female). Because assignment has already taken place, the researcher has a high degree, but not the highest degree, of control over the cause of whatever effects are being examined.

For the highest degree of control to occur, the true experimental model needs to be followed.

METHODS OF RESEARCH

Methods of research can be classified into two categories: Non-experimental methods and experimental methods.

Non-Experimental Methods

Naturalistic Observation

Sometimes all researchers need to know is what is happening to a group of animals or people. The best way to look at his behaviour of animals or people is to watch them behave in their normal environment. In naturalistic observation a scientist observes behaviour in real world settings and makes no effort to manipulate or control the situation. Researchers conduct naturalistic observation at homes, day-care canters and so on. For example, if someone wanted to know how adolescents behave with members of the opposite sex in a social setting the researcher might go the mall on a weekend night.

The most important advantage of naturalistic observation is that it allows researchers to get a realistic picture of how behaviour occurs because they are actually watching that behaviour. In many cases animals or people who know they are being watched will not behave normally anyway in a process called the observer effect so often the observer needs to remain hidden from view. In these cases researcher might use one way mirror, or they might actually become participant in the group. This technique is called participant observation.

One of the major disadvantages of the naturalistic observation is the possibility of observer bias. That happens when the person doing the observing has a particular opinion about what he or she is going to see or expects to see. Sometimes that person sees only those actions that supports that expectation and ignores actions that don't fit. Another disadvantage is that each naturalistic setting is unique and unlike any other. Observations that are made at one time in one setting may not hold true for another time even if the setting is similar because the conditions are not going to be exactly the same time after time, researchers don't have that kind of control over the natural world.

Archival Research

In this method the researchers do not actually collect data themselves but they obtain data from public records, archives and so on. The researches merely analyses the data

attempts to draw certain conclusions from them. The method can be valuable in many respects. For instance there is no other way to collect data on suicides and homicides. Archival Data are those that are present in existing records or archives. The researcher simply examines or selects the data for analysis. Archival research may already exist or logistics or ethics may make it infeasible to conduct an experiment relating the variables of interest. Archival research has limitations; First most archival data are collected for naturalistic reasons. Governments are private agencies collect the data for their own purpose and such data often do not suit the purposes of the scientist. Second because archival research is by nature carried out after the fact ruling out alternative hypotheses for particular observed correlations may be difficult. A researcher who relies on archival data is at the mercy of any biases that may have occurred in collecting the data. Police records are notoriously subject to bias. Many categories of crime are seldom reported to the police.

Content Analysis

Content analysis sometimes known as document analysis is a method of systematic, examination of communications or of current records or documents. Instead of questioning respondents according to some scale items or observing their behaviour directly the content – analyser takes the communications or documents prepared by the respondents and systematically find out the frequency or proportion of their appearances.

In content or documents analysis the primary sources of data are: letters, autobiographies, diaries, compositions, records, reports, printed forms, themes or other academic work, books, periodicals, bulletins or catalogues, syllabus, court decisions, pictures, films, cartoons etc. It is the obligation of the researchers to establish the trustworthiness of these data that have been drawn. Content analysis can also be used with responses of projective test with all kinds of verbal materials and with materials specially produced for research problems.

Merits and Demerits

- First content analysis is applicable to a wide variety of materials such as creativity, attitude, and ethnocentrisms, stereotypes, curriculum changes values, interest, religiosity, college budgets etc.
- Second content analysis can also be used to examine the effect of experimental manipulation upon the dependent variables. If the investigator wants to study the effect of practice upon the improvement of handwriting of children, content analysis may be of no less importance than any experimental design.
- Third content analysis is also used to validate other methods of observation. Suppose one wants to validate a self-disclosure inventory. It is expected that people in general would not like to give personal information against which the test can be validated. But subjects can be asked some projective-type of

questions and the responses can be content-analysed. Subsequently the test can be validated against the content- analysed response.

- Despite these merits content analysis should be used with caution because of the complexities involved.

Surveys

Survey methods are widely used gathering scientific information. It involves collection of data by asking questions and recording people's answers to them. They are used for various purposes on frequent goal of this kind of research is to estimate population characteristics. For example the goal of survey might be to determine the percentage of people who hold supporting or opposing positions on particular social issues, such as provision of reservation for women in job. The census and public opinion done by various agencies are good examples of surveys.

Surveys can also be used to test hypotheses about the relationships among variable. One may try to find out the effect of some event on people's behaviour. For example surveys have been conducted after the earth quack at Bhuj in Gujarat to find out the impact of earthquake on people's lives.

In undertaking surveys the researcher defines the study population and draws the sample. The sample must be representative of the population. Researcher use different procedures of sampling. They can use random sampling in which every member of the population has an equal and independent chance of being included in the sample. Usually the researcher use stratified random sampling in which two or more sub samples are represented according to some predetermined proportion as they exist in the population. Sometimes groups are selected by using clusters or groupings from a larger population. This is known as cluster sampling. The sample size is also determined because the ability to generalise depends on the sample size used in the survey.

Depending upon the ways of collecting data survey methods can be classified into different categories namely personal interview, mail questionnaire, telephone survey, internet survey, web survey, etc.

Advantages:

- Survey methods have wide scope. In other words through survey method a great deal of information can be obtained by studying the larger population
- It is more accurate. As Kerlinger (1986) has put it." The accuracy of properly drawn samples is frequently surprising, even to experts in the field. A sample of 600 to 700 individuals or families can give a remarkably accurate portrait of a community its values attitudes and beliefs.
- A survey method has been frequently used in almost all the social sciences. Hence the method has inter-disciplinary value. In fact such researches provide raw materials for a vast increasing "gross disciplinary research" (Cambell & Katona, 1953).

- Survey method is considered a very important and indispensable tool for studying social attitudes, beliefs, values etc. with accuracy at the economic rate.

Disadvantages:

- Survey methods remains at the surface and it does not penetrate into the depth of the problem being investigated.
- Survey methods are time consuming, and demand a good amount of expenditure.
- Although it is true that survey research is accurate, it is still subject to sampling errors. In survey research there is always the probability of one chances in a twenty or hundred with an error, more serious than minor fluctuation of a chance, may occur and distort the validity of the result obtained.
- Survey method demands expertise, research knowledge and sophistication on the part of the researcher. In other words the researcher must know the techniques of sampling, questionnaire construction, interviewing and analysis of data.

Field Studies

Field studies are ex-post scientific inquiries aimed at discovering the relations and interactions among sociological, psychological and educational variables in real social structures. In scientific studies, large or small, they systematically pursue relations and test hypotheses, that are ex-post facto, that are made in actual life situations, will be considered field ex-post factor, that are made in actual life situations, will be considered field studies. The investigator in a field stud looks at the social or institutional situation and then studies the relations among the attitudes, values, perceptions, and behaviours of individuals and groups in the situation. He ordinarily manipulates no independent variables.

Katz (1953) has divided field studies into two board types exploratory and hypothesis testing. The exploratory types seek what is, rather than predict relations to be found. They have three purposes: (1) to discover significant variables in the field situation, (2) to discover relations among variables (3) to lay a ground work for later, more systematic and rigorous testing of hypothesis.

It is well to recognise though that there are activities preliminary to hypothesis testing in scientific research. In order to achieve the desirable aim of hypothesis testing, preliminary methodological and measurement investigation must often be done. The second subtype of exploratory field studies, research aimed at discovering or uncovering the relations, is indispensable to scientific advancement in the social sciences.

The field studies are strong in realism, significance, strength of variables, theory orientation and heuristic quality. The realism of field studies is obvious. They are

highly heuristic. Any researcher knows that one of the research difficulties of the field studies is to keep himself contained within the limits of his problem. Hypothesis is frequently fling themselves at one. The field is rich in discovery potentiality. After starting to gather data, he might stumble upon many interesting notions that can reflect the course of investigation.

Despite these strengths, the field study is a scientific weakness of laboratory experiments. Its most serious weakness of course is its ex-post facto character. Another methodological weakness is lack of precision in the measurement of field variables. Other weakness of field studies are practical problems: feasibility, cost, sampling, and time. The field researcher therefore, needs to be salesman, administrator and entrepreneur as well as investigator.

Case Studies

The case study is one of the important types of non-experimental research. The case study is not a specific technique rather it is one way of organising social data for the purpose of viewing social reality. It tends to preserve the unitary character of a social object being studied. It tends to examine a social unit as a whole. The unit may be a person a family a social group a social institution or even a community (Goode & Hatt 1981, Best & Kahn 1992).

A case study may utilise interview, observation, and psychological tests. It is a valuable research strategy in the fields of clinical psychology and human development. Using case study a researcher is able to have an in-depth look at one person. Those unique aspects of a person's life which cannot be duplicated for practical or ethical reasons are captured by case study. With the help of case study you can try to understand fantasies hopes fears traumatic experiences upbringing or anything that helps to understand a person's mind and behaviour. Case studies provide a narrative or detailed description of the events that takes place in a person's life. Freud's insight that led to the development of psychoanalytic theory emerged from his observation and reflections on individual cases. It should be remembered that the person studied as a case is unique and our judgments are of unknown reliability. Case studies provide detailed in-depth depictions of people' lives but we need to exercise caution when generalizing from individual cases. They are like naturalistic observations and all one can do is to describe the course of events.

The problem of validity of single case study is very serious. It is therefore recommended that researchers should use objective measurement techniques multiple sources of information and frequent assessment of relevant variables. The uses of case study as a research strategy requires that the cases must be chosen that represent the variable in question and one must have sufficient access to the cases. Careful planning of data collection is very necessary. Throughout the data-collection process the investigator is required to maintain a chain of evidence linking the various data sources having bearing on the research questions.

Check Your Progress Exercise 2.2

Notes: I. Write your answer in the space given below. II. Compare your answer with the one given at the end of this Unit.

Q.8 True/False

q) Detailed and in-depth description of people lives can be obtained through survey methods. T/F

r) Census is an example of correlational research. T/F

s) Survey helps to understand population. T/F

t) A case study may utilise observation and interview. T/F

u) Observer bias is one of the important problems associated with survey method. T/F

v) Case study method is most useful in clinical setting. T/F

w) Opinion polls are the examples of survey methods. T/F

x) Social behaviour under the war condition can be studied by the field study method. T/F

i) Quasi-experimental research involves random assignment of subject to different groups. T/F

j) Descriptive research does not have the characteristics of manipulations. T/F

EXPERIMENTAL METHODS

Laboratory Experiments

As you know a laboratory experiment is one of the most powerful techniques for studying the relationships between variables under controlled condition. It may be defined as the study of a problem in a situation in which some variables are manipulated and some are controlled in order to have an effect upon the dependent variable. The variables which are manipulated are known as independent variables and the variables which are controlled, are known as extraneous or relevant variables. Thus in a laboratory experiment the effect of manipulation of an independent variable upon the dependent variable is observed under controlled conditions. Festinger & Katz (1953:137) have defined a laboratory experiment as "one in which the investigator creates a situation with the exact conditions he wants to have and in which the controls some, and manipulates other variables".

Kerlinger (1986), there are three main purposes of the laboratory experiment. First, a laboratory experiment purports to discover a relationship between the dependent variable and the independent variable under pure, uncontaminated and controlled conditions. When a particular relationship is discovered, the experimenter is better able to predict the dependent variable. Second, a laboratory experiment helps in testing the accuracy of predictions derived from theses or researches. Third, a laboratory experiment helps building the theoretical systems by refining theories and hypotheses and thus, provides a breeding ground for scientific evaluation of those theories and hypotheses.

A laboratory experiment has some strength and weakness you have already read in the previous unit II, you may refer this for the detailed thereof.

Field Experiment

A field experiment is very similar to a laboratory experiment. A field experiment may be defined as a study carried out in a more or less realistic situation or field where the experimenter successfully manipulates one or more independent variables under the maximum possible controlled conditions. Experimenter manipulates one or more independent variable in natural setting for determining their effect upon behaviour, the procedure is known as field experiment.

Field experiment has number of Strengths which are given below:

9) A field experiment deals with the realistic life situation. Hence it is more suited for studying social changes, social processes and social influence.

10) One principle of research is that the more realistic the situation, the stronger is effect of the variables under study. In a field experiment this principle is fully satisfied. Thus, one can say that in the field experiment, since it deals with a realistic situation, the variables have stronger and more obvious effects.

11) Is derived from the above two points. When variables are stronger because of more realistic situations, an experimenter can make better and sound generalisations on the basis of the obtained results. In other words, this tends to increase the external validity of the field experiment. For example, when one carried out a field experiment by taking small groups of workers from a factory, and reaches the conclusion that absenteeism among workers is primarily due to the poor financial incentive, this can be safely generalized with respect to the workers of other factories as well because the experiment has been carried on actual workers in a factory.

12) A field experiment is well-suited for testing a broad hypothesis and theories and for obtaining answers to practical questions.

The principles weaknesses of field experiments are as given below:

11) Since a field experiment is carried out in a realistic situation, there is always the possibility that the effect of independent variables is contaminated with uncontrolled environmental variables.

12) The unexpected noise and gathering may affect the dependent variable and thereby, contaminate the influence of the independent variable. In a laboratory experiment this problem does not arise because of the fully controlled laboratory situation. However, if the situation is somehow fully controlled in a field experiment, it would prove to be a more powerful tool than the laboratory experiment.

13) In many field situations the manipulation of independent variables may be difficultdue to non-cooperation of subjects. Children are to be exposed to frustrating situations; they may not like it and may restrain their children from being exposed to field situation.

14) In a field experiment it is not possible to achieve a high degree of precision or accuracy because of some uncontrolled environment variables.

15) Field experiment requires that the investigator has high social skills to deal effectively with people in a field situation.

SUMMARY

Psychological researches have been classified depending upon the extent to which they satisfy requirement of a scientific procedure based on the purpose for which it is undertaken. There are two types of psychological researches – Non-experimental and experimental research. In non-experimental researches, the independent variable is not manipulated; the researcher does not have complete control over the conditions of the non-experimental research study. Non-experimental researches are covered descriptive, historical correlational, qualitative and ex- post facto research. Experimental researches are controlled manipulation of the variables that allows the researcher to determine the cause and effect relationship. The unit has described the two types of experimental research i.e. true experimental research and quasi experimental research. Moreover this unit has described the major methods of nonexperimental researches namely – naturalistic observation, case studies, content analysis, achieves, field studies etc. Finally two research method of the experimental research i.e. laboratory experiment and field experiment are highlighted.

Glossary

Archival Method:	study method that examines existing records to obtain date and test hypotheses.
Case Study:	Study of one individual in great detail
Correlational:	Examine the relationship between variables.
Descriptive:	Describe the characteristics of an existing phenomenon.
Ex-Post Facto Research:	investigator attempts to trace an effect which has already occurred to its probable causes
Field Experiment:	a study carried out in more or less realistic situation where the experimenters manipulate independent under the maximum possible control condition.
Historical:	Relate events that have occurred in the past to current events.
Laboratory Experiments:	the techniques for studying the relationship between the variables under control condition
Naturalistic Observation:	observational research of subjects in their natural environment carried out to disturb the subjects as little as possible.
Observer Bias:	tendency of observer to see what they expect to see.
Qualitative:	To examine human behaviour and the social cultural and political contexts within which it occurs.
Quasi Experimental:	To test for casual relationship without having full control.
Survey:	assessing public opinion or individual characteristics by the use of questionnaire and sampling methods.
True Experimental:	To test for true cause and effect relationship.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: (a) Observer bias

Answer to Q.2: (d) All of these

Answer to Q.3: (c) Experimental

Answer to Q.4: (a) artificial environment

Answer to Q.5: (b) Field experiment

Answer to Q.6: (a) Naturalistic observation

Answer to Q.7: (c) Case Study

Answer to Q.8: a) F, b) F, c) T, d) T, e) F, f) T, g) T, h) T, i) F, j) T

Exercise

1. Discuss the different types of research?
2. What is true experimental research?
3. Explain the differences between basic and applied researches.
4. Discuss the experimental and non-experimental research.

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UNIT 5 METHODS OF RESEARCH (Experimental Methods)

STRUCTURE

INTRODUCTION

Now you have a good idea about what research is, what are the bases for the conduction and experiment in tests, and how research process works? Now, it is time to turn to another related issue; how do social scientists actually perform the task of adding to our knowledge of human behaviour and relationship? There are a number of ways to investigate into the answer of research questions. The kind of methods researchers use depends on kind of questions they want to answer. This unit begins with discussion of two types of researches i.e. non-experimental researches and experimental researches. Non-experimental researches will cover various kinds of researches along with examples, namely; historical research, correlation research, qualitative research and ex-post facto researches. Further, you will learn about experimental researches which are conducted to establish the cause and effect relationship. This is followed by the details of main types of experimental researches i.e. true experimental researches and quasi experimental researches. Then, you will learn how true experimental researches differ from quasi experimental researches. We now need to enquire into various methods of psychological researches for obtaining data that may be used to arrive at an evidence report. Various kind of nonexperimental methods which are used to answer the questions, such as naturalistic observation, survey method, case study, content analysis, field studies are described. Finally, besides non-experimental methods, this unit will explain you the experimental methods i.e. laboratory experiment and field experiment.

LEARNING OBJECTIVES

After reading this unit, you will be able to:

- Explain the types of researches;
- Differentiate between experimental and non-experimental researches;
- Explain true experimental researches and quasi experimental researches;
- Describe advantages and disadvantages of each method which are used in psychological research;
- Differentiate laboratory experiments from field experiments;
- Explain the differences between basic and applied researches; and
- Identify experimental and non-experimental researches and methods.

TYPES OF RESEARCH

The types of research differ mostly on three dimensions:

10) The nature of the question asked;

11) The method used to answer it; and

12) The degree of precision the method brings to answering the questions.

One way in which these methods do not necessarily differ, however is in the content or the focus of the research. In other words, if you are interested in the effects of television viewing in children, your research can be non-experimental, wherein you survey watching habits. If experimental, you may expose children models to the TV and one group non-viewing of TV and look at the effect of the exposure on their behaviour. The most general way of classifying research is to divide it into fundamental or pure or basic research and applied research. A fundamental research is the formal and systematic process where the researcher aims to develop a theory or a model by identifying all the important variables in a situation and by discovering broad generalisations and principles about those variables. It utilizes a careful sample so that its conclusion can be generalised beyond the immediate situation. For example biological psychologists explore the links between brain and mind; developmental psychology studies our changing abilities from womb to tomb and the personality psychologists investigate our inner traits. Applied research, as its name implies, applies the theory or model developed through the fundamental research to the actual solution of the problems. Applied research tackles practical problems, as for example, industrial/ organisational psychologists study and advise on behaviour in the workplace. They use psychology concepts and methods to help organisations select and train employees. They boost morale of the employees and also their productivity. They design products and answer people's responses to them. Besides the fundamental research and the applied research another type of research has recently been popular in the fields of social psychology, industrial psychology, and education. This is known as „action research". In action research the researcher emphasises a problem which is immediate, urgent and has local applicability. Thus, the researcher here focuses upon the immediate consequences and applications of a problem and not upon general or universal application or upon the development of a theory or a model. A teacher may undertake a research to know the reasons underlying unhealthy classroom habits so that immediate outcome may benefit the local class- room students. There are number of researches, given here under:

Table 2.1Type of Research

Types of Research	
Non-Experimental	Experimental
Historical, Descriptive, Correlational, Qualitative , Ex-post facto	True experimental, Quasi experimental

NON-EXPERIMENTAL RESEARCH

A non-experimental research is one where independent variables cannot be manipulated. The researcher does not have complete control over the conditions of the non-experimental research studies. For example, if you want to survey the television-watching behaviour of adolescents, you could do so by having them maintain a diary in which they record what shows they watch and with whom. This descriptive study provides information about their television-watching habits but says

nothing about why they watch what they do. You are not in any way trying to have an impact on their television watching behaviour or investigate why they might watch particular shows. This is non-experimental in nature because no cause-and-effect relationships of any type are being hypothesized or investigated. Non-experimental or descriptive research describes the characteristics of an existing phenomenon. Census of any contrary, current unemployment rate of working single parents who have children under age 5 etc. are the examples of descriptive research. A second characteristic of non-experimental is that the data collection procedure often must forfeit some degree of control in return for obtaining the data. For example the researcher may decide to study public records that may be almost, but not exactly in the form we desire or researcher may have to keep a questionnaire start to help gain the cooperation of subjects.

Historical Research

Historical research relates past events to one another or to current events. Basically, historical research (or historiography) answers the question: what is the nature of events that have happened in the past? For example, one might want to examine trends in treatment of mental illness or how attitudes toward work and families have changed. All of these questions require the detective work of a historian, finding and collecting relevant data and then, just as with any other research endeavour, testing a hypothesis. In fact, like any other researcher, the historian collects data, analyses them, and then comes to conclusions about the tenability of the hypothesis. One significant difference between historical research and other types of research is the type of data collected and the method of collection. Researchers who do historical research often accomplish this goal through the use of primary sources (original documents or information from people who have personally experienced an event) and secondary sources (second hand documents or information from people who may have some knowledge about the event but did not experience it first hand). Even if these sources are readily available, however, one of the greatest challenges doing such research is in knowing how much faith the researcher can put on the accuracy of the sources. Examining the trends in achievement level of Indian children compared with American children is an example of historical research.

Descriptive Research

Descriptive research describes and interprets what is. It is concerned with conditions or relationships that exist, the practices that prevail, the beliefs or attitudes that are held, the processes that are going on; effects that are being felt or trends that are developments. The approach is directed towards identifying various characteristics of research problems and to create observations conducive to further research. Descriptive research describes characteristics of an existing phenomenon. Descriptive research provides a broad picture of a phenomenon you might be interested in exploring. Current employment rates, census of any country, number of working single parents are examples of descriptive research.

Correlational Research

Descriptive and historical research provides a picture of events that are currently happening or have occurred in the past. Researchers often want to go beyond mere description and begin discussing the relationship that certain events might have to one another. The most likely type of research to answer questions about the relationship among variables or events is called correlational events. Correlational research provides some indication as to how two or more things are related to one another or, in effect what they share or have in common or how well a specific outcome might be predicted by one or more pieces of information. Correlational research uses a numerical index called the correlation coefficient as a measure of the strength of this relationship. For example, if you are interested to find out the relationship between the number of hours spent in studying and their achievement, then you would be doing correlational research, because you are interested in the relationship between these two variables. If you are interested in finding out the best predictors of success in a school you would be doing a type of correlational research that includes prediction.

One of the most important points about correlational research is that it examines relationships between variables but in no way implies that one causes changes in the other. In other words, correlation and prediction examine associations but not causal relationships, wherein a change in one factor directly influences a change in another.

Qualitative Research

The general purpose of qualitative research methods is to examine human behaviour in the social, cultural, and political contexts in which they occur. This is done through a variety of tools, such as interviews, historical methods, case studies, and ethnography and usually results in qualitative (or non-numeric) primary data. In other words, the qualitative researcher is more (but not only) interested in the contents of an interviewee's speech than in the number of times (frequency) a particular comment is made. Qualitative research is relatively new to the social and behavioural sciences and, to a large extent its increasing popularity is due to a degree of dissatisfaction with other available research methods. Some social scientists view that the traditional experimental model is just too restrictive and narrow, prevent underlying and important factors and relationships from being revealed. But what's so valuable about this set of tools is that it allows you to answer a whole new set of questions in a whole new way.

Qualitative research is the interpretive study of a specific issue or a problem in which the researcher is central to the research process. It's a naturalistic inquiry, which unfolds in a non-manipulative fashion. It lacks the predetermined constraints on outcome variables. Qualitative methods yield data in the form of words than numbers. Qualitative studies provide rich description and explanation of processes in specific local contexts. They provide a feel of the processes by focusing on the chronological

flow or sequence of events leading to certain outcomes or consequences. The whole phenomenon is studied with a strategy of a detailed or elaborate (thick) description. Throughout the conduct of qualitative study interpretation and reflection on the part of researcher is required.

Qualitative data can come from a variety of sources and can take a variety of forms. The data may be used as a supplement to quantitative data or may be used in their own right. Qualitative data can be obtained through a variety of methods such as case studies, interviews, discourse analysis, narratives, and ethnography and participant observation.

Ex-post-facto Research

In this kind of research, the independent variable or variables have already occurred in which the researcher starts with observation of a dependent variable or variables. He then studies the independent variables in retrospect for their possible relations to and effects on the dependent variable or variables. The most important difference between experimental research and ex-post facto research is control. In the former, the investigator has a manipulative control on the independent variable, whereas in the latter this control is not possible, more than this, randomization is not possible. In the ex-post facto research, the researcher must take things as they are and try to collect data and analyse them in that context.

In an ideal social scientific research, the possibility of finding random samples of subjects and randomly assigning them to groups and treatment to group would always be possible. However, these possibilities do not exist in the real situation. The ex-post facto research could be of a large scale or a small scale. This type of research has three weaknesses:

- the inability to manipulate the independent variables,
- lack of power to randomize, and
- the risk of improper interpretation.

In other words, compared to experimental research, other things being equal, ex-post facto research lacks control. This lack is a basis for the third weakness: the risk of improper interpretation. Therefore, committing unequivocally to experimentation or to ex-post facto research may be poor policy; Ex-post facto research may not have particular hypothesis as a predicted relationship may be quite spurious. Therefore, expost facto research that is conducted without hypothesis, without predictions, research in which data are just collected and then interpreted is even more dangerous in its power to mislead.

Check Your Progress Exercise 2.1

Note:

VII. Write your answer in the space given below.

VIII. Compare your answer with the one given at the end of this Unit.

In a naturalistic observation , the phenomenon in which the behaviour of thesubjects being observed changes because they are being watched is called:

a) Observer Bias
b) Participant Observation
f) Observer Effect
d) Representative Sampling

Fields experiments are concerned with:

a) casual relationships
b) direction of relationships
c) natural setting
d) all of these

Results are obtained under artificial conditions is a limitation of method:

m) observational
n) clinical
o) experimental
p) none

Which one is not the limitation of laboratory experiment:

m) artificial environment
n) lack of internal validity
o) study of all variables not possible
p) extraneous factors

Which one is not a non-experimental research

m) field study
n) field experiment
o) case study
p) survey

The investigator simply observes and records what happens in the natural environment in the:

a) naturalistic observation
b) the survey method
c) the clinical approach
d) experimental method

Results of which methods cannot be generalise to the population at large:

a) survey
b) experiment
c) case study
d) field study

EXPERIMENTAL RESEARCH

You already know that correlational research can help to establish the presence of a relationship among variables but does not provide any reason to believe that variables are causally related to one another. How does one find out if characteristics, behaviour, or events are related in such a way that the relationship is causal one? There are two types of research that can answer that question: true experimental research and quasi-experimental research.

True Experimental Research

In true experimental research, participants are assigned to groups based on some criterion, often called the treatment variable or treatment condition. For example, you want to compare effects of two different techniques for reducing obsessive compulsive disorder behaviour in adults. The first technique includes behavioural therapy and the second does not. Once adults are assigned to groups and the programs are completed, you will want to look for any differences between the two groups with regard to the effects of the therapy on the number of obsessive-compulsive behaviours. Because assignment to the groups is determined by the researcher, the researcher has given assignment to the groups as determined by the researcher, and thus the researcher has complete control over the factors to which the adults are exposed. This is the ideal model for establishing a cause and effect relationship because the researcher has clearly defined the possible cause and can keep very close tabs on what is happening. Most important, however is that the researcher has complete control over the treatment.

Quasi Experimental Research

In quasi-experimental study, the researcher does not have a such a high degree of control because people have already been indirectly assigned to those groups (e.g., social class, type of abuse, gender, type of injury) for which you are testing the effects. In these researches participants are pre-assigned to groups based on some predetermined characteristics or quality. Differences in gender, race, age, grade in school, neighbourhood of residence, type of job, and even experiences are examples. These groups‟ assignments have already taken place before the experiment begins, and the researcher has no control as to who is assigned to each group.

The most important use of the quasi experimental method occurs where researchers cannot, in good conscience, assign people to groups and test the effects of group membership on some other outcome. For example, researchers who are interested in the effects of parental unemployment on children could not very well encourage mothers or fathers to quit work. Rather, they would seek out families where parents are already unemployed and then conduct the research.

Quasi-experimental research is also called post hoc, or after-the-fact, research because the actual research takes place after the assignment of groups (e.g., employed

versus unemployed, malnourished versus non-malnourished, male versus female). Because assignment has already taken place, the researcher has a high degree, but not the highest degree, of control over the cause of whatever effects are being examined.

For the highest degree of control to occur, the true experimental model needs to be followed.

METHODS OF RESEARCH

Methods of research can be classified into two categories: Non-experimental methods and experimental methods.

Non-Experimental Methods

Naturalistic Observation

Sometimes all researchers need to know is what is happening to a group of animals or people. The best way to look at his behaviour of animals or people is to watch them behave in their normal environment. In naturalistic observation a scientist observes behaviour in real world settings and makes no effort to manipulate or control the situation. Researchers conduct naturalistic observation at homes, day-care canters and so on. For example, if someone wanted to know how adolescents behave with members of the opposite sex in a social setting the researcher might go the mall on a weekend night.

The most important advantage of naturalistic observation is that it allows researchers to get a realistic picture of how behaviour occurs because they are actually watching that behaviour. In many cases animals or people who know they are being watched will not behave normally anyway in a process called the observer effect so often the observer needs to remain hidden from view. In these cases researcher might use one way mirror, or they might actually become participant in the group. This technique is called participant observation.

One of the major disadvantages of the naturalistic observation is the possibility of observer bias. That happens when the person doing the observing has a particular opinion about what he or she is going to see or expects to see. Sometimes that person sees only those actions that supports that expectation and ignores actions that don't fit. Another disadvantage is that each naturalistic setting is unique and unlike any other. Observations that are made at one time in one setting may not hold true for another time even if the setting is similar because the conditions are not going to be exactly the same time after time, researchers don't have that kind of control over the natural world.

Archival Research

In this method the researchers do not actually collect data themselves but they obtain data from public records, archives and so on. The researches merely analyses the data

attempts to draw certain conclusions from them. The method can be valuable in many respects. For instance there is no other way to collect data on suicides and homicides. Archival Data are those that are present in existing records or archives. The researcher simply examines or selects the data for analysis. Archival research may already exist or logistics or ethics may make it infeasible to conduct an experiment relating the variables of interest. Archival research has limitations; First most archival data are collected for naturalistic reasons. Governments are private agencies collect the data for their own purpose and such data often do not suit the purposes of the scientist. Second because archival research is by nature carried out after the fact ruling out alternative hypotheses for particular observed correlations may be difficult. A researcher who relies on archival data is at the mercy of any biases that may have occurred in collecting the data. Police records are notoriously subject to bias. Many categories of crime are seldom reported to the police.

Content Analysis

Content analysis sometimes known as document analysis is a method of systematic, examination of communications or of current records or documents. Instead of questioning respondents according to some scale items or observing their behaviour directly the content – analyser takes the communications or documents prepared by the respondents and systematically find out the frequency or proportion of their appearances.

In content or documents analysis the primary sources of data are: letters, autobiographies, diaries, compositions, records, reports, printed forms, themes or other academic work, books, periodicals, bulletins or catalogues, syllabus, court decisions, pictures, films, cartoons etc. It is the obligation of the researchers to establish the trustworthiness of these data that have been drawn. Content analysis can also be used with responses of projective test with all kinds of verbal materials and with materials specially produced for research problems.

Merits and Demerits

- First content analysis is applicable to a wide variety of materials such as creativity, attitude, and ethnocentrisms, stereotypes, curriculum changes values, interest, religiosity, college budgets etc.
- Second content analysis can also be used to examine the effect of experimental manipulation upon the dependent variables. If the investigator wants to study the effect of practice upon the improvement of handwriting of children, content analysis may be of no less importance than any experimental design.
- Third content analysis is also used to validate other methods of observation. Suppose one wants to validate a self-disclosure inventory. It is expected that people in general would not like to give personal information against which the test can be validated. But subjects can be asked some projective-type of

questions and the responses can be content-analysed. Subsequently the test can be validated against the content- analysed response.

- Despite these merits content analysis should be used with caution because of the complexities involved.

Surveys

Survey methods are widely used gathering scientific information. It involves collection of data by asking questions and recording people's answers to them. They are used for various purposes on frequent goal of this kind of research is to estimate population characteristics. For example the goal of survey might be to determine the percentage of people who hold supporting or opposing positions on particular social issues, such as provision of reservation for women in job. The census and public opinion done by various agencies are good examples of surveys.

Surveys can also be used to test hypotheses about the relationships among variable. One may try to find out the effect of some event on people's behaviour. For example surveys have been conducted after the earth quack at Bhuj in Gujarat to find out the impact of earthquake on people's lives.

In undertaking surveys the researcher defines the study population and draws the sample. The sample must be representative of the population. Researcher use different procedures of sampling. They can use random sampling in which every member of the population has an equal and independent chance of being included in the sample. Usually the researcher use stratified random sampling in which two or more sub samples are represented according to some predetermined proportion as they exist in the population. Sometimes groups are selected by using clusters or groupings from a larger population. This is known as cluster sampling. The sample size is also determined because the ability to generalise depends on the sample size used in the survey.

Depending upon the ways of collecting data survey methods can be classified into different categories namely personal interview, mail questionnaire, telephone survey, internet survey, web survey, etc.

Advantages:

- Survey methods have wide scope. In other words through survey method a great deal of information can be obtained by studying the larger population
- It is more accurate. As Kerlinger (1986) has put it." The accuracy of properly drawn samples is frequently surprising, even to experts in the field. A sample of 600 to 700 individuals or families can give a remarkably accurate portrait of a community its values attitudes and beliefs.
- A survey method has been frequently used in almost all the social sciences. Hence the method has inter-disciplinary value. In fact such researches provide raw materials for a vast increasing "gross disciplinary research" (Cambell & Katona, 1953).

- Survey method is considered a very important and indispensable tool for studying social attitudes, beliefs, values etc. with accuracy at the economic rate.

Disadvantages:

- Survey methods remains at the surface and it does not penetrate into the depth of the problem being investigated.
- Survey methods are time consuming, and demand a good amount of expenditure.
- Although it is true that survey research is accurate, it is still subject to sampling errors. In survey research there is always the probability of one chances in a twenty or hundred with an error, more serious than minor fluctuation of a chance, may occur and distort the validity of the result obtained.
- Survey method demands expertise, research knowledge and sophistication on the part of the researcher. In other words the researcher must know the techniques of sampling, questionnaire construction, interviewing and analysis of data.

Field Studies

Field studies are ex-post scientific inquiries aimed at discovering the relations and interactions among sociological, psychological and educational variables in real social structures. In scientific studies, large or small, they systematically pursue relations and test hypotheses, that are ex-post facto, that are made in actual life situations, will be considered field ex-post factor, that are made in actual life situations, will be considered field studies. The investigator in a field stud looks at the social or institutional situation and then studies the relations among the attitudes, values, perceptions, and behaviours of individuals and groups in the situation. He ordinarily manipulates no independent variables.

Katz (1953) has divided field studies into two board types exploratory and hypothesis testing. The exploratory types seek what is, rather than predict relations to be found. They have three purposes: (1) to discover significant variables in the field situation, (2) to discover relations among variables (3) to lay a ground work for later, more systematic and rigorous testing of hypothesis.

It is well to recognise though that there are activities preliminary to hypothesis testing in scientific research. In order to achieve the desirable aim of hypothesis testing, preliminary methodological and measurement investigation must often be done. The second subtype of exploratory field studies, research aimed at discovering or uncovering the relations, is indispensable to scientific advancement in the social sciences.

The field studies are strong in realism, significance, strength of variables, theory orientation and heuristic quality. The realism of field studies is obvious. They are

highly heuristic. Any researcher knows that one of the research difficulties of the field studies is to keep himself contained within the limits of his problem. Hypothesis is frequently fling themselves at one. The field is rich in discovery potentiality. After starting to gather data, he might stumble upon many interesting notions that can reflect the course of investigation.

Despite these strengths, the field study is a scientific weakness of laboratory experiments. Its most serious weakness of course is its ex-post facto character. Another methodological weakness is lack of precision in the measurement of field variables. Other weakness of field studies are practical problems: feasibility, cost, sampling, and time. The field researcher therefore, needs to be salesman, administrator and entrepreneur as well as investigator.

Case Studies

The case study is one of the important types of non-experimental research. The case study is not a specific technique rather it is one way of organising social data for the purpose of viewing social reality. It tends to preserve the unitary character of a social object being studied. It tends to examine a social unit as a whole. The unit may be a person a family a social group a social institution or even a community (Goode & Hatt 1981, Best & Kahn 1992).

A case study may utilise interview, observation, and psychological tests. It is a valuable research strategy in the fields of clinical psychology and human development. Using case study a researcher is able to have an in-depth look at one person. Those unique aspects of a person's life which cannot be duplicated for practical or ethical reasons are captured by case study. With the help of case study you can try to understand fantasies hopes fears traumatic experiences upbringing or anything that helps to understand a person's mind and behaviour. Case studies provide a narrative or detailed description of the events that takes place in a person's life. Freud's insight that led to the development of psychoanalytic theory emerged from his observation and reflections on individual cases. It should be remembered that the person studied as a case is unique and our judgments are of unknown reliability. Case studies provide detailed in-depth depictions of people' lives but we need to exercise caution when generalizing from individual cases. They are like naturalistic observations and all one can do is to describe the course of events.

The problem of validity of single case study is very serious. It is therefore recommended that researchers should use objective measurement techniques multiple sources of information and frequent assessment of relevant variables. The uses of case study as a research strategy requires that the cases must be chosen that represent the variable in question and one must have sufficient access to the cases. Careful planning of data collection is very necessary. Throughout the data-collection process the investigator is required to maintain a chain of evidence linking the various data sources having bearing on the research questions.

Check Your Progress Exercise 2.2

Notes: I. Write your answer in the space given below. II. Compare your answer with the one given at the end of this Unit.

Q.8 True/False

y) Detailed and in-depth description of people lives can be obtained through survey methods. T/F

z) Census is an example of correlational research. T/F

aa) Survey helps to understand population. T/F

bb) A case study may utilise observation and interview. T/F

cc) Observer bias is one of the important problems associated with survey method.
T/F

dd) Case study method is most useful in clinical setting. T/F

ee) Opinion polls are the examples of survey methods. T/F

ff) Social behaviour under the war condition can be studied by the field study

i) Quasi-experimental research involves random assignment of subject to different groups. T/F

j) Descriptive research does not have the characteristics of manipulations. T/F

EXPERIMENTAL METHODS

Laboratory Experiments

As you know a laboratory experiment is one of the most powerful techniques for studying the relationships between variables under controlled condition. It may be defined as the study of a problem in a situation in which some variables are manipulated and some are controlled in order to have an effect upon the dependent variable. The variables which are manipulated are known as independent variables and the variables which are controlled, are known as extraneous or relevant variables. Thus in a laboratory experiment the effect of manipulation of an independent variable upon the dependent variable is observed under controlled conditions. Festinger & Katz (1953:137) have defined a laboratory experiment as "one in which the investigator creates a situation with the exact conditions he wants to have and in which the controls some, and manipulates other variables".

Kerlinger (1986), there are three main purposes of the laboratory experiment. First, a laboratory experiment purports to discover a relationship between the dependent variable and the independent variable under pure, uncontaminated and controlled conditions. When a particular relationship is discovered, the experimenter is better able to predict the dependent variable. Second, a laboratory experiment helps in testing the accuracy of predictions derived from theses or researches. Third, a laboratory experiment helps building the theoretical systems by refining theories and hypotheses and thus, provides a breeding ground for scientific evaluation of those theories and hypotheses.

A laboratory experiment has some strength and weakness you have already read in the previous unit II, you may refer this for the detailed thereof.

Field Experiment

A field experiment is very similar to a laboratory experiment. A field experiment may be defined as a study carried out in a more or less realistic situation or field where the experimenter successfully manipulates one or more independent variables under the maximum possible controlled conditions. Experimenter manipulates one or more independent variable in natural setting for determining their effect upon behaviour, the procedure is known as field experiment.

Field experiment has number of Strengths which are given below:

13) A field experiment deals with the realistic life situation. Hence it is more suited forstudying social changes, social processes and social influence.

14) One principle of research is that the more realistic the situation, the stronger is effect of the variables under study. In a field experiment this principle is fully satisfied. Thus, one can say that in the field experiment, since it deals with a realistic situation, the variables have stronger and more obvious effects.

15) Is derived from the above two points. When variables are stronger because of more realistic situations, an experimenter can make better and sound generalisations on the basis of the obtained results. In other words, this tends to increase the external validity of the field experiment. For example, when one carried out a field experiment by taking small groups of workers from a factory, and reaches the conclusion that absenteeism among workers is primarily due to the poor financial incentive, this can be safely generalized with respect to the workers of other factories as well because the experiment has been carried on actual workers in a factory.

16) A field experiment is well-suited for testing a broad hypothesis and theories andfor obtaining answers to practical questions.

The principles weaknesses of field experiments are as given below:

16) Since a field experiment is carried out in a realistic situation, there is always the possibility that the effect of independent variables is contaminated with uncontrolled environmental variables.

17) The unexpected noise and gathering may affect the dependent variable and thereby, contaminate the influence of the independent variable. In a laboratory experiment this problem does not arise because of the fully controlled laboratory situation. However, if the situation is somehow fully controlled in a field experiment, it would prove to be a more powerful tool than the laboratory experiment.

18) In many field situations the manipulation of independent variables may be difficult due to non-cooperation of subjects. Children are to be exposed to frustrating situations; they may not like it and may restrain their children from being exposed to field situation.

19) In a field experiment it is not possible to achieve a high degree of precision or accuracy because of some uncontrolled environment variables.

20) Field experiment requires that the investigator has high social skills to deal effectively with people in a field situation.

SUMMARY

Psychological researches have been classified depending upon the extent to which they satisfy requirement of a scientific procedure based on the purpose for which it is undertaken. There are two types of psychological researches – Non-experimental and experimental research. In non-experimental researches, the independent variable is not manipulated; the researcher does not have complete control over the conditions of the non-experimental research study. Non-experimental researches are covered descriptive, historical correlational, qualitative and ex- post facto research. Experimental researches are controlled manipulation of the variables that allows the researcher to determine the cause and effect relationship. The unit has described the two types of experimental research i.e. true experimental research and quasi experimental research. Moreover this unit has described the major methods of nonexperimental researches namely – naturalistic observation, case studies, content analysis, achieves, field studies etc. Finally two research method of the experimental research i.e. laboratory experiment and field experiment are highlighted.

Glossary

Archival Method:	study method that examines existing records to obtain date and test hypotheses.
Case Study:	Study of one individual in great detail
Correlational:	Examine the relationship between variables.
Descriptive:	Describe the characteristics of an existing phenomenon.
Ex-Post Facto Research:	investigator attempts to trace an effect which has already occurred to its probable causes
Field Experiment:	a study carried out in more or less realistic situation where the experimenters manipulate independent under the maximum possible control condition.
Historical:	Relate events that have occurred in the past to current events.
Laboratory Experiments:	the techniques for studying the relationship between the variables under control condition
Naturalistic Observation:	observational research of subjects in their natural environment carried out to disturb the subjects as little as possible.
Observer Bias:	tendency of observer to see what they expect to see.
Qualitative:	To examine human behaviour and the social cultural and political contexts within which it occurs.
Quasi Experimental:	To test for casual relationship without having full control.
Survey:	assessing public opinion or individual characteristics by the use of questionnaire and sampling methods.
True Experimental:	To test for true cause and effect relationship.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: (a) Observer bias

Answer to Q.2: (d) All of these

Answer to Q.3: (c) Experimental

Answer to Q.4: (a) artificial environment

Answer to Q.5: (b) Field experiment

Answer to Q.6: (a) Naturalistic observation

Answer to Q.7: (c) Case Study

Answer to Q.8: a) F, b) F, c) T, d) T, e) F, f) T, g) T, h) T, i) F, j) T

Exercise

1. Discuss the different types of research?
2. What is true experimental research?
3. Explain the differences between basic and applied researches.
4. Discuss the experimental and non-experimental research.

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UNIT 6 SCIENTIFIC METHOD AND ITS CHARACTERISTICS

Structure

INTRODUCTION

Research is a process by which one acquires dependable and useful information about a phenomenon or a process. It may be broadly defined "as a systematic inquiry towards understanding a complex social phenomenon or a process". It follows the scientific approach to gain knowledge. The most important characteristic of this approach is its thrust on objectivity. To what extent is the research using scientific approach is useful in studying the problems of society? How can we acquire reliable knowledge about the various aspects of human experience? To be more specific how can the scientific approach be of value in understanding social phenomena? In this Unit we will discuss these questions. Our approach would be first, to understand the meaning of the scientific method, its application in social sciences.

LEARNING OBJECTIVES

At the end of this unit, you will be able to:

- Describe the meaning of scientific method;
- Explain the application of scientific method in social sciences;
- Outline the characteristics of scientific method;
- Discuss the possibilities and limitations of scientific method in social sciences.

SCIENTIFIC METHOD: MEANING AND DEFINITION

It is obvious that it would be impossible to comprehend the nature and content of research without an appreciation of a method. The method used in scientific research is usually designated as scientific method. According to George Lundberg (1946), scientific method consists of three basic steps; systematic observation, classification and interpretation of data. Through these steps, scientific method brings about not only verifiability of the facts, but also it lays the confidence in the validity of conclusions. The definition requires some more explanations. First when Lundberg (1946) says that scientific method is systematic observation, he means, the scientific investigation is not ordered, it aims only at discovering facts as they actually are and not as they are desired to be and as such the investigators can have critical confidence in their conclusions. Second, the scientific method is concerned with „classes of objects" not „individual objects" specially university and predictability. The method makes it possible to predict about a phenomenon with sufficient accuracy. The scientific method could either be an inductive method or deductive method. Inductive method involves establishing generalizations, i.e. building generalizations inferred from specific facts, or drawing particular principles from general instances, while deductive method involves testing generalizations, i.e. it is the process of reasoning from general principles to particular instances

Use of Scientific Method in social Science

Social sciences primarily deal with human behaviour, which is, by and large, complex and dynamic in nature. One cannot, therefore investigate the human behaviour under guided conditions as in natural and physical sciences. This creates many problems to the researcher such as the problems of subjectivity and individualistic generalisations etc.

The problem arising out of the nature and content of social sciences do not seriously diminish the importance of scientific method for social scientists. Notwithstanding the inherent defects of social sciences, scientific method can be acceptable with its own limitations for the study of social phenomena so far, as it helps to arrive at valid generalisations.

Possibilities and Limitations of Use of Scientific Method in Social Sciences

As described above, the social sciences deal with human beings. Hence, the subject of educational research poses much greater complexity than that in natural sciences. The usual criticism is that social science research largely emanates from ill-conceived notion of research and its application in complex human setting. The social researcher needs the wisdom to choose research methodologies that are responsive to the problem; this is, in contradiction to the obsessive use of complex quantitative method. The issue is that of a careful balance between quantitative and qualitative techniques of research depending on the nature of the problem, sample and the nature of the data.

Although problems of discovering principles of human behaviour are difficult, they are not impossible. Social scientists will need to carry out observations as carefully as are done in natural sciences. Subjective, qualitative judgements need to be supplemented by more exact, quantitative measurements which are not easy to achieve in the case of human beings. This lack of quantifying and generalising of data, quite often becomes a drawback in social research as well. Whereas exact sciences tend to become increasingly quantitative in their units, measures and the terminologies, in social sciences most of the matter is qualitative and does not approve of quantitative statements. We may talk of growing indiscipline, but unless we can measure it, we cannot generalise the concept. Research adopts both quantitative and qualitative techniques. Social sciences have not been able to establish generalisations equivalent to theories of the natural sciences or, to predict events accurately. Perhaps, social sciences will never realise the objective of science as completely as natural sciences do. In fact, there are several limitations involved in the application of the scientific approach in social sciences. Let us try to see what they are:

i. Complexity of Subject Matter

A major obstacle is the inherent complexity of the subject matter. Natural scientists deal with the physical and biological phenomena. A limited number of variables that can be measured precisely are involved in the explanation of many of these phenomena, and it is possible to establish universal laws. For example, Boyles‟ Law on the influence of pressure on the volume of gases, which deals with relatively uncomplicated variables, formulates the relationship between phenomena that are apparently unvarying throughout the universe. On the other hand, social scientists deal with the human subjects. They are concerned with the subject's behaviour and development both, as an individual and as a member of a group. There are so many variables acting independently and in interaction, that must be considered in any attempt to understand complex human behaviour. Each individual is unique in the way he or she develops, in the mental equipment, in social and emotional behaviour and in application of the overall personality. The behaviour of human beings in groups and the influence of the behaviour of group members on an individual must also be dealt with by social scientists. A group of youth leaders in one situation will not behave like youth leaders in another situation. There are youth leaders, their siblings, relatives, and community people, each with variables that contribute to the behavioural phenomena observed in a setting. Thus, researchers must be extremely cautious about making generalisations, since the data obtained in one group situation may not be valid for another group.

ii. Difficulties in Observation

Observation, the sine qua non of science, is more difficult in the social sciences than in natural sciences. Observation in social sciences is more subjective because it frequently involves interpretation on the part of the observer. For example, the subject

matter for investigation is often a person's responses to the behaviour of others. Motives, values and attitudes are not open to inspection. Observers must make subjective interpretations when they decide that behaviours observed indicate the presence of any particular motive, value or attitude. The problem is that social scientist's own values and attitudes may influence both the observations and the assessment of the findings on which they base their conclusions. Natural scientists study phenomena that require little subjective interpretation.

iii. Difficulties in Replication

A chemist can objectively observe the reaction between two chemicals in a test tube. The findings can be reported and the observations can be easily replicated by others. This replication is much more difficult to achieve in social sciences. Even within a community, one cannot reproduce a given situation in its entirely and with precision. Social phenomena are singular events and cannot be repeated for purposes of observation.

iv. Interaction between an Observer and Subjects

An additional problem is that mere observation of social phenomena may produce changes that might not have occurred otherwise. Researchers may think that X is causing Y, when, in fact, it may be their subjective observation that X causes Y. For example, in the well-known Hawthorne experiments, changes in the productivity of workers were found to be not due to the varying working conditions but to the mere fact that the workers knew they had been singled out for investigation. Investigators are human beings and their presence as observers in a situation may change the behaviour of their human subjects. The use of hidden cameras and tape recorders may help minimize the interaction in some cases, but much of research in social science includes the responses of human subjects to human observers.

v. Difficulties in Control

The range of possibilities of controlled experiments on human subjects is much more limited than in natural sciences. The complexities involved in research of human subjects present problems in „control" that are unparalleled in natural sciences. In the latter, rigid control of experimental conditions is possible in the laboratory. Such control is not possible with human subjects. The social scientists must deal with many variables simultaneously and must work under conditions that are much less precise. They try to identify and control as many of these variables as possible, but the task is very difficult.

vi. Problems of Measurement

Experimentation must provide for measurement of the factors involved. The tools for measurement in social sciences are much less perfect and precise than the tools of the natural sciences. We have nothing that can compare with the precision of the ruler,

the thermometer, or the numerous laboratory instruments. We have already pointed out that an understanding of human behaviour is complicated by the large number of determining variables acting independently and in interaction. The multivariate statistical devices available for analysing data in social sciences take care of relatively few of the factors that are obviously interacting. Furthermore, these devises permit the researcher to attribute the variance only to factors operating at the time of measurement. Factors that have influenced development in the past are not measurable in the present, and yet they significantly influence the course of development.

Since research in behavioural sciences including research in education is complicated by these factors, researchers must exercise caution in making generalisations from their studies. It will often be necessary to conduct several studies in an area before attempting to formulate generalisations. If initial findings were consistently confirmed, then, one would have more confidence in making broad generalisations.

Despite these handicaps, social sciences have made great progress, and their scientific status can be expected to increase as scientific investigation and methodology become more systematic and rigorous in their research activities.

Check Your Progress Exercise 3.1

Note:

I. Space is given below for your answer.

II. Compare your answer with the one given at the end of this unit.

What is scientific method?

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Describe briefly the limitations of use of scientific method in social sciences.

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CHARACTERISTICS OF SCIENTIFIC METHOD

Horton and Hunt (1984) have given following characteristics of scientific method.

- Verifiable evidence i.e. factual observations which other observers can see and check.

- Accuracy, i.e., describing what really exists. It means truth or correctness of a statement or describing things exactly as they are and avoiding jumping to unwarranted conclusions either by exaggeration or fantasising.
- Precision, i.e., making it as exact as necessary. Or giving exact number or measurement. In scientific precision, one avoids colourful literature and vague meanings. How much precision is needed in social science will depend upon what the situation requires.
- Systematization, i.e. attempting to find all the relevant data, or collecting data in a systematic and organized way so that the conclusions drawn are reliable. Data based on causal recollections are generally incomplete and give unreliable judgements and conclusions.
- Objectivity, i.e. being free from all biases and vested interests. It means, observation is unaffected by the observer's values, beliefs and preferences to the extent possible and he is able to see and accept facts as they are, not as he might wish them to be. The research remains detached from his emotions, prejudices and needs, guards his biases. A bias is an unconscious tendency to see facts in a certain way because of one's wishes, interests and values.
- Recording, i.e., jotting down complete details as quickly as possible. Since human memory is fallible, all data collected are recorded. Researcher will not depend on the recalled facts but will analyse the problem on the basis of the recorded data. Conclusions based on recalled unrecorded data are not trustworthy.
- Controlling conditions, i.e., controlling all variables except one and then attempting to examine what happens when that variable is varied. This is the basic technique in all scientific experimentation-allowing one variable to vary while holding all other variables constant.

Henry Johnson (1960, pp. 5-6) has stated following four characteristics of scientific method:

- It is empirical (it is based on observation and reasoning and not on speculation).
- It is theoretical (it summaries data precisely giving logical relationship between propositions which explain causal relationship).
- It is cumulative (generalizations/theories are corrected, rejected and newly developed theories are built upon one another).
- It is non-ethical (scientists do not say whether particular things/ structures are good or bad. They only explain them).

SUMMARY

This unit has described the main features of scientific method. Scientific method consists of three basic steps; systematic observation, classification and interpretation of data. Although scientific research method depends on the collection of empirical facts, yet facts alone do not constitute a science. For meaningful understanding of facts must be ordered in some fashion, analysed, generalised and related to other

facts. So, scientific research is the creation of knowledge through the collection of empirically verifiable facts.

GLOSSARY

Empirical: Adjective referring to information gained by means of observation or experimentation. A central concept in the scientific method is that all evidence must be empirical, or empirically based, that is, dependent on evidence or consequences that are observable by the senses. It is usually differentiated from the philosophic usage of empiricism by the use of the adjective empirical or the adverb empirically. The term refers to the use of hypotheses that are testable using observation or experiment. In this sense of the word, scientific statements are subject to, and derived from, our experiences or observations.

Generalization: providing generality or an overview of a phenomenon. An occurrence that is argued as very commonly present. Often, it may even be easily observable too.

Scientific method: unbiased, objective and provable with evidences.

Validation: a way of ensuring that the evidence collected in support of empirical presence of a phenomenon is scientifically correct.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: scientific method consists of three basic steps; systematic observation, classification and interpretation of data. Through these steps, scientific method brings about not only verifiability of the facts, but also it lays the confidence in the validity of conclusions

Answer to Q.2: There are several limitation involved in the application of the scientific method in social sciences. Some of the important limitations are: complexity of subject matter, difficulties in observation, difficulties in replication, interaction between an observer and subjects, difficulties in control and problems of measurement.

EXERCISE

1. What is scientific method of research?
2. Explain the application of scientific method in social sciences.
3. What are the characteristics of scientific method?
4. Discuss the limitations of scientific method in social science.

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UNIT 7 THEORY BUILDING AND UNDERSTANDING THE LANGUAGE OF RESEARCH (CONCEPT, CONSTRUCT, DEFINITION, VARIABLE)

Structure

INTRODUCTION

This Unit elaborates the process of theory building which constitutes different elements. In addition, it discusses the use and scope of social theory and the issues of researcher's values affecting theory building. Social science research is interesting, but requires a clear understanding of its basic components. If the components on which social science research are based, are not understood, it will be difficult to undertake research. If components of social science research like concept, construct, definition, variable, etc., are not understood, a researcher will not be able to understand the basic principles underlying social science research. It is therefore, essential that these concepts are understood. These concepts will be explained here in simple language, through relevant examples wherever required, in order to have a basic understanding of what social science research is all about.

LEARNING OBJECTIVES

After studying this unit, you should be able to:

- Understand the meaning of a theory
- Describe how to build a theory;
- Explain the meaning of concept, types of concept, difference between concept and construct;
- Describe how to develop a theoretical and conceptual framework;
- Explain the meaning and characteristics of definition, types, and the role of definition;
- Describe the meaning, types, and the role of variables.

MEANING OF A THEORY

Theory refers to knowledge arranged so that the facts are subsumed under general principles. The difference between commonsensical knowledge and scientific knowledge is that the latter is systematised and classified. But only classification does not make any knowledge scientific, what really makes it scientific is that while commonsensical knowledge is satisfied most often with the desired effects, science looks into the causes of a phenomenon. It is the task of theory to organise such causal relationships into observable repetitive or classifiable regularities so that one can make general observations that encompass diverse but related phenomena and explain them by not individual and specific relationships only but by a higher and abstracted general relationship.

To look for causes underlying any observable phenomenon is the first task of science for otherwise as often happens with respect to common sense, people expect or demand contradictory goals without realising that they are doing so. Establishing the correct causal relationship between facts is followed by bringing together diverse facts within a single frame of causality; the process by which this is done is called theory building for the resulting relationship is often called a theory. In other words, you can say that there are three constituents or properties of theory, namely, i) explanation, ii) prediction and iii) verification. The systematically interrelated sociological propositions, which hold in different contexts, comprise theories. You can put to test each of these propositions as to how well it conforms to data and how well in relation to each other the propositions account for the outcomes in a given setting. If such a prediction is possible, you can say that the result has been explained in terms of known propositions. While verifying the sociological propositions, one needs to look for a logical relationship as well as empirical relationship. As you can make out, explanation, predictability and verification in sociological theory building are closely interrelated elements. We shall now discuss them in detail. Before we go on to the discussion, it may be a good idea to carry out one Reflection and Action exercise right in the beginning of the unit in order to fully appreciate what is meant

when we suggest that to look for causes underlying any observable phenomenon is the first task of a social scientist.

As said earlier, we look at theory as „an account of the world which goes beyond what we can see and measure. It embraces a set of interrelated definitions and relationships that organises our concepts of and understanding of the empirical world in a systematic way (Oxford Dictionary of Sociology 1998: 666). In this sense, we can agree with Waters (1994: 3), who says that social theory needs to be abstract and separable from the social practices that the theory has addressed. Such a theory needs to also focus on a specific thematic argument that runs through the set of propositions providing them coherence and force. Next, the theory has to be logically consistent and explanatory, that is, it needs to have a thesis about social phenomena to account for their form or existence. Further the theory is to be general enough to account for all instances of the phenomena it proposes to explain. Also the theory cannot be reduced to the explanations informants or participants themselves provide to explain their behaviour. Finally, the theory needs to be substantively valid, that is, it is to be consistent with what is already known about the social world by its participants and by the social scientists, including other sociologists. This means that it should be possible to link the theory to other bodies of knowledge.

The best way to test the validity or truth of a theory is to test its predictability. For example, Thorsten Veblen (1857- 1929) had collected together some properties of the elite in society, designated by him as the theory of the leisure class (see Veblen 1899). The validity of this theory lays in how often and how predictably will the persons belonging to the elite class exhibit the properties so designated. The sciences by definition need to be predictive on the basis of their theories. In the natural or called „pure" sciences, there is a set limit on the probable range of failure of predictability of a theory before it is ·rejected. In the social sciences, theories rarely have that capacity for predictability yet some degree of ascertaining the truth of a situation has to be assigned to any statement for it to take on the mantle of a theory.

Check Your Progress Exercise 4.1

Note:
I. Write your answer in the space given below.
II. Compare your answer with the one given at the end of this Unit

Q.1 What is theory? Discuss its elements
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THE NEED OF A THEORY

The need for theory lies first of all in that theories help us to put order in a bewildering range of phenomena that might seem unrelated. But with the help of theory, we may summarise in terms of a few principles the nature of the relationship between them. The more abstract a theory, meaning the more generalised a theory, the wider is its application but the further away it is from actual situations. You may say there are two types of theory, namely i) formal, and ii) substantive. Formal theory is most inclusive and basic in the sense that it aims to isolate a single set of principles, which are the foundation for social life. Through these principles you can explain every social phenomenon. Its paradigms give birth to grand theories. Evolutionary theory is an example of a grand theory, which makes some broad generalisations regarding the nature of society and the nature of transformations that one expects to see, but it would not be very predictive when applied to everyday realities of life except in a very broad sense.

The last significant attempt to write grand theory was made by Sorokin (1962). His theory on social and cultural change attempts to establish two basic laws- like generalisations (for details of Sorokin's grand theory see Zetterberg 1965: 15-16). As a reaction to writing grand theory, Pitirim Sorokin's student, Robert K. Merton (1957: 5- 10), formulated theories of middle range. You can say that these are miniature theories or partial theories. Such theories endeavour to explain specific but generally branching out events or specified types of the social process. When we designate a theory partial or middle range or miniature, we mean that this theory does not contradict other accepted theories. Examples of such middle range theories are, Pareto‟ s theory of elites (see Finer 1966), Murdock's (1975) theory of kinship structures, and Haman's (1950) theory of elementary social behaviour. But whether grand or middle range, a theory is a necessity for it simplifies the task of dealing with reality.

A theory provides a means for dealing with reality in terms of providing neat and compact explanations that can be set into a known explanatory framework. In this context you may like to quote Simmel (1898: 829-836)), who said that...we shall discover the laws of social forms only by collecting such societal phenomena of the most diverse contents, and by ascertaining what is common to them in spite of their diversity". Simmel's (1858-1918) assumption is that sociology can discover a small number of propositions, which would be verifiable in diverse contexts. In this sense, you may say that the task of the sociological theorist is to discover general propositions. Such an effort generates systematically interrelated propositions. Only after generating such propositions can we test a theory. To test a theory, we need to check how well each proposition of the theory conforms to data (see below the discussion on hypothesis, description and experimentation).

Interestingly, often the situation is the other way round and most of those engaged in social research collect data and look for theories to make sense of their data. In fact the task of collecting empirical data often culminates in the scholar trying to make sense of the data in terms of available theories. If such a task is successfully accomplished, then the data stand explained. However, if the data refute or contradict the theory then they provide a basis for reformulation of the existing theory or a new theory altogether. For example neo-evolutionary theories such as that of Leslie White (1945, 1947 and 1959) were modifications on the evolutionary theory. The replacement of the evolutionary theory by the functional theory was a refutation of the earlier theory and its replacement by another. The second task of theory, apart from the first one of explaining reality, is to generate a hypothesis that can be tested. We shall now discuss this process in detail as this helps all young researchers to initiate their research projects.

THEORY BUILDING AND RESEARCHER'S VALUES

The important point on which we will concentrate in this unit would be the extent to which the values held by a social scientist enter into the process of theory formation or in other words what is known as the value oriented bias of social science inquiry. The four points at which values can enter is at the level of

i) Selection of problems
ii) The determination of the contents of conclusions
iii) The identification of facts
iv) The assessment of evidence

We shall now discuss each of the entry points for values of researchers to creep into the social research.

i) Selection of Problems

A social scientist is guided by several considerations in the choice of subject matter of which her/his value orientation is one, that is a feminist would be interested to research women's problems, or a Marxist to work on subjects like agrarian relations or the exploitation of labour in factories. Moreover the manner in which a concept is constructed such as say the concept of culture or what goes into determining the status of women, is also conditioned by the subjective orientation of the researcher.

ii) The Determination of the Contents of Conclusions

The determination of contents of conclusion is something on which the criticism of almost all theories is based. It is felt that most social scientists have a fairly well formed idea of what is the nature of the reality that they are trying to prove and most research is aimed at proving or disproving what is already intuitively known to the scholar. Moreover larger interests about the society at large or moral and ethical viewpoints often creep into whatever a theory is trying to prove or disprove. During

the colonial regimes most anthropologists took equilibrium as the natural state of societies and their theories were directed towards demonstrating how such equilibrium states are maintained. Any disruption of the equilibrium was seen as abnormal or pathological (or a condition of anomie). The value orientation of the sociologists and anthropologists colluded with that of the administrators and often both were one and the same person. Or otherwise the anthropologist was on the payroll of the administrator or the goal of the administrators was to establish equilibrium in their colonies therefore equilibrium was also the desired state and viewed as such by the scholars too.

iii) The Identification of Facts

It is not impossible to distinguish between facts and values and contributions to theoretical understanding may be achieved even if the values of the social scientist are at variance. For example the contribution made by avowed ideologically oriented social scientists such as Marxists is still considered of considerable theoretical significance especially if they had been able to contain their value orientations within the limits of reason. Another remedy often resorted to in contemporary theory is to make the value orientation of any work quite clear so that the reader is not misled and is able to contextualise the theory to its orientation. This could also take care, for example, of the difficulties faced in the social sciences because of the evaluative character of the terms and concepts used. It is not always very clear as to what exactly is the distinction between facts and values. For example in the 1970s a certain kind of ecological approach concentrated quite a bit on the study of resource utilisation as a way of looking at a community's relationship with its habitat, often looking towards the goal of maximising such utilisation. But another school of environmentalists would vehemently be opposed to the term "resource" being used for the habitat as this term in itself is reflective of an exploitative attitude towards the environment. Such persons may not think of the environment as a resource for use by human communities but as something that has a right to existence by itself. The second point of view may look upon maximisation of resource utilisation as a negative rather than a positive goal. Moreover while writing ethnography one may be tempted to use words like kind or cruel, both of which cannot be understood without reference to a value framework. Contemporary ethnographies normally tend to consciously avoid using such terms preferring instead to give a detailed description of the .actions leaving it to the readers to form their own judgments or using such terms by which the actors themselves designate the acts.

iv) The Assessment of Evidence

There is always the apprehension that only conclusions but even the process of evaluation of data is often value loaded. Some kind of data may be totally overlooked or ignored by a social scientist simply because of innate value orientations. For example, the feminist scholars had alleged that male scholars ignored women's activities and role in society simply because of their patriarchal bias. Does this

discussion remind you of the example of Weiner's (1976 and 1977) study of Trobriand Islanders? Similarly Dalit scholars have often made allegations that upper caste scholars have often presented a biased Brahmanical view of society in India, selectively using data to do so.

Even in statistical analyses, value commitments are not ruled out. But value commitments are also of two kinds, covert and overt. For example Malinowski's oversight may have been unintentional but sometimes researchers allegedly manipulate data towards a particular end.

One kind of bias that is almost inevitable is the one connected with the historical and situational impact upon a student of society of the place and time to which she/he belongs. As we shall discuss in greater detail in the next unit, the evolution of scientific thought is also a product of the history of human society. World events and transformations of intellectual climate are determining factors that can rarely be avoided in the manner in which theory is formed.

UNDERSTANDING THE LANGUAGE OF RESEARCH

Since science attempts to investigate particular sections or aspects of reality, with an abstract system of thought to interpret those segments, it should not be surprising that each science develops its own terms or concepts for communicating its findings. So much is this the case that we may refer to the theoretical system of the science as a conceptual system. Now, we use these terms to stand for the phenomena, or aspects of phenomena, which we are investigating. Consequently, when we formulate a proposition, we use concepts as symbols of the phenomena we are studying, and it is really these underlying phenomena which we are relating to one another. Some of the components of social science research are discussed below:

Concept

A concept is a general idea derived, or, inferred, from specific instances or occurrences. It is something formed in the mind; a thought or notion. A concept is a cognitive unit of meaning - an abstract idea or a mental symbol sometimes defined as a „unit of knowledge", built from other units which act as a concept's characteristics. A concept is typically associated with a corresponding representation in a language or symbol such as a word.

Meaning of the Concept

A concept can be defined as a verbal response evoked by objects of the class to which the concept applies, for example, light, temperature, sound, age, sex, accidents, etc., are all class names applied to stimuli, subjects or responses of a specific kind. These are all examples of concepts which cannot be directly observed, but their instances can be located. There are other concepts like mental strength, drive, attitude, motivation, etc., whose instances too cannot be directly observed because they are

presumed to be located inside the organism. They are called hypothetical constructs. A concept is a property, or characteristic of some case, or unit of analysis in which one might be interested. It is essentially an idea about some aspect of some phenomenon, for example, gender, self-esteem, bureaucracy, social classification, etc. A case (unit of analysis) is that defined entity that is sampled and scored, or measured, on variables of interest in a research project. A case is defined in terms of its major characteristics and their location in time and place. In Sociology, a case is often a human individual, a group, an organisation or a society. It can also be social entities such as the father-child role relationship. In research, a sample or population of these cases is targeted for examination. Research involves special concepts such as total family income, self-employment, and economic returns. These are generally technical terms that point to some phenomenon that is an important aspect of a topic to be researched. Such concepts must be defined carefully so that others understand specifically what they mean. The concept of total family income, for example, is defined to have a range of possible values. Thus, it is called a variable in a given piece of research. To be useful to researchers, however, the abstract definition of a concept is not enough. A set of indicators must be developed in order to actually measure or classify families in terms of their total family incomes. Families can be classified, for example, into low, middle and high income groups. They can further be categorised into: less than Rs.5000 per month; between Rs.5, 000 and Rs.10, 000 per month; and Rs.10, 000 and above, per month.

Types of Concepts

Concepts are basically of two types:

I. Concepts which cannot be directly observed, but their instances can be located. Examples of such concepts are: temperature, sound, age, etc. II. Concepts whose instances cannot be directly observed because they are presumed to be located inside the organism. They are called hypothetical constructs. Examples of such concepts are: mental strength, drive, attitude, motivation, etc.

A concept can have a conceptual definition as well as an operational definition. In the above example of the total family income, the conceptual definition is the total monthly earnings of the family (that is, all earning members in the family) through all sources. In the same example, the operational definition would be the range of categories of income such as less than Rs.5,000 per month, between Rs.5,000 and Rs.10,000 per month and Rs.10,000 and above, per month.

Role of Concepts in Research

Concepts play an important role in research. In fact, research cannot be conducted without concepts. Every research is based on a concept, as research tries to establish relationship between two concepts, one of which is dependent on the other. Let us explain this through an example. „Vitamins supplement the growth in babies‟ is a

topic of research. This is a hypothesis which needs to be tested (as we are hypothesizing that vitamins supplement the growth in babies). The statement could be true or false. In this topic of research, as in any other research, we are dealing with concepts. One concept that we have identified is „vitamins" and the other concept is „growth in babies". According to the hypothesis, the higher the dose of vitamins (up to a certain level), and the healthier the growth among babies. Here, we are dealing, as already mentioned, with two concepts. One concept, „vitamin", is an independent variable and the other concept, „growth in babies" is a dependent variable. Concepts also help in understanding the cause and effect relationship in research. Let us take an example to understand the cause and effect relationship, as well as the role of dependent and independent variables in research. Concepts are used in all types of research. We have just given examples of the use of concepts (which are also variables) in experimental research. We can also examine the importance, or role of concept in other types of research. In case study research, for example, the role of concept is equally important. A case study is one of several ways of doing research, whether it is social science related, or even socially related. It is an intensive study of a single group, incident, or community. Case study is a method of exploring and analysing the life of a single social unit be it a person, a family, an institution, cultural group or even an entire single community these entities are all concepts. Similarly, concepts are used in historical as well as descriptive research, as in all types of research we are dealing with individuals, families, institutions, communities, etc., which are all concepts. Thus, research is incomplete without concepts.

Construct

A concept, as already defined, is a property or characteristic of some case or unit of analysis in which one might be interested. It is essentially an idea about some aspect of some phenomenon, for example, gender, self-esteem, bureaucracy, social classification, etc.

A construct, too, is a verbal response evoked by objects of the class to which the concept applies. Some concepts such as temperature, sound, age, sex, etc. cannot be directly observed, but their instances can be located. Other concepts such as mental strength, drive, attitude, motivation, etc., can neither be directly observed nor can their instances be located as they are presumed to be located inside the organism, and are called constructs. A construct is a concept. It has the added meaning, however, of having been deliberately and consciously invented or adopted for a special scientific purpose. Constructs play a very important role in theory building. Many theories such as the memory trace theory, the frustration-aggression theory, etc. have emerged out of this. Constructs cannot be observed and, thus, are called non-observables. Constructs are also known as intervening variables. An intervening variable is a term invented to account for internal and directly unobservable psychological processes that, in turn, account for behaviour. In other words, an intervening variable is an in the-head variable which cannot be seen, heard, or felt. It is inferred from the

behaviour of the individual. Hostility is inferred from aggressive acts. When we display aggression, it reflects hostility. Learning is inferred from test scores. We exhibit learning when we perform well in test scores. Similarly, anxiety is inferred from skin response, heart beats, etc. When we are nervous or anxious (maybe at the time of facing an interview, or before the announcement of a result), the hair on our skin rises, or, our hearts start beating faster. In research the name for these terms is „invented constructs", the reality of which is inferred from human behaviour. For example, while studying the effect of motivation, a researcher is aware that motivation is an intervening variable, a construct invented by men to account for persistently motivated behaviour.

Definition

Defining a concept is not very different from defining any word. The objective is to make it very clear to some audience what one is dealing with. Logically, definitions aim to lay bare the principal features or structure of a concept, partly in order to make it definite, to delimit it from other concepts, and, partly, in order to make a systematic exploration of the subject matter with which it deals.

Meaning and Characteristics of Definition

The dictionary meaning of definition is the act or process of giving an exact meaning to a concept or word; describing or explaining the scope of the concept or word; describing or explaining a statement of the meaning of a concept, or, word or the nature of a thing. All research deals with concepts which have to be clearly defined. In the absence of a clear cut definition of a concept, the concept becomes ambiguous and vague, creating problems for a researcher in carrying out research. Definitions have the following characteristics:

i. Definitions provide alternate meaning to concepts.
ii. Definitions explain the meaning of concepts in clear and explicit terms.
iii. Definitions provide reasonable and logical explanations to concepts.
iv. Definitions describe concepts in terms which are easily understandable.
v. Definitions use common sense to describe and explain concepts to make them easily identifiable.

Types of Definitions

Definitions are of two types:

1. Conceptual
2. Operational

Conceptual definition

The first step is to define what we mean by any particular concept. Once that has been done, it will then be possible to develop indicators for that concept as it has been

defined. Conceptual definitions are those which define a concept. For example, what is the concept of religiousness or, how a person can be called more religious or less religious? Similarly, poverty may be conceptualised in economic terms, perhaps using income to assess its existence. Similarly, it can be conceptualised in social terms, using the crime committed in a particular area to assess its magnitude. There are several dimensions to conceptualise poverty.

i. Poor purchasing power low capacity to purchase because of low income.
ii. Powerlessness inability to influence others.
iii. Isolation being cut off from society.
iv. Meaninglessness no purpose of life as basic needs are not fulfilled.

Operational definition

Once we are able to specify the different dimensions of a concept, we will be at a point where we can move from the abstract to the concrete. The operational definition refers to the process through which indicators are developed to measure the concepts – that is, to transform them into observable phenomena. From each of the four dimensions of poverty, a set of questions can be developed to operationalize each dimension. For example, indicators can be developed for the first dimension of poverty, that is, poor purchasing power. In order to get information on this dimension, following questions can be asked:

i. What necessities do you purchase for your family's sustenance?
ii. How do you meet the requirements of your child if you are unable to provide mother's milk?
iii. What are other items apart from food on which you spend money?

The questions identified above indicate one dimension of poverty. Operational definitions, thus, provide indicators to the conceptual definition of a concept, in this case, poverty.

Role of Definitions

Social Science Research revolves around the definition of concepts – both conceptual and operational. If definitions of concepts are not accurate, the researcher may not be able to understand what the concept is and how to ask questions related to the concept from the respondents. It is important for the researcher to understand the concept as it is defined and then conduct the interview. If this is not done, bias may be reflected from the way the questions are addressed to the respondents, and from the response of the respondents, as well. Concepts like motivation, learning, perception, etc., are research in the Behavioural Sciences (a branch of the Social Sciences) which need to be clearly defined conceptually, and understood by the researcher before the researcher is able to undertake research on these topics. These conceptually defined concepts, then, need to be made operational (operationally defined) by devising indicators that can be used to measure these concepts. If the researcher is unable to understand the conceptual and operational definitions of these concepts, he or she,

will not be able to do justice with research. It is, therefore, important that definitions of concepts are clearly understood before they are used by researchers for the purpose of conducting research.

Variable

Concepts such as „total family income" are ideas an investigator has about important characteristics of some entity such as a family. The concept must be clarified and defined, preferably explicitly, so that researchers can understand and share the phenomenon that is being studied. The concept of „total family income" is defined to have a range of possible values. Thus, it is called a variable in a given piece of research.

Meaning of Variables

A variable is an indicator of some defined concept or characteristic of a case. For example, a response to the question, "What is your age?" is a variable that can be used as indicator of the concept age. The indicator of the concept age can be: less than one year; between 1 and 5 years; between 5 and 10 years; between 10 and 15 years; and, so on. The indicator of the concept age can be the actual age in numerical terms or the date of birth (date, month, and year). A variable may also be defined as a property that takes on different values, as many measurable attribute of objects, things or beings. Examples of variables could be any concept such as age, income, community, intelligence, motivation, etc. The term variable more directly expresses the quantitative meaning. It means, whatever varies". The most intricate variations can be expressed in terms of numbers which are capable of indefinite divisions. A variable has, accordingly, been defined as „a symbol to which numerals or values are assigned.

Types of Variables

Variables are of different types

i. Dependent and independent variables
ii. Qualitative and quantitative variables

Dependent and independent variables

Researchers aim at studying the relationship between variables which is described as one of dependence. They are dependent variable and independent variable. The independent variable is the stimulus variable, and the dependent variable is the response variable. An independent variable is the presumed cause of the dependent variable, which is the presumed effect. In the above two examples, the cause and effect relationship can also be seen. For example, milk is the cause and children's growth is the effect and the kind of school is the cause and mannerism is the effect.

Qualitative and quantitative variables

Qualitative variables are those which vary in kind and not in degree. An example of a qualitative variable is sex, race, religion, etc. They cannot be described in numbers. A quantitative variable, on the other hand, is one whose values can be ordered in respect of their magnitude, that is, they can be described as being more or less, higher or lower, larger or smaller, etc. Examples of quantitative variables are intelligence, age, time, temperature, etc. Quantitative variable can further be classified into two: (i) discrete or discontinuous and (ii) continuous. The value of a discrete variable is a fixed quantity. For example, sex and family size are discrete variables. These can be stated in terms of indivisible quantity, and not in terms of fractions like, 2.5 or 15.75, and, so on. Discrete variables consist of two or more classes – dichotomous, those that consist of two categories (for example, sex has two categories-male and female); and, polychromous, those that consist of more than two categories (for example, intelligence can be categorized into high intelligence, average intelligence and low intelligence). A continuous variable is described as a „quantitative variable which can be measured with an arbitrary degree of fineness". For example, time is a continuous variable, since it can be measured in years, months, days, minutes, seconds, one hundred of a second, and so on.

Role of Variables

Variables play an important role in research. In fact, research cannot be conducted without variables. Every research is based on variables, as research tries to establish relationship between two variables, one of which is dependent and the other is independent. Variables also help in understanding cause and effect relationship in research. Variables are used in all types of research. We have just given examples of the use of variables in experimental research. We can also examine the importance or role of variables in other types of research. In case study research, for example, the role of variables is equally important. A case study is an intensive study of a single group, incident, or community. A case study is a method of exploring and analysing the life of a single social unit be it a person, a family, an institution, cultural group or even an entire single community these entities are all variables.

Check Your Progress Exercise 4.2

Note:
I. Write your answer in the space given below.
II. Compare your answer with the one given at the end of this Unit

Q.2 Explain the meaning of definitions and discuss its salient characteristics?
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Q.3 Discuss with your friends and see what they mean by concepts?
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SUMMARY

In this Unit, we have defined we have discussed several concepts and issues related to social science research. We have discussed, in this unit, the meaning, types and importance of various terms like objectives, concepts, variables, etc. Objectives are useful for conducting research. Concepts play an important role in research. In fact, research cannot be conducted without concepts. All research is based on concepts, as research tries to establish relationships between two concepts, one of which is dependent on the other. Concepts also help in understanding cause and effect relationship in research, and are used in all research. Behind a good research question is some idea or hunch, or, ideally, a more carefully researched theory. Research questions involve special concepts. A variable is an indicator of some defined concept or characteristic of a case. Variables are of different types: dependent and independent variable; qualitative and quantitative variable. Variables play an important role in research. In fact, research cannot be conducted without variables. Variables also help in understanding cause and effect relationship in research. Definitions have certain characteristics: they provide alternate meaning to concepts, explain the meaning of concepts in clear and explicit terms; provide reasonable and logical explanations to concepts; describe concepts in terms which are easily understandable; use common sense to describe and explain concepts to make them easily identifiable. Social science research revolves around the definition of concepts – both conceptual and operational. If definitions of concepts are not accurate, the researcher may not be able to understand what the concept is, and how to ask questions related to the concept from the respondents.

GLOSSARY

Concept:	a property, or characteristic of some case, or unit of analysis
Construct:	a verbal response evoked by objects of the class to which the concept applies
Definition:	describing or explaining a statement of the meaning of a concept, or, word or the nature of a thing

Hypothesis: a testable proposition

Theory: a proposed explanation about social interactions or society

Variable: an indicator of some defined concept or characteristic of a case.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: Theory refers to knowledge arranged so that the facts are subsumed under general principles. There are five elements of building theory such as (1) concepts, (2) variables, and (3) statements/formats.

Answer to Q.2: A concept can be defined as a verbal response evoked by objects of the class to which the concept applies, for example, light, temperature, sound, age, sex, accidents, etc., are all class names applied to stimuli, subjects or responses of a specific kind. A case (unit of analysis) is that defined entity that is sampled and scored or measured on variables of interest in a research project. Research involves concepts such as total family income, self-employment and economic returns. The concept of total family income, for example, is defined to have a range of possible values.

Answer to Q.3: The dictionary meaning of definition is the act or process of giving an exact meaning to a concept or word; describing or explaining the scope of the concept or word; describing or explaining a statement of the meaning of a concept or word or the nature of a thing. Definitions have the following characteristics.

- Definitions provide alternate meaning to concepts.
- Definitions explain the meaning of concepts in clear and explicit terms.

EXERCISE

1. What is the process to build the theory in research?
2. Explain the meaning and characteristics of definition, types, and the role of definition.
3. Discuss the meaning, types, and the role of variables.

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UNIT 8 RESEARCH ETHICS AND EMPIRICISM

STRUCTURE

INTRODUCTION

Now we will look into ethical issues that need to be followed while carrying out any research. Ethics, which means rules of conduct or moral principles, gains importance when it comes to creating knowledge of any kind and specifically in the domain of research because the outcome of research is directly influenced by the integrity of the researcher. In this unit we discuss how the issue of ethics in research evolved followed by research ethics in social sciences. The unit next discuss the concepts and procedures related to research ethics. Lastly, there are case studies and points of discussion to make you understand how ethics becomes important while dealing with field situations. Let us now have a look at the objectives of the unit.

LEARNING OBJECTIVES

After reading this unit you will be able to:

- Discuss ethical issues in research;
- Explain concepts and procedures related to research ethics;
- Outline field specific research ethics;

- Explain importance of research ethics; and
- Describe empiricism.

RESEARCH ETHICS

Everything in society does not follow the same pattern. Whenever a social scientist observes actual human behavior and activities, there are always some differences of opinion about what is right and what is wrong. We have already discussed that the scientist is the one without any moral bias, such that what is right or wrong cannot be determined according to any particularistic principles, such as one's own value systems, but must have a universal referent. There has to be some universal criteria of wellbeing, such as health, life and so on, by which we may judge an action to be right or wrong. But this is a question that has continued to plague the social sciences. By what criteria do we construct a universal code of morality or ethics? How do we reconcile the idea of cultural relativity with transcendence of ethnocentrism? For example, anthropologists have been accused of trying to find a justification for every custom found in any society including human sacrifice and infanticide. It is still a very big question mark as to how we judge the concept: of right and wrong when they do not apply to us.

The intellectual task of the natural scientist is greatly simplified because his data are, comparatively speaking, hard and reliable, and because the separation between him and the natural phenomena he studies is clear-cut. The social scientist, however, deals with data that usually are unreliable and fuzzy and, more importantly, his relation to the phenomena he studies is two-sided. The people he studies not only talk, they also talk back to him. Consequently it is his kind of science, rather than that followed by the physicist or chemist that should be called hard if we wish to indicate the difficulty of the task he faces. Certainly the small amount of success achieved so far in social science, as compared to natural science, suggests that social science is indeed a hard undertaking. Ethical problems constitute a major component of its intrinsic difficulty.

Ethical questions come up also for the natural sciences. For example, we are all aware of ethical questions regarding weapons of mass destruction and genetic engineering. But, as Laszlo and Wilbur (1970) pointed out, it is only after scientific discoveries affect the humankind that we raise ethical questions about natural sciences. Otherwise, humans as such do not figure into the theories of physics. In contrast to this situation, in the social sciences, we are dealing with human beings all the time and that is why we in social sciences have to continuously face ethical questions and it is just not possible to ignore them.

At this juncture, it seems a good idea to complete Reflection and Action 5.1 exercise for appreciating the ethical problems in studying the social reality around us.

Reflection and Action 5.1

Read the excerpt, given below, from Thapan (2004: 253) about her fieldwork in Rishi Valley School in 1981. Identify the nature of the problem in her fieldwork. Discuss both its ethical and moral aspects in terms of „not to betray participants and lose their goodwill and credibility in the field" and „the trust and confidence which has been placed in the ethnographer and which, in human terms, is not usually possible to betray". In the light of your discussion, answer the following questions on a separate sheet of paper.

The Excerpt from Thapan (2004: 253)

It is the ethnographer who seeks to elicit the participants" cooperation and has thus to take the initiative to negotiate, cajole, and use alternative strategies to tease out, as it were, information which is secret and therefore restricted. This may include presenting different fronts to different kinds of participants, as I di d, to make oneself acceptable to the entire community and thereby eligible for receiving secret information. Success with participants depends on the ethnographer's ability to handle interaction in a manner that engenders confidence and trust. Some participants may of course decline to enter into interaction and the ethnographer has no power to make them do so. Once the ethnographer has obtained information from others, who become friends and informants, the balance of power shifts from the participants to the ethnographer inasmuch as the latter may choose to use the information in any desired manner.

Questions:

* Is it fair to drop some significant findings of the research because of the feeling of betraying „my informants in the field"?

* Does the researcher really possess the kind of power she has after obtaining the sensitive and significant pieces of information?

* Is it necessary that practical, moral and human considerations need to determine the ethnographer's use of the material obtained during the course of research?

History of Ethical Issues in Research

Research ethics is a field which developed against the background of the Nuremburg trials held in 1945-46, at which several Nazi scientists, who had conducted inhuman experiments on Jewish inmates of the concentration camps, disabled, homosexuals and other persecuted groups, were tried. The discovery of the brutal methods adopted by these scientists shocked the world. This indicated the extent to which researchers could go, indulging in torture, ostensibly, in the pursuit of knowledge. This was a wake-up call to the scientific community, indicating the need to set down ethical rules for researchers that they must follow while conducting research. These rules were encoded in the Nuremburg Code (1947), which lay down the directives for human

experimentation. Its basic principles state that experiments cannot be conducted on any human being without his or her consent. Any experiment which can lead to disability or death is prohibited and no harm should come to a research subject. Risk of any kind associated with a study is acceptable only to the extent that it is compensated by the benefits expected from the research. The safety and consent of the research subject overrides all other considerations.

The Nuremburg Code is the basis of all subsequent ethical guidelines and protocols for research ethics. Several such guidelines have been adopted by various professional associations and research councils across the world, including India. In India, two significant ethical guidelines for research include the Ethical Guidelines for Biomedical Research on Human Participants (2006) issued by the Indian Council of Medical Research and the Ethics Guidelines for Social Science Research in Health (2000) issued by the National Committee for Social Science Research in Health.

At the heart of all these guidelines are some basic principles:

- Research is a voluntary activity that must be undertaken only when it is expected to lead to some benefit for humanity.
- It is not meant to serve the vested interest of any individual or group, whether it be, those conduct the research, those who commission it or those who sponsor it. If research has no other purpose than to benefit them, such research is unethical.
- Research on human beings cannot be conducted without their knowledge and consent. All human beings have the right to decide whether they would like participate in research or not.
- Any research which causes harm to any participant is not justified. Only in exceptional circumstances, harm that is minimal and inevitable and can be justified by the potential benefits of the research.

ETHICAL PRACTICES IN RESEARCH

Apart from the larger ethical questions that are discussed above, researchers need guidance on how to deal with specific problems and adopt specific measures while conducting research. Some of these are outlined below.

Informed Consent

As stated above, the willingness of an individual or group to participate in research is an essential ethical requirement. This willingness must be based on full knowledge of what it means to participate in this research and freedom from any form of external pressure or constraints. Full knowledge would include knowing why the research is being done, who is doing the research, what one stands to gain from the research, what are potential risks associated with participation and what are the terms on which one can participate in the study.

Usually, this information is provided in a written form in a document called an information sheet, which is given to the participants. If they cannot read, it may be read out to them and explained. Some groups have also used innovative methods like group meetings, films, posters and role plays to convey this information. Any method which communicates this information effectively and provides space for the participants to clarify doubts, ask questions and make comments is a good method to use.

A useful checklist for drafting this document is as follows:

- **Name and description**

  Name and description of the researcher/research team/organization should be informed to the participants. This should include names and contact details of all the key individuals involved, information about their legal status, their scope of work and any specific details that may be relevant to the study.

- **Description of the research**

  This should include the goals of the study, where it is being conducted, who or what will be studied, how will they be selected, what kinds of questions will be asked, what other information will be recorded, how long will all this take and who will be involved in collecting all this information. If the research involves conducting any kind of experiments or observations or tests, this should also be explained clearly.

- **Risks and benefits**

  All significant risks associated with the study should be explained. The concept of risks is explained in more detail below. While the risks need not be exaggerated, they must also not be underplayed. Likewise, benefits, also explained in more detail below, must be reasonably stated.

- **Rights of the participants**

  Certain basic rights are accorded to all participants. This includes the right to withdraw from the research at will, the right to protection of confidentiality and privacy (explained below in sub-section 4.5.2) and the right to know the findings of the research. Stating these rights explicitly in the research is essential and amounts to a written assurance by the researcher that they will fulfil their obligations to the participants.

Box No. 5.1

An information sheet containing all these components must be given to the participants. Following this, an informed consent form may be signed by the participant. This consent form states that the participant has understood the nature of the study and the implications of participation and accepts these conditions. An informed consent form is, in a sense, a contract, which documents the agreement between the researcher to fulfil certain obligations and the participant to provide information/data for the study. In our context, where not everyone is literate, the written consent form may be countersigned by a witness, who endorses the fact that the entire informed consent procedure was followed. Occasionally, a written consent may not be taken because doing so may put the participant in some kind of problem. This could be because the participants are engaged in some unlawful activity or are in a very vulnerable situation where discovery of their involvement in research could invite harm. However, as a rule, such conditions are rare and need to be carefully assessed. Several other variations of this consent procedure also exist. This includes audio-recording or video recording of the entire informed consent procedure. In certain circumstances, where information/data which has already been gathered is being used and that cannot be traced back to the individuals to whom it belongs, informed consent requirement may be waived.

Privacy and Confidentiality

This concept derives from two principles;

The respect for a person's dignity and the obligation prevent harm. It essentially means that all information which could identify a person which is received during the research process must be protected and not shared with anyone outside the research team. There are two aspects to this concept. Firstly, it means that data gathering must be done in conditions where participants have privacy. The researcher must ensure that they cannot be overheard. In some cases, it may be important to ensure that the participant is also not seen giving an interview or participating in a discussion. In many cases, particularly, in research studies conducted in closed institutions, there may a need to keep the identity of those who refused to participate in the study, also secret. In such cases, even the informed consent procedure must be conducted in complete privacy.

In addition to this, respecting privacy also means that the researcher must respect boundaries laid down by the participants and not intrude into areas beyond the scope of the research. This may mean that they must not approach participants outside certain spaces. They must not attempt to eavesdrop or spy on participants. They may, during the course of the study, become privy to information about the participants

through other sources, but they should not use this as data. They should not also use this information to interrogate participants.

Secondly, information gathered from the data collection process must be kept safe and must not be shared with anyone outside the research team. This may require that paper records are kept under lock and key. Digital records may be stored with password protection or encrypted. Further, researchers are required to „anonymise" data, which means that all identifiers such as names, addresses, details of personal history which could lead to identification of that individual are removed and replaced either by acronyms or pseudonyms. Such practices enhance the safety of data and ensure that confidential information about participants is not unwittingly revealed. Apart from the data, while reporting the findings too, care must be taken to avoid details which could lead to identification of the participants. This means that specific individual details which are not relevant to the study must be omitted. Findings may need to be presented in aggregate form when disaggregation may lead to revealing the identity of an individual participant, an institution or a community. Certain exceptions are permitted. Such as:

- When the information is already in the public domain and pertains to a public figure, names may be mentioned.
- When a participant or group of participants explicitly states that they want their identity to be stated, the researcher may choose to state their identity.

Risk and Harm

As we have seen, one of the most important ethical requirements for research is that it should not endanger participants in any way. No scientific achievement is great enough to justify deliberate injury or harm caused to research participants. Thus, in every study, it is important to assess what risk it poses to the participants. These risks may be of varied kinds. At its most fundamental level, it may be a risk to the life and health of the participant. At another level, it may be a risk of financial and material loss. This may be in the form of wages lost, cost of travel and stay, cost of hosting the research team, loss of production due to inability to devote adequate time to their work.

Research may also pose the risk of stigmatisation and discrimination. When it is known that a particular study involves only certain kinds of participants e.g. those suffering from a certain disease or those engaged in a certain activity, those who participate in the study would get identified. Stigmatisation and discrimination may also result from the manner in which findings are reported e.g. when certain clandestine practices prevalent in a particular group or among particular individuals are revealed. Risks may also be emotional. Certain research studies which focus on topics such as violence, abuse or other traumatic experiences may compel participants to relive painful experiences. Some studies may force them to reflect on problems that they find difficult to confront.

A researcher must assess beforehand what risks are associated with a study and what can be done to minimize them. Some measures to change the study design, the data collection procedures, and better training of the research team could very effectively address these risks. In a study, where inherently the risks are very high, the researchers must consider putting in place safeguards, remedial measures and reparation for those who are affected by the research. These could be in the form of monetary compensation, counselling support, access to medical and psychiatric care, information and education and linkup to support facilities such as voluntary organizations, legal aid and welfare services.

Harm is actual injury of any kind caused to a participant. This, again, could be physical, financial, social or emotional. In most cases, harm is not deliberate. However, the failure to assess risks, make attempts to minimize them, and put in safeguards to deal with situations and problems that could have been predicted is negligent and unethical. In some cases, harm may befall on participants despite the best efforts of the researcher. In such cases, those harmed must be suitably compensated. Firstly, all attempts must be made to alleviate their suffering and, secondly, appropriate compensation in cash, kind or services must be made. There is a valid space for ascertaining the degree to which the researcher or the research study is responsible for the harm caused. It may also be that either that harm was inevitable and would have befallen the participant in any case. In some cases, the participants‟ own actions may have contributed to the harm. Regardless of cause, as a basic principle, researchers must recognise that participants voluntarily contribute their time, make them vulnerable and put themselves at risk for the sake of research. Thus, it is only fitting that, at the very least, researchers make all attempts to alleviate their suffering.

Benefits

By benefits, we refer to those which accrue to the research participants and to society at large. As discussed earlier, the relevance of a research study is determined by the extent to which it contributes to the public good. This contribution may be in terms of useful knowledge, innovations and inventions, goods and services. Some studies may provide direct benefits to the participants in the form of goods and services. Other direct benefits may include education and skill development which may enable participants to enhance their well-being. Other benefits may be collective, such as access to networks, assistance for resource mobilization, publicity, which enables that collective to achieve its objectives. Some studies may not result in any tangible benefits, but serve an emotional or ideological need. They may provide participants with an opportunity to voice their feelings, share their experiences, reflect on their situation and become more aware. While, in general, benefits accruing to participants are viewed positively, in some circumstances they may be regarded as inducements. A benefit which is large enough to make a participant ignore the risks associated with a study is termed as an inducement. The quantum and type of benefit, which may

serve as an inducement, differs from context to context. For those participants who have no access, for e.g. to medical services, the promise of free treatment may serve as an inducement. In another context, teenagers, who are otherwise ignored and not consulted by adults, may feel induced to participate in a study without understanding its objectives, simply because there is someone who wants to listen to them. In all cases, the researcher must make a judgment about where to draw the line.

Apart from the benefits that accrue directly to the participants, research produces benefits for society. It may add to the body of knowledge, it may provide evidence about the outcomes of programmes, it may provide useful explanations for phenomena and events. Oftentimes, this benefit is realized only in the long term. Those conducting the research may not be in a position to assure the realization of these benefits. There may be a long process of public debate, consensus building, policy making or translation required to transform the findings of any research into tangible benefits. This kind of research is also very important and relevant. However, in order to be useful, it must be well designed, rigorously implemented and extensively disseminated. Research, which is not made public, most often, does not serve a useful purpose. Moreover, it is the duty of a researcher to ensure that the findings of all research, which can be validated, should be put in the public domain, whether they are positive or negative. This is particularly so, when research findings do not conform to the expectations of the researcher or reveal uncomfortable truths.

Integrity

Another set of concepts in ethics pertain to the „intentions" of the researcher rather than his or her actions. Integrity, as the word supposes, is about being honest and forthright. There are several aspects of research in which no ostensible harm comes to any participant, but a wrong is committed. This may be due to several reasons.

- **Conflict of interest**: This is a situation in which two or more roles of an individual conflict with each other and can bias the researchers" perspective. Several forms of conflict of interest exist e.g. an organization may be interested in showing that their programme succeeded and may, therefore, decide to conduct the evaluation themselves or nominate a researcher who is biased towards it. A researcher may be involved in advocacy and campaigns and wants to conduct research to validate her stand. A researcher may be tempted to alter the design of the study or the interpretation of results if she stands to gain financially or professionally from doing so. It is impossible to eliminate all forms of conflict of interest, but being aware of them and making them explicit is essential. In conditions where the conflict of interest is serious enough to damage the credibility of the researcher and influence the conduct of the study, the researcher must give up one of the competing roles. Alternatively, s/he must withdraw from the research.

- **Fraud**: This refers to any form of manipulation of the data. It includes fictitious data generation (called fabrication), selective recording of

information, tampering with test results and findings. All forms of fraud are unethical.

- **Plagiarism**: Plagiarism includes using someone else's work without according credit to that person. The most common form of plagiarism is using someone else's published or unpublished writing and claim authorship. Oftentimes, the plagiarized material is not from one source alone, but compiled from various sources. Citing passages from other texts without references is also plagiarism. Other forms of plagiarism include using unpublished data belonging to someone else for analysis and writing. Often, students placed for internship at an institution get access to the records of e.g. patients/clients of an institution and use them for research without permission or acknowledgement. All such forms of plagiarism must be prevented.

Mechanism for Regulating Research

While self-regulation by the researcher is imperative to the ethical conduct of research, there are also institutional safeguards in place. The primary institutional measure for ethics regulation is a research ethics committee or an institutional review board. These are autonomous bodies nominated by the institution to review all research being conducted in a particular institution to ensure that it meets the basic ethical standards. Some ethics committees are not attached to any institution, but function independently. They may review protocols for a fee.

Such bodies are usually present in institutions which conduct biomedical research. In India, social science research is not so regularly reviewed by Research Ethic Committees (RECs) or Institutional Review Boards (IRBs). However, of late, more and more universities and research institutions are instituting such bodies to review research, both conducted by the students and by the faculty. While such bodies may differ in composition, periodicity of meetings and procedures but, they must meet certain criteria. They must be headed by an external person, not connected in any way to the organization. It must be multi-disciplinary, having members from various disciplines, and from law and philosophy. There should be at least one member who can represent the participants. The minimum number of members should be five. Of these, external members not connected to the institution must be in a majority. The proceedings of the meetings of the REC/IRB must be formally documented and filed. It is necessary to protect the confidentiality of the discussion, but decisions of the RECs/IRBs must be made available to all in the organization. If there is a member whose own study is being reviewed, then that person must withdraw from the discussion. Generally speaking, RECs arrive at decisions by consensus. However, in case consensus is not reached, a vote is taken.

EMPIRICISM

Empiricism surfaced as a reaction to rationalist arguments and the events that were transforming the British society influenced the way it took roots in the way Anglo Saxons• perceived social reality. The first of these events was the English civil war in which monarchy and feudalism were challenged. The second was the increasing demand for individual rights and equality among all human beings. The third was unprecedented growth of commerce and science that was fuelled by inventions and discoveries such as Leeu wenhoek's use of the microscope to discover the world of bacteria, and William Harvey's discovery of the circulation of blood. The laws of· motion established by Newton (who used Descartes‟ theory in his calculus) influenced the way the empiricists developed the arguments, which went beyond Descartes‟ rationalism. You may say that in a way, such empiricists as John Locke combined the forces of experience and reflection. David Hume's scepticism and questioning on the other hand paved the way for establishing the empiricist tradition in social inquiry. Hume concluded what began with Locke, in laying the foundations for many methodological questions that came up in the philosophy of the sciences. This is why we will discuss their ideas in detail in this section. Before proceeding to the details, let us have a few words to introduce empiricism. The central principle of empiricism is that truth comes only from direct experience. Words can only be understood if they are connected by their recipient to actual experiences. The word „empirical‟ comes from the Greek word imperia, meaning "experience", and its history goes back to Plato and the Sophists (which has the same root as "sophisticated"). British empiricism refers to the eighteenth century philosophical movement in Great Britain, which maintained that all knowledge comes from experience. As mentioned before, in contrast to the empiricists, the rationalists maintained that knowledge comes from foundational concepts known intuitively through reason, such as innate ideas. Other concepts are then deductively drawn from these.

British empiricists staunchly rejected the theory of innate ideas and argued that knowledge is based on both sense experience and internal mental, experiences, such as emotions and self-reflection. Let us see what they have to say by examining some of the fundamental ideas of John Locke and David Hume as the foremost representatives of British empiricism.

John Locke: From Sensation to Reflection

Box 5.2 John Locke (1632-1704)

John Locke was one of the most respected British philosophers, Oxford academic and researcher of medicine. He served as a physician to Lord Ashley Cooper, the Earl of Shaftsbury and supervised an operation to remove a cyst from Lord Ashley's liver. The operation was successful. He served as a government official In-charge of collecting information about trade and colonies. He was an economic writer, political

activist, and a revolutionary, who cause ultimately triumphed. In the Glorious Revolution of 1688, much of Locke's work is characterized by opposition to authoritarianism. This opposition is both at the level of the individual person and at the level of institutions such as the government and the church.

For Locke the mind of a child is like a blank sheet of paper and all ideas come from actual experience. The mind has no innate ideas, but it has innate faculties; it perceives, remembers, and combines the ideas that come to it. The mind desires, deliberates, and wills and the segmental activities are themselves the source of a new class of ideas. Experience is therefore twofold. On the one hand, there are ideas of sensations of seeing, hearing, touching, etc., and on the other there are ideas of reflection, which are thinking, believing, etc. The first ideas are simple where the mind is passive and the second ones of reflection are more complex and active. Such ideas reflect our awareness of our own mental experiences (introspection).

As for the relation between the idea and the object one experiences, Locke makes a further distinction. He argues that objects have qualities, which produce an idea in the mind. Locke said there were primary and secondary qualities. Primary qualities are qualities which are produced by the senses such as smell, colour, taste and sound. The secondary qualities are those which refer to bulk, hardness, volume etc. According to Locke, the mechanical operations of nature remain hidden to us. Careful observation and experimentation may support a reliable set of generalisations about the appearances of the kinds of things we commonly encounter, but we cannot even conceive of their true natures. What we know essentially, according to Locke, is the nominal essence of an idea or thing. Thus, common names for substances are general terms by means of which we classify as we observe them to be. We can agree upon the meaning of such terms even though we remain ignorant of the real essences of the things themselves. Locke held that the extent of our knowledge is quite limited; the most we can hope for is probable knowledge. He extends this argument to the general nature of knowledge and comes up with a deceptively simple notion of knowledge as the perception of agreement or disagreement of ideas. The result of all this is that our knowledge is limited.

As per Locke's definition, we can achieve genuine knowledge only when we have clear ideas and can trace the connection between them enough to perceive their agreement or disagreement. That doesn't happen very often, especially where substances are a tissue. Locke's efforts have therefore led to the sobering conclusion that certainty is rarely within our reach; and therefore we must often be content with probable knowledge or mere opinion. Locke ultimately recommends that we adopt significantly reduced epistemological expectations. Hume takes another step and reduces one's expectations of certainty of knowledge by being sceptic to begin with. John Locke influenced the way his contemporaries viewed the process of human

understanding. Many of them disagreed with his ideas. His main critique came from George Berkeley (1685-1753), who wrote two books (Treatises Concerning the Principles of Human knowledge (1710) and Three Dialogues between Hylas and Philonous (134), in his reply to the views of John Locke. Quite contrary to Locke's theories that the fundamental essence of the world was matter, and, mind was only a passive instrument, George Berkeley placed mind first and asserted that things exist only when they are perceived by a mind.

As pointed out earlier, John Locke had his supporters too. One of them was the Scottish philosopher, David Hume, who applied Locke's ideas in a logical manner and argued that all thought is built up from simple and separate impressions. Let us examine his ideas a little further.

David Hume: Belief as a Habit

David Hume (for a note on his contributions see Box 5.3) argued that as human beings do in fact live and function in the physical world, we should try to observe how they do so. According to Hume, the proper goal of philosophy is simply to explain why we believe what we do.

Box 5.3 David Hume (1711-1776)

David Hume is generally regarded as the most important philosopher ever to write in English. Hume‟s major philosophical works, A Treatise of Human Nature (17391740), the Enquiries Concerning Human Understanding (1748) and Concerning the Principles of Morals (1751), as well as the posthumously published Dialogues Concerning Natural Religion (1779), remain widely and deeply influential, despite their being denounced by many of his contemporaries as works of scepticism and atheism. While Hume‟s influence is evident in the moral philosophy and economic writings of his close friend Adam Smith, he also awakened Immanuel Kant from his "dogmatic slumbers" and "caused the scales to fall from Jeremy Bentham‟s eyes.

Hume's analysis of human belief begins with a careful distinction among our mental contents of impressions, which are the direct, vivid, and forceful products of immediate experience. Ideas are mere copies of these original impressions. For example, the colour of the tree at which I am now looking is an impression, while my memory of the colour of my mother's hair is merely an idea. Since each idea must be derived from an antecedent impression, Hume supposed, it always makes sense to inquire into the origins of the idea by asking from which impressions it is derived.

The apparent connection of one idea to another is invariably the result of an association that we manufacture ourselves. We use our mental operations to link ideas to each other in one of three ways: resemblance, contiguity, or cause and effect. (You can give such examples animal looks like that animal; this book is on that table; moving this switch turns off the light, etc.) Experience provides us with both the ideas

themselves and our awareness of their associations. All human beliefs result from repeated applications of these simple associations.

Such beliefs can reach beyond the content of present sense- impressions and memory, by appealing to presumed connections of cause and effect. But since each idea is distinct and separable from every other, there is no self-evident relation. These connection scan only be derived from our experience of similar cases. Hume argues that causal reasoning can never be justified rationally. In order to learn, we must suppose that our past experiences bear some relevance to present and future cases. Although we do indeed believe that the future will be like the past, the truth of that belief is not self-evident. In fact, it is always possible for nature to change, so inferences from past to future are never rationally certain. Thus, in Hume's view, all beliefs as a matter of fact are fundamentally non-rational.

You may consider Hume's favourite example about our belief that the sun will rise tomorrow. Clearly, this is a matter of fact; it rests on our conviction that each sunrise is an effect caused by the rotation of the earth. But our belief in that causal relation is based on past observations, and our confidence that it will continue tomorrow cannot be justified by reference to the past. So we have no rational basis for believing that the sun will rise tomorrow. Yet we do believe it.

Scepticism quite properly forbids us to speculate beyond the content of our present experience and memory, yet we find it entirely natural to believe much more than that. Hume held that these unjustifiable beliefs can be explained by reference to custom or habit. That is how we learn from experience. When I observe the constant conjunction of events in my experience, I grow accustomed to associating them with each other.· Although many past cases of sunrise do not guarantee the future of nature, my experience of them does get me used to the idea and produces in me an expectation that the sun will rise again tomorrow. I cannot prove that it will, but I feel that it must.

Remember that the association of ideas is a powerful natural process in which separate ideas come to be joined together in the mind. Of course they can be associated with each other by rational means, as they are in the relations of ideas that constitute mathematical knowledge. But even where this is possible, Hume argued, reason is a slow and inefficient guide, while the habits acquired by much repetition can produce a powerful conviction that is independent of reason.

Our beliefs in matters of fact arise from sentiment rather than from reason. For Hume, imagination and belief differ only in the degree of conviction with which their objects are anticipated. Although this positive answer may seem disappointing, Hume maintained that custom or habit is the guide of life and the foundation of all natural sciences.

The primitive human belief, Hume noted, is that we actually see (and hear, etc.) the physical objects themselves. But modern philosophy and science have persuaded us that this is not literally true. According to the representation list philosophy, we have no direct experience of the presumed cause! If we know objects only by means of ideas, then we cannot use those ideas to establish a causal connection between the things and the objects they are supposed to represent.

In fact, Hume supposed that our belief in the reality of an external world is entirely non-rational. It cannot be supported either as a relation of ideas or even as a matter of fact. Although it is utterly unjustifiable, however, belief in the external world is natural and unavoidable. We are in the habit of supposing that our ideas have external referents, even though we can have no real evidence for doing so.

Where does this leave us? Hume believed himself to be carrying out the empiricist program with rigorous consistency. Locke honestly proposed the possibility of deriving knowledge from experience, but did not carry it far enough and Berkley noticed further implications. Next, Hume has shown that empiricism inevitably leads to an utter and total scepticism.

According to Hume, knowledge of pure mathematics is secure because it rests only on the relations of ideas, without presuming anything about the world. Experimental observations (conducted without any assumption of the existence of material objects) permit us to use our experience in forming useful habits. Any other epistemological effort, especially if it involves the pretence of achieving useful abstract knowledge, is meaningless and unreliable.

The most reasonable position, Hume held, is a “mitigated” scepticism that humbly accepts the limitations of human knowledge while pursuing the legitimate aims of mathematics and the sciences. In our non- philosophical moments, of course, we will be thrown back upon the natural beliefs of everyday life, no matter how lacking in rational.

Hume thought that a human being is a bundle of different perceptions and in that sense has no fixed identity. He criticized the idea that everything has a cause. In fact, he doubted everything that we assume on the basis of our common sense and also on the basis of scientific knowledge. Philosophers have found it hard to answer his penetrating doubts. Hume influenced philosophical debates about principles of knowledge.

As mentioned earlier, Hume has been described as awakening Kant from his dogmatic slumber; it is partly as a reaction to Hume that Kant attempted a theory of knowledge. He wanted to rise above the scepticism of Hume to look for certainties, yet he was not in favour of the pure rationalism of Descartes. Immanuel Kant took rationality of the human mind to a transcendental level and this attempt put him in the category of idealists.

In the next section we will carry forward our discussion of theories of knowledge to cover the idealist approach to understanding the social reality around us. Before moving on to the next section, it is a good idea to complete Reflection and Action 5.1 exercise for absorbing what John Locke and David Hume have said about the ways of acquiring knowledge.

Reflection and Action 5.2

According to Locke our ideas about things come out of our experience of sensations and reflections. And Hume takes it further by concluding that a lot of what we think of as certainties are only habits.

What are you expected to do?

In the light of the above statements find out from at least five persons, including those who haven‟t been schooled in scientific explanations, as to how they will explain the movement of the sun and how they perceive that the earth is round. Write a short note of about five hundred words on their explanations and share it with the fellow students and the academic counsellor at your Study Centre.

SUMMARY

This unit began with the evolution of ethical issues in research which started with Nuremberg Code in 1947 with the laying down of directives for human experimentation. In India two important bodies regulating ethical guide lines and protocol in research are functional. One of them regulates the issues in bio-medical research and the other one looks into ethical issues in social science research. The unit that delves into research ethics specific to the field of women's and gender studies especially because this field blurs the boundary between the researcher and the researched. Thereafter, there is a discussion on the various ethical practices that need to be followed while carrying out research namely, informing the participants about the aim of the research and its description, risks and benefits to the participants, researcher and the society at large. Other aspects like privacy, confidentiality and intention of research should be shared with the participants.

GLOSSARY

Empiricism: Empiricism is the theory that the origin of all knowledge is sense experience.

Research Ethics: deals with the analysis of ethical issues that are raised when people are involved as participants in research.

EXERCISE

1. What is ethics? Discuss in the context of research.
2. Explain how research ethics are different in the field of social sciences?
3. Discuss various practices to address the ethical questions in research with regards to research in this discipline.

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UNIT- 9 SOCIAL RESEARCH PROCESS

STRUCTURE

INTRODUCTION

In the preceding Block we have learnt about the concept and meaning of social research. We have also discussed various languages of social research. In this unit, first, we will present to you two prominent approaches of social research, namely, qualitative approach and quantitative approach. This will be followed by a detailed discussion on the various stages of social research which will help you to prepare a research plan.

LEARNING OBJECTIVES

On completion of this unit, you will be able to:

- understand the various approaches of social research;
- bring out the differences between the two approaches;
- identify the strength and weaknesses of the approaches;
- select a right approach to study a problem;
- list out the various stages of social research

THE SCIENTIFIC APPROACH

We all have been interested in the facts and events that have been taking place around us and have been exploring different sources of evidence concerning the facts and events to acquire knowledge about the various aspects of human experience. People in general use their common sense to understand the facts and events that take place around them. However, it was observed that personal bias influenced the selection of

sources of evidences and that care was not exercised to examine the authenticity of the evidence provided by these sources. The result was inconsistency in the explanation of the same facts and events time and again.

The scientific approach has one characteristic that no other method of attaining knowledge has - objectivity - through which we can attain consistency in the explanation of the same facts and events time and again. There is a well-conceived self-control mechanism all along the way to the scientific approach. This mechanism is so designed that it not only controls and verifies the facts, events and conclusions but it also keeps the researcher away from his personal beliefs, perceptions, biases, values, attitudes and emotions. Thus the approach helps the researcher attain objectivity.

Social researches primarily deal with human behaviour, which is, by and large, complex and dynamic in nature. One cannot, therefore investigate under guided conditions as in natural and physical sciences. This creates many problems to the researcher such as the problems of subjectivity and individualistic generalizations etc. The problem arising out of the nature and content of social researches do not seriously diminish the importance of scientific method for social researcher. Notwithstanding the inherent defects of social researches scientific method can be acceptable with its own limitations for the study of social phenomena so far as it helps to arrive at valid generalisations.

THE APPROACHES TO SOCIAL RESEARCH

A problem can be studied with different approaches. A researcher may take into consideration the phenomenon as a whole and describe it as it exists or may wish to analyse it by its components in measurable or quantifiable terms. The former approach is termed as qualitative approach and the later is known as quantitative approach. Thus, there are two prominent approaches to study a problem in social research. They are:

1. Qualitative approach
2. Quantitative approach

1. Qualitative Approach

In some situations it is difficult to analyse a phenomenon into various components **or** variables which can be measured in quantified terms. In such cases the researcher takes into consideration the phenomenon as a whole and assumes that there is some quality in the phenomenon in its entirety. When the researcher attempts to retain the totality of a phenomenon while verifying propositions regarding it, he/she adopts a qualitative approach. This approach describes the experiences of people in-depth and permits the researcher to record and understand people in-depth in their own perceptions. Qualitative approach helps us to examine the nature of human behaviour

arid experience and social conditions. It also permits the researcher to study selected issues, cases or events in-depth. While using this approach the researcher seeks to capture what people have to say in their own words.

Qualitative approach takes into consideration 'detailed descriptions' of situations, events, interactions, people and their observed behaviours. These data are also available in the form of 'direct quotations' from people about their experiences, attitudes, beliefs, and thoughts. Data in qualitative approach are collected through direct observation, participant observation, in-depth interviewing, case studies, recorded documents, open-ended questionnaires and journals.

The validity and reliability of qualitative data depend to a great extent on the methodological skills, sensitivity, and integrity of the researcher. Systematic and rigorous observation involves far more than just being present and looking around. Skilful interviewing involves much more than just asking questions. Content analysis requires considerably more insights into the data than reading to see what's there. Thus, generating useful, credible qualitative findings through observation, interviewing and content analysis requires discipline, knowledge, training, practice, creativity .and hard work (Patton, 1990: II).

2. Quantitative Approach

Quantitative approach focuses on objective and standardized means of inquiry and application of statistical analysis for attainment of objectivity and generalisations. The researcher identified the various components of the problem and operationalizes the concepts into variables. Quantitative researchers use interview, questionnaire and structured observation as major methods to collect data. Quantitative approach use standardized measures that fit diverse opinions and experiences into predetermined response categories. This approach measures the reactions of a large number of individuals to a limited set or questions, thus facilitating comparison and analysis of data with the help of close-ended questionnaires, attitude scales, rating scales and postal surveys.

Qualitative Approach versus Quantitative Approach

For quite some time the qualitative-quantitative debate has persisted in the field of social research. It has been more of a philosophical debate than that of research practices. Qualitative methods have been the subject of considerable controversy among social scientists. The philosophical and theoretical perspectives which undergird qualitative approach include phenomenology, naturalistic behaviourism and the socio-cultural context of social interaction. This method estimates validity, reliability and objectivity of a social situation and tries to picture the empirical social world as it actually exists to those under investigation, rather than as the researcher imagines it to be.

In recent years, the debate has softened. A consensus has gradually emerged that the important challenge is to match appropriate methods to research questions and not to advocate any single methodological approach for all research situations. Both qualitative and quantitative data can be collected for/under the same studies.

Check Your Progress Exercise 6.1

Notes:

I. Use the space given below for your answer

II. Check your answer with given at the end of this unit

What is the characteristics feature of scientific approach?

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What is qualitative approach in social research?

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What is quantitative approach in social research?

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How can we establish the validity and reliability of qualitative data?

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STAGES OF SOCIAL RESEARCH PROCESS

The approaches discussed in the above section will provide you with guidelines by which you can develop a research plan, select suitable techniques to collect data, interpret data and arrive at generalizations. Before embarking on the details of research methodology and techniques, it seems appropriate to present a brief overview of the research process. Research process consists of series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps.

In this section of the unit we will learn the stages of doing research. The stages consist of every details of doing research. It helps a researcher in many ways. First of

all it gives you a complete picture of the whole research process you need to undergo if you are interested in studying a phenomenon. Finally, this section enables a researcher to monitor his/her research project.

Stage 1: Identification and Formulation of a Research Problem

The first step in planning a research project is the identification of a suitable problem. The choice of a suitable problem is one of the most difficult tasks for a researcher, especially if he/she is a beginner. A thorough understanding of known facts and ideas in the broad area of research constitute the first and the most important step in identification and selection of a problem for your study. A thorough knowledge of the research studies conducted in the field provides you with details about the problems which have remained unresolved. A list of suggestions for further research given at the end of research reports and reviews of research would help you to get an idea about the gaps which exist in the knowledge pertaining to your field of research. Periodicals and bibliographies of research are helpful in keeping you informed about the research going on in the field in which you are interested and show competence. As a researcher first you are required to single out the broad area you wish to study. Once you decide the broad area for your research study immediately you need to evaluate the proposed area in the light of your competence, possible difficulties, in terms of availability of literature, the financial and field constraints, limitations of time etc. After evaluating the broad area you have to choose a specific subject for the study. Let us assume that you have chosen the 'problem of street children'. To undertake a research study on this problem you have to narrow it down to specific research problem. You may make it specific by saying that you would like to study the Psychosocial Problems of Street Children with specific reference to a slum. It is very commonly experienced in social sciences in general and social work in particular, that students respond to this assignment by drawing a total blank. Other students grasp eagerly onto a topic, such as "the causes of delinquency," and rush off with total confidence that they are about to solve this enduring problem. It is very obvious that in each case, the student will be having difficulty in formulating a research problem. In the first case, the difficulty is in locating a problem to investigate whereas, in the second, it is in formulating a problem sufficiently specific that it is amenable to scientific research. This problem is not unique to students. Every student researcher must grapple with the issue of problem formulation. Because it is the initial step and provides the basis for the complete research project. Many potentially serious research problems can be avoided - or at least minimized-by careful process of problem formulation. In this section of this unit, we will present the major issues to be considered in problem formulation, beginning with how to select a problem on which to conduct research.

Stage 2: Defining the Research Topic

Once a research problem has been identified, the research topic needs to be defined. In this stage of research the overall plan for the research project must be set out in

logical order to see if it makes sense. Your research topic should be defined in such a way that it is clearly understood. If you are studying, say for example, alcoholism; you need to put your research question into a framework which suggests that you are very clear and specific about the problem of alcohol consumption and its abuse. In short, topics of research must be grounded in some already-known factual information which is used to introduce the topic and from which the research questions will emerge.

Stage 3: Reviewing the Existing Literature

The beginning of this section has suggested you to get literature relevant to the topic before you want to study it. Since social research topics are usually embedded in so many different kinds of literature a researcher must be careful in selecting the best literature to examine. While many researchers collect every material which has some linkages with the topic, you need to keep the central theme of your topic in mind to guide you through your search of the literature in the field. It is also important to examine different types of literature where relevant inferences are drawn from scientific data interpretations. It would be very useful if research findings from studies using various methods are critically examined. For preparing a research plan, you should refer to the significant findings you have gathered. This will help you to raise questions which in turn will guide you to decide your area and unit of study. You must be able to draw out these findings from the studies and summarize them in such a way that someone unfamiliar with study can easily grasp their meaning and importance. To help you to do this, you should look at the background literature review sections which generally come at the beginning of published research articles. Most of these reviews are very condensed; they extract a few salient points from numerous studies, summarizing them in a way that is relevant to the study in question.

Stage 4: Identification of Objectives of the Study

Once the problem, the theoretical background, the clarification of concepts, and the major methods of data collection have been explained, it is time to address the aim and objectives of the study. At this stage you are required to present the aim and the objectives of the study in brief justifying your study in terms of both its rationale and the implications that it might raise. But in a proposal the study design must be presented before the rationale. Here it is important to note that rationale for' doing the project will be accomplished only if the study is done well. It is important to examine whether the researcher has raised very clearly the questions to which he/she is looking for a solution. These questions should be explicit the researcher should categorically put down the questions on paper. This set of questions can be converted into objectives. Objectives are the foundations of a research project. Eventually the objectives guide the entire process of research. The major attributes of well-written objectives are:

a. Clarity of expression and direction

The objectives must have been stated clearly enough to indicate what the researcher is trying to investigate. It is equally important to avoid overlaps in stating objectives.

b. Measurability

The objectives must be stated in a manner that they are measurable; in case of qualitative research it should be possible to at least codify the data and information so that assessment can be made whether the objectives have been achieved or not.

c. Comprehensiveness

The objectives provide the guiding framework for a research project. Hence, the statement of objectives should be comprehensive enough to cover each and every aspect of the research study. Stating differently, nothing should be outside the purview of the stated objectives.

Stage 5: Formulation of Hypotheses

A common strategy in scientific study is to move from a general theory to a specific researchable problem. A part of this exercise is to develop hypotheses, which are testable statements of presumed relationships between two or more concepts. In other words, hypothesis is tentative assumption made in order to draw out and test its logical or empirical consequences. Hypothesis states what we expect to find rather than what has already been determined to exist. After extensive survey of literature and statement of objectives, researcher should state in clear terms the hypothesis. It may be noted here that we do not need to propose hypothesis in the case of exploratory or formulate researches.

Stage 6: Research Design

After the research problem and its aims and objectives are stated and hypotheses are formulated in clear cut terms, the researcher is required to prepare a research design, i.e., he/she will have to state the conceptual framework within which research would be conducted. The preparation of such a research design facilitates researcher to complete his/her research project as proposed. In other words, the function of research design is to provide for the completion of the research project with minimum effort, time and money. But how all these can be achieved depends mainly on the research purpose. Research purpose may be grouped into four categories, viz., (i) Exploration, (ii) Description, (iii) Diagnosis, and (iv) Experimentation. A flexible research design, which provides opportunity for considering many different aspects of a problem, is considered appropriate if the purpose of the research study is that of exploration. But when the purpose happens to be an accurate description of a situation or of an association between variables, the suitable design will be one that minimizes bias and maximizes the reliability of the data collected and analysed. There are

several research designs, out of which the researcher must select one for his/her own project. The preparation of the research design (you will know about research designs in detail in Block 2), appropriate for a particular research problem, depends usually on its objectives and hypotheses, the sample, the type of data to be collected, time available for research; and the finance available for the purpose.

Stage 7: Selection of Sample

At this stage the researcher is required to decide the sample design of his/her study i.e. the way of selecting a sample. In other words, a sample design is a plan decided before any data are actually collected. The selection of the sample for the study depends on many factors. Some of these factors affect the selection of the sample to a great extent. We will discuss a few of them. The homogeneity or heterogeneity of the universe is one such factor which affects the sample selection procedure to a great extent. For example, if you are interested in studying medical students, which is a very homogeneous group, even a very small sample will be representative of the universe where as if you plan to study a college having arts, science and commerce faculties you may have to choose a very large sample and even then you may not have confidence to say that your sample is representative. Other important issues with regard to selection of sample that need to be considered are: sample size, sampling technique and type of the sample. The size of the sample depends on the nature of objectives of a research project and the research design. For example, in case of rigorous experimentation, it is difficult to handle large samples. Also, it is not necessary. Similarly, for surveys and such other status studies, samples have to be large. The main consideration here is that there has to be an optimum size of sample beyond which it is waste of research resources. What is to be considered is whether the sample size is large enough for the study and the sample size has been determined scientifically.

Stage 8: Selection of Methods and Tools of Data Collection

There are three primary means of data collection, namely, observation, interview and questionnaire. You will learn about these methods in subsequent units of this block. In these units the methods are explained in detail so that you can use them to design and carry out a study based on questionnaires or interviews and in field studies use different types of observation techniques. It also describes different forms of what might be called data collection procedures for using secondary data. While preparing the research plan you must describe how you will collect primary data. In case you are planning to use secondary data you must mention which sources of available data you will actually use. It is important for a researcher to see whether, he/she can get the proposed data. If you anticipate problems in securing the proposed data, these problems should be discussed and possible alternate sources of data might be suggested. Most researchers propose to use one source of data yet to widen their scope you, may propose few more sources through which you may also collect data.

It is important to note that the research instruments are for the measurement of variables. Every variable has certain attributes of its own, amenable to measurement by different types of scaling, namely, nominal, ordinal, ratio and interval. Similarly, these are variables which are amenable only to rigorous standardised tests, like those of intelligence, reasoning ability, etc. There are others which can be measured through inventories or questionnaires. Then there are variables which necessitate the use of interviews with probing questions to be able to go into the details of a process. The common mistake in this area is the use of incompatible instruments vis-à-vis the variables being measured; for example, researchers may use a questionnaire to measure attitude. Similarly, in the name of a questionnaire, researchers may actually frame an opinionative. Sometimes researchers use questionnaires for conducting interviews as if a questionnaire is no different from an interview schedule. More often than not, interviewing is called for when a lead question to 'Yes' and/or 'If no' kind of situation. The points to be borne in mind while preparing a research.

Stage 9: Collection of Data

There are different methods of data collection. Each method of data collection has its special concerns which need to be considered fully before doing the study. This is why pre-testing is so valuable, because it helps you to find and address potential problems before they enter your study and cause bigger problems. The plans for collecting data should be described carefully. In a field study, it is always more difficult to be precise, and you may need to make changes once you enter the field. Nevertheless, it is better to have a clear plan that can be changed as you move forward. For an experiment; data collection procedures can usually be described very precisely. This is also true of a survey. Surveys using mailed questionnaire tend to have multiple stages in the data collection procedure to increase the response rate. If you are using secondary data, you need to describe at this stage how you will collect the data. The quality of the outcome of research also depends on the quality of data itself. In turn, the quality of data is determined by the procedure of data collection. The indication of the quality of data lies in the dependability of the information collected from the sample.

Stage 10: Processing of the Data

Once the data are collected, they must be processed. If the responses are in qualitative terms you have to prepare a code book where you have to give numbers for the qualitative responses. This is very much essential if you wish to process your data through computer. If they are field notes, they must be organised and categorised. In the research proposal, a concise statement may be included to address this subject. It may describe what type of computer facilities is available, what possible sources of assistance are available, and what efforts are being made to increase accuracy in the handling of the data. There are now some technological advances in data gathering which speed the process from data gathering to data entry. An example is the SPSS

(Statistical Package for Social Sciences) now becoming quite common for social research.

Stage 11: Analysis and Interpretation of Data

You need to plan how you will analyse the data. It is advisable to prepare a plan of analysis of data spelling out the various applications of statistical tests carefully while the study is being designed. It is better to have a planned strategy that can be adapted than to end up with piles of data for which you have no organised plan. You are also required to explain how you are planning to compare or contrast different variables, for example, men with women, one rehabilitation program with another, length of time spent in an organisation by the attitude of employees towards the new incentive introduced recently? In addition, you need to consider which statistical tests you plan to apply to evaluate the association/differences between the variables. For example, if you propose to measure correlation between the variables to test whether there are significant correlations between them you have to select an appropriate test of correlation that could get the result you need.

Stage 12: Presentation of the Report

Every research is conducted by presenting its results in the form of a report. The reporting of results of a research study depends on purpose, with which it was undertaken. A study might have been conducted for various reasons, such as; a personal research may be for award of a degree, an institutional project, a project funded by an outside agency, etc. At the end of the study, you have to present the results of the study in the form of a report. Research studies follow scientific process. As such, when it is reported it follows certain conventions and formats for maintaining parity in reporting and for easy grasps by readers. While preparing a research report you have to follow a number of writing conventions. These conventions are commonly known as research formats. These conventions/research formats allow the researcher to present his/her findings within a framework, a framework which is both logical and sequential. By following conventions/research formats the researcher not only systematises and structures his/her research findings in terms of the research problem and its objectives but also facilitate the reading and comprehension of the report by others. In a very broad sense, the format of a research report consists of three parts: the preliminaries, the text and the reference materials. The length of any of these three parts is conditional on the extent of the study. Each of these parts may consist of several subsections. (For order of individual items within the three main sections and other details about the conventions/research formats you are advised to refer “Thesis and Assignment Writing” by Anderson, et.al.).

The stages discussed above are presented below in a diagrammatic form to help the learners to comprehend the complete research process quickly. The research process is cyclic in nature. In fact, the research process is not complete at the stage 12. The

process leads to two situations: The first situation may be that the data did not support or partially support the hypothesis. In this situation the researcher must return to the stage I. He/she, then, may decide to reformulate the problem and hypothesis and then list it exactly as before. In the second situation, that is, even if the research is successful and the findings of stage 12 confirm the hypothesis of stage 5, it is advisable to repeat the study preferably with a different sample as to reconfirm the findings. This will also support the contention that the hypothesis cannot be rejected. The exact 'repetition' of a study is called replication. Another characteristic feature of the research process is 'self-correction'. In the situation, when the data did not support or only partially support the hypothesis and the researcher have sufficient reasons to decide that the hypothesis is adequate then he may decide that the failure to confirm the hypothesis is due to error in selecting a sampling design or in measurement of the key concepts or in analysis of data. In these situations the researcher may decide to repeat the study beginning with the faulty stage after rectifying the faults. Finally, the six stages of the research process make the study potentially replicable. The researcher designs his/her study in such a way that either the researcher or others can replicate it. The replications of study substantiate the fact further that the findings are not due to mere coincidence.

Check Your Progress Exercise 6.2

Notes:

I. Use the space given below for your answer

II. Check your answer with given at the end of this unit

Q. 5 List out at least three advantages of a research plan.

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Q. 6 Differentiate between processing and analysis of data

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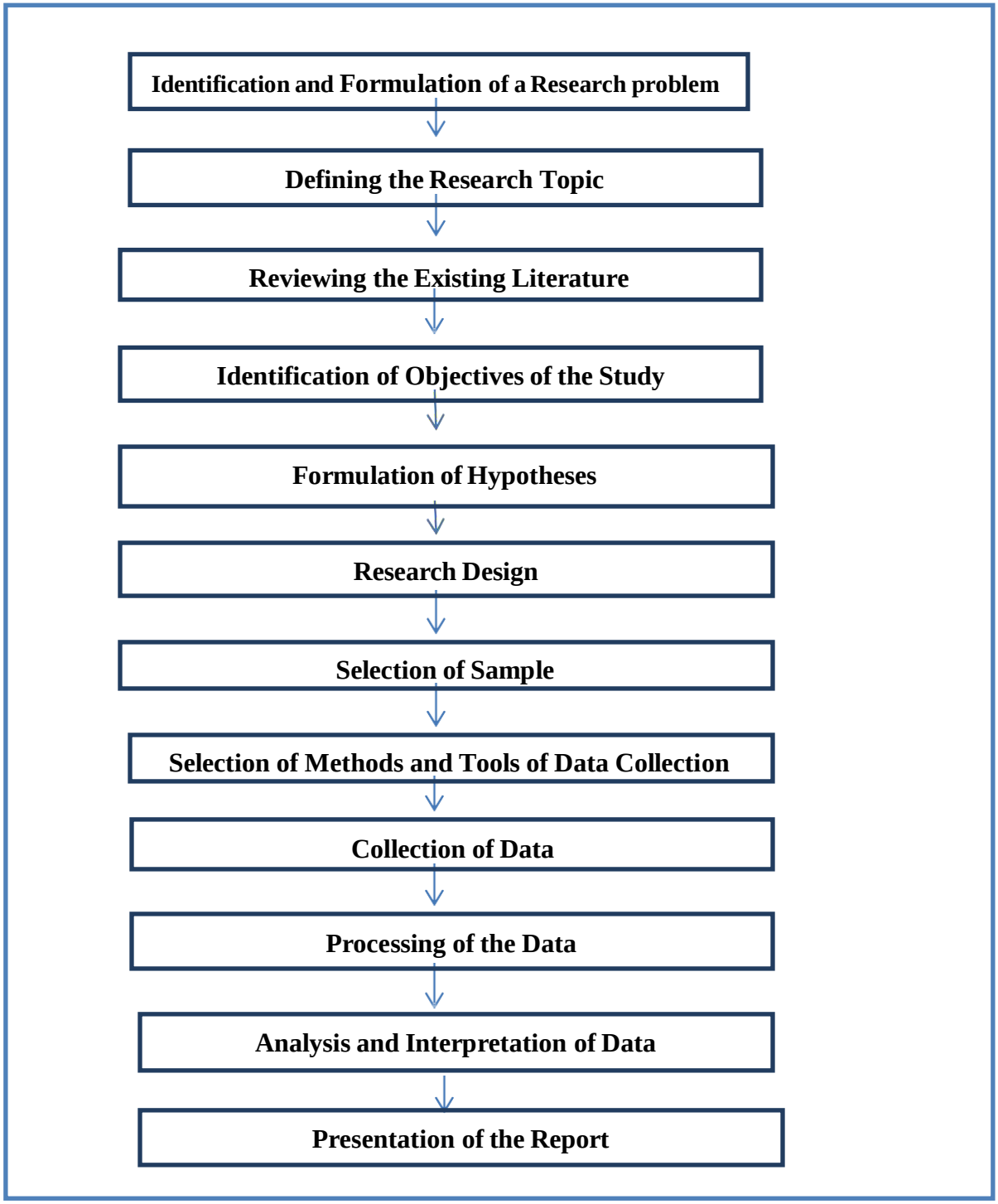
Figure 6.1 Stages of Social Research



SUMMARY

There are two prominent approaches in social research, namely, qualitative, approach and quantitative approach. When a researcher takes into consideration the phenomenon as a whole and describes it as it exists, the approach is termed as qualitative approach. When a phenomenon is analysed by its components in measurable or quantifiable terms it is known as quantitative approach.

Qualitative approach takes into consideration 'detailed descriptions' of situations; Data in qualitative approach are collected through direct observation, participant observation, in-depth interviewing, case studies, recorded documents, open-ended questionnaires and journals. The validity and reliability of qualitative data depend to a great extent on the methodological skills, sensitivity, and integrity of the researcher. Quantitative approach focuses on objective and standardized means of inquiry and application of statistical analysis for attainment of objectivity and generalisations. In recent years, the debate has softened. A consensus has gradually emerged that the important challenge is to match appropriate methods to research questions and not to advocate any single methodological approach for all research situations. Both qualitative and quantitative data can be collected for/under the same studies.

A social research is completed in various stages. Some of the important stages of a research project are: identification of a research problem, defining the research topic, reviewing the existing literature, identifications of objectives of the study, formulation of hypotheses, selection of method of data collection, selection of sample, collection of data, processing and analysis of the data and presentation of the report.

GLOSSARY

Concepts: terminological means by which social scientists seek to analysis social phenomena and formulate higher level propositions.

Generalization: outcome/results of the scientific study

Hypotheses: testable statements of presumed relationships between two or more concepts.

Qualitative Approach: takes into consideration detailed descriptions of situations, events, people interaction and their observed behaviour.

Quantitative Approach: focuses on objective and standardized means of inquiry by using statistical analysis.

Research Problem: the topic of study selected for intensive research.

Sample: representative parts/units selected from the universe (the domain of study).

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: The characteristic feature of scientific approach is attaining knowledge with objectivity through 'objectivity' we can attain consistency in the explanation of the same facts and events time and again.

Answer to Q.2: Qualitative approach is one of the approaches of social research to study the phenomenon as a whole. This approach assumes that there is some quality in the phenomenon in its entirety. This approach describes the experiences of people in-depth and permits the researcher to record and understand people in-depth in their own perceptions. It helps us to examine the nature of human behaviour and experience and social conditions. It also permits the researcher to study selected issues, cases or events in depth. While using this approach the researcher seeks to capture what people have to say in their own words.

Answer to Q.3: In quantitative approach, the researcher identifies the various components of the problem and operationalizes the concepts into variables. Thereafter he uses questionnaire or structured interview schedule to collect data and makes generalisations by application of statistical tests.

Answer to Q.4: The validity and reliability of qualitative data are established mostly through methodological skills, like sensitivity and integrity of the researcher. Systematic and rigorous observation and skilful interviewing are some other methodological techniques, which assure researcher of validity and reliability in qualitative approach.

Answer to Q.5: i) Research plan gives a complete picture of the whole research process.

ii) Research plan helps to make time and budget estimate.

iii) A plan of research project enables a researcher to monitor his/her
research project.

Answer to Q.6: Once data are collected it needs to be processed. Processing of data includes a number of operations such as, editing of data, coding of data, categorisation and re-categorisation of data, recoding and computing of data. Analysis of data mainly

consists of cross-tabulation of variables and application of statistical tests. The purpose of analysis of data is to examine association differences/correlations between variables and draw inferences.

EXERCISE

1. Discuss the various approaches of social research.
2. What is scientific approach?
3. What is qualitative approach to study the social science research?

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UNIT -10 LITERATURE REVIEW PROCESS AND FORMULATION OF RESEARCH QUESTIONS

STRUCTURE

INTRODUCTION

Review of literature is a collective body of works done by earlier scientists' and published in the form of books or in the form of articles in journals or published as monograph etc. Every scientific investigation starts with a Review of Literature. In fact, working with the literature is an essential part of the research process which helps generate ideas, helps in developing significant questions and is regarded as instrumental in the process of research design. In this unit we will be dealing with the review of literature, how to go about it, what its importance is and how the review should be organised and how to relate it to the present research report.

OBJECTIVES

After reading this unit, you will be able to:

- Discuss the purposes of review of literature;
- Explain the sources of review of literature in psychology;
- Identify different types of literature;
- Learn about the writing process; and
- Describe the process of preparation of index card.

PURPOSES OF REVIEW OF LITERATURE

A literature review is part of a report. It provides considerable information on the topic being researched and the various works that had gone on in the field over the years. These materials are gathered by the researcher from many sources such as journals, books, documents etc. The review of such a literature could be a matter of fact presentation of the information or it could be a synthesis of a large number of information and put together subject wise for the purpose of understanding. It can be just a simple summary of the sources, but it usually has an organisational pattern and combines both summary and synthesis. In summary all the information is synthesised and given in a capsule form. It synthesises and organises the entire information in terms of its relevance and appropriateness to the topic of research. It might give a new interpretation of old material or combine new with old interpretations. Or it might trace the intellectual progression of the field, including major debates. And depending on the situation, the literature review may evaluate the sources and advise the reader on the most pertinent and relevant information.

Difference between Literature review and Academic research report

The question arises as to how the literature review differs from an academic research paper. While the main focus of an academic research paper is to develop a new argument, a research report will contain the literature review as one of its chapters. In a research report one uses the literature as a basic foundation and support for newer ideas and insights into the research topic of interest. Literature review on the other

hand summarises and synthesises the many arguments and literature and research findings gathered from such a review and puts forward arguments in favour or against the particular topic and its findings.

Materials to be included in review of literature

The next question is regarding how many and how much of materials to be included in review of literature. There is no hard and fast rule about this. The researcher has to definitely include the materials from classic and pioneering works in the area. In addition the researcher should also include all the relevant research works published more recently especially in the last 5 to 10 years. As for the types of sources to be consulted for review of literature, this includes books, journal articles, monographs, documents, grey literature such as unpublished documents or research papers read at some conferences etc. In addition the internet is an important source from where articles and abstracts could be downloaded for this purpose. Once all the materials have been gathered from different sources as mentioned above, the researcher should organise the same according to the year of publication and the subject matter must be organised to give meaning to the entire literature gathered keeping in view the present research topic of interest to the researcher. The researcher can evaluate these materials on the basis of the methodology used, the research findings arrived etc. The researcher could also include in such a review certain minimal and directly relevant historical account regarding the research topic.

The specific purposes of a Review of the Literature are enumerated below:

- *Identifying variables relevant for research*

When the researcher makes a careful Review of the Literature, he becomes aware of the important and unimportant variables in the concerned area of research. A careful Review also helps the researcher in selecting the variables lying within the scope of his interest, in defining and operationalizing as well as in identifying variables which are conceptually and practically important. Thus a Review of the Literature, on the whole, prepares the researcher to formulate a research problem in which conceptualisation and practically important variables are selected.

- *Avoidance of repetition*

A Review of the Literature helps the researcher in avoiding any duplication of work done earlier. A careful review always aims at interpreting prior studies and indicating their usefulness for the study to be undertaken. Thus prior studies serve as the foundation for present research. In some cases the duplication or replication of prior studies becomes essential. This is especially true when the researcher wants to test the validity of the earlier studies. In such a situation, too, a careful review helps the researcher in getting acquainted with the number and nature of the studies related to the present research whose validity is being assessed at present.

- *Synthesis of prior works*

Review of the Literature enables the researcher to collect and synthesise prior studies related to the present study. This, in turn, helps the researcher in building a better perspective for future research. A synthesised collection of prior studies also helps a researcher to identify the significant overlaps and the gaps among the prior works.

Determining meaning and relationship among variables

A careful Review of the Literature enables the researcher in discovering important variables relevant to the area of the present research. When significant variables are discovered, the relationship among them can be identified, subsequently, the identified relationship is incorporated into different hypotheses. Thus, for conducting a scientific study, the relationship between the different variables must be explored by reviewing the literature so that a good context may be built up for subsequent investigations. In addition to these specific purposes, there are some general purposes of the literature review:

- To argue for the relevance and the significance of the research question.
- To provide the context for one's own methodological approach
- To establish one's own credibility as a knowledgeable and capable researcher.
- To argue for the relevance and appropriateness of one's own approach.

SOURCES OF THE REVIEW OF LITERATURE

There are diverse sources of the Review of the Literature. Some of them are enumerated below.

Journals and Books

Different research journals and books relevant to the areas of interest are the primary sources of the Review of Literature. Most major libraries have a periodical section where different types of research journals are made easily available. A research journal generally contains the publication of original research reports with their detailed methodology and results. Such journals contain original research reports with their detailed methodology and result. Such journals are referred and therefore are different from non-referred journals. A referred journal is one which reports only those articles which are carefully reviewed by the experts before publication. Often, the reviewer rejects several manuscripts and selects a few for publication. Similarly, books are also direct sources of the Review of Literature. Of these two, journals are regarded as more useful because they provide the researcher with the latest and up-to-date information relevant to the area of interest.

Reviews

Reviews are short articles that give brief information regarding the work done in a particular area over a period of time. Reviews are commonly published in journals, yearbooks, handbooks and encyclopaedias. Reviewers select research articles of their interest, organise them content wise, criticise their findings and offer their own suggestions and conclusions. Review articles are a good source for those investigators who wish to have all the relevant researches at one place without taking pains to look for them. Since the reviewers organise all the possible research papers of the relevant area in their review articles, review articles also provide the advantage of prior reviews.

Abstracts

Abstracts provide a summary of the research reports done in different fields Psychological abstract (Washington: American Psychological Association), and Sociological abstract (New York: Sociological Abstracts, INC) are the two common examples of abstracts. These abstracts are the useful sources of up-to-date information for researchers. In an abstract, besides a summary, researchers get all the relevant information such as the title of the Research Report, name of the author and the journal pagination information, etc., regarding the research article. The only limitation of abstracts is that they fail to satisfy those researchers who desire detailed information regarding the methodology and results of the research articles.

Indexes

Indexes show the titles of the research report without any abstract. The titles are categorised and arranged alphabetically in each category so that the researcher can locate any article of interest easily. The Education Index (New York: H W Wilson Co.) is a good example of an index. As indexes do not provide detailed information they keep many a researcher dissatisfied. They can be best regarded as the supplementary source which, if combined with other sources, can yield valuable information to the researchers.

Internet

Today Internet is a very easy and quick source of Review of Literature. Internet sites are very useful for providing easy access to original writings by important researchers. They also provide such updated information on the topic that ordinarily is not available in the library. Internet sites also provide for useful bibliographies related to a particular researcher. Search on Internet also reveals some relevant professional societies and academic associations which can provide a lot of support to the studies in the concerned area. Such organisations also sometimes publish important papers or periodicals which can be of immense help to the researchers. Some publishers put the brief content and extracts from the recently published books on the Internet and these can be of valuable help to the researchers. Sometimes, the Internet sites include

articles extracted from encyclopaedias which can also be very useful and informative as background reading. However, they are not normally suitable for citing in a report.

Doctoral Dissertations

Doctoral dissertations have also been a very good source of the Review of the Literature. In libraries of universities, doctoral dissertations are available. The researcher can choose the dissertations of their interest and find useful and relevant information there. There are no set forms for writing the research report in a doctoral dissertation but most dissertations contain chapters like an Introduction, Review of the Literature, Purpose of the Study, Method of the Study, Results, Discussion, Summary and Conclusion.

Some researchers prefer not to add a separate chapter on Discussion, Summary and Conclusion. Some do not add a separate chapter on the Review of the Literature but incorporate it into the Introduction itself. Thus the doctoral dissertations present the advantage of prior review. Ordinarily, it is not possible for the researcher to move through all the important libraries in the country to consult all existing doctoral dissertations. Hence, he/she can have access to those dissertations that interest him through Dissertation Abstracts International, which publishes the abstracts of the doctoral dissertations submitted to different universities. In India, the Survey of Research in Education (edited by M. B. Buch) does much the same function. The second Survey of Research in Education covering the period during 1972-78 has also been released. Recently, the listing of dissertation abstracts has been computerised through DATRIX in terms of the key words (usually words appearing in title of the dissertation).

Supervisors/Research Professors

Supervisors often know the literature well and are able to guide in right direction. They are the recognised authority on the topic or research problems. Therefore, they should be consulted and their suggestions and advices should be carefully analysed. It may also be that the other research professors have recently sourced and reviewed the literature or an area very close to the literature the researcher is seeking. So they also constitute one important source. Whatever may be the sources of reviews, the process of reviewing literature itself is not above criticisms. Inevitably, the interpretation of findings insights derived, the manner in which conclusions are drawn are all solely dependent upon the judgments of the reviewer, In other words, such reviews fall prey to what is called subjective judgment.

Check Your Progress Exercise 7.1

Notes:

I. Use the space given below for your answer

II. Check your answer with given at the end of this unit

Point out the major purpose of literature search.

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Name two important sources of literature, available in print form, which are widely used nationally and internationally.

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What are the technological sources of literature search?

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TYPES OF LITERATURE

In order to work with appropriate literature it is essential that the researcher must be able to identify and find it. For this, he/she must have an understanding of various literature types. Some of the common types of literature are as under:

Subject-Specific Books

Introductory and advanced text books and research report can provide important background and context for the research. Such literatures also provide information about theory and method of the research.

Grey Literature

Grey literature means both published and unpublished materials that somehow do not have International Standard Book Number (ISBN) or an International Standard Serial Number (ISSN). Grey literature is a broad category that includes unpublished research newspaper articles, conference paper and pamphlets, etc. During the course of doing research most researchers do utilise one or the other type of grey literature.

Official Publications, Archives and Statistics

This type of literature serves the dual purpose. Firstly such literature can be a valuable source of background and contextual information and secondly, they can also be used as a source of secondary data, Document analysis and secondary data analysis are often based upon this type of literature.

Writing Aids

As its name implies, such literature generally offer a significant support during the process of writing and can be easily used to improve the linguistic style of the work. Such literature includes dictionaries, bibliographic works, encyclopaedias, thesauruses, yearbooks, books of quotes, almanacs, etc.

Journal Articles

This type of literature is very common among the researches. It popularity is due to several factors; First, journal articles are very credible. Second, they are often targeted for academic audience. Third, they possess the trait of specialty. Fourth, they possess the regularity of production which meant that research articles are not only relevant but also current.

WRITING PROCESS OF THE REVIEW OF LITERATURE

Since the Review of Literature may be a very long chapter, it does need some form of structure. The simplest way of organising the research works is to discuss them in chronological order. But this may not prove to be appropriate in all situations. Another way is that one can group the works on different subjects together with the date of publication as the only criterion of order. But this may also be confusing. Still another way may be to base the structure on the different types of publications. For example, chapters from books, journal articles and single authored books should be separately grouped and structured. The basic aim of the Review of Literature is to use the literature for informing, establishing and arguing. In fact, the Review of Literature should go beyond the said report.

Find a Focus

A literature review is not the sources themselves. This means that the researcher will not just list the sources but selectively use them in the research topic area. These can be accommodated in terms of themes, or issues and bring those sources together, and present them. Some of the questions the researcher should ask self are the following:

- Do they present one or different solutions?
- Is there an aspect of the field that is missing?
- How well do they present the material?
- Do they portray it according to an appropriate theory?
- Do they reveal a trend in the field?
- A raging debate?

One of the above themes should be picked up to focus the organisation of the review.

Construct a Working Thesis Statement

The thesis statement should argue for a particular perspective on the material. Some sample thesis statements for literature reviews are as follows:

The current trend in treatment for congestive heart failure combines surgery and medicine.

More and more cultural studies scholars are accepting popular media as a subject worthy of academic consideration.

Consider Organization

Once the statement has been made, what is the most effective way of presenting the information? What are the most important topics, subtopics, etc., that the review needs to include? And in what order should they be presented? The researcher should develop an organisation for the review at both a global and local level.

Cover the Basic Categories

Just like most academic papers, literature reviews also must contain at least three basic elements: an introduction or background information section; the body of the review containing the discussion of sources; and, finally, a conclusion and/or recommendations section to end the paper.

Organise the Body of the Report

Once the basic categories are in place, then the researcher must consider how the sources should be presented within the body of the report. To work out an overall organisational framework for the review, the following three typical ways of organising should be considered

- *Chronological Method*

If your review follows the chronological method, you could write about the materials above according to when they were published. For instance, first you would talk about the studies of the 19th century, and then about the book published in the 1970's and then end up with articles about the topic in the recent years.

- *Method By publication*

If the order demonstrates a particular trend, then the researcher can arrange the reviews in the order of publication chronology. For instance, you could order a review of literature on the psychological aspects of suicides, if the progression revealed a change in suicidal practices over the years.

- *Method By trend*

Another way to organise the resources is to examine the sources under another trend such trends in couple suicide or suicidal pact etc. Under this method, the researcher

would combine the recent studies on suicidal pacts, of a century ago with those that are available today.

Thematic Reviews of Literature

Thematic reviews of literature are organised around a topic or issue, rather than the progression of time. However, progression of time may still be an important factor in a thematic review. For instance, the suicidal review could focus on the development of the self-esteem or disappointment in love affair leading to suicide. These studies could be organised chronologically. The only difference here between a "chronological" and a "thematic" approach is what is emphasised the most: the reason of injury to one's self esteem leading top suicide.

A Methodological Approach

This approach differs from the two above in that the focusing factor. Here the focus is on the method used by the researcher. For the suicidal issue, one methodological approach would be to look at cultural differences between the methods of suicides. Or the review might focus on the economic impact of suicides. A methodological scope will influence either the types of documents in the review or the way in which these documents are discussed. Once you've decided on the organisational method for the body of the review, the sections to be included should be easy to figure out. They should arise out of the organisational strategy. In other words, a chronological review would have subsections for each vital time period. A thematic review would have subtopics based upon factors that relate to the theme or issue. Sometimes, though, one might need to add additional sections that are necessary for the study, and a few are given below:

Current Situation: Information necessary to understand the topic or focus of the literature review.

History: The chronological progression of the field, the literature, or an idea that is necessary to understand the literature review.

Methods and/or Standards: The criteria used to select the sources in the literature review or the way in which the researcher presents the information. For instance, one may explain that your review includes only peer-reviewed articles and journals.

Questions for Further Research: What questions about the field has the review sparked? How will the researcher use the review for further work in the area? O'heary (2004) has recommended that for writing a good literature review, the following steps should strictly be followed:

- *Relevant reviews*

The researcher should give a look on the literature reviews done in several of the journal articles. From these reviews, good and relevant reviews should be sorted and

this depends upon the research skills of the researchers. Supervisor should help him in selecting the relevant and good reviews.

- *Write critical annotations while going through the various reviews*

The researcher should sort and organise the annotations of the reviews by themes, issue of concern and common limitations, etc. While doing so, some patterns would start emerging and this would, in turn, help in developing researcher's own argument.

- *To develop a structure*

The researcher should structure the potential reviews according to the most urgent needs such as topical themes, arguments that the researcher wishes to establish, etc. The structure so developed is always subject to modification with the emergence of new thinking.

- *To write purposefully*

The researcher should note that he can review the literature without any agenda but he cannot write a formal literature review without any definite agenda or aim. The reader must know the reasons why and what are you telling them.

- *Use the literature to support the argument*

The researcher should not use the review only for reporting or borrowing the arguments from others rather he should use the literature for generating ideas that may help or support his own arguments.

- *Make the literature review an on-going process*

The researcher should make the literature review an on-going process. In other words, the literature review should answer the researcher's question, theories and methods and these should help in setting the parameters of the literature review. Thus literature review becomes a cyclical process and should often have a moving target.

- *Get plenty of feedback*

The researcher should not wait up to the last minute of writing process. Whatever has been written should be passed over to supervisors and other experts for their feedback. Early feedback gives a chance for rethinking and modification of ideas being incorporated in the writing process.

- *Remain prepared for redrafting*

In view of the suggestions through feedback, the researcher should redraft the review in a coherent manner so that the argument is reasonably supported. Thus, writing the literature review is a complex task which can be made easy by following the above mentioned steps meticulously.

HOW OLD SHOULD THE LITERATURE BE?

One of the important questions for a researcher is: how old may the literature be? The simplest answer to this question is that it can be of any age, In fact, academic research

is a cumulative activity. Each generation of researcher learns from the work of previous generation and current research basically depends upon the work and insights of the previous researchers. Since in any society the latest and contemporary research and publication are in great demand it is preferable to cite as many recent publications as possible.

Despite this, almost in any discipline, there are some seminal works which are centuries old but have become so significant that they are still being preferred by the researchers. Although their original ideas have been modified by the subsequent researchers over the years, their original spirit and views still remain significant and are held in considerable esteem. For example, the work of Sigmund Freud in the field of Psychoanalysis is of about 150 year back but his ideas, theories, viewpoints are so pertinent and of importance to any researcher of today, that working in this field is bound to have these included in the Review of the Literature.

However, it would be a healthy suggestion for researchers that they should always take precaution in citing older works unless they are confident and convinced in quoting them.

PREPARATION OF INDEX CARD FOR REVIEWING AND ABSTRACTING

After going through the different sources of the Review of the Literature, researchers prepare their own review and abstract on the index card. Usually, for the purpose, a 6" × 10" index card is recommended. In most journal articles, an abstract in about 150 words is provided. The researcher can incorporate it in the abstract being written. Where the article seems to be very important and relevant, the researcher can prepare a more detailed version. Usually, the abstract, thus prepared, is divided into three parts.

i) The first part consists of the purpose and hypothesis of the study. The researcher should write down the purpose of the study in not more than two lines. If the hypotheses are small. They can be recorded verbatim but if they are lengthy, they should be synthesised.
ii) The second part consists of the methodology of the study in which size of the sample, nature of the population, methods for measuring or manipulation of the variables, methods of data collection, designs and statistics are shown in synthesised form.
iii) The third part consists of the findings and conclusions. In this part, the researcher should briefly take down the findings relating to each hypothesis and also concisely the conclusion drawn by the author.

At the top of the index card, a full reference should be clearly written in exactly the same way in which it appears in the researcher's own reference list. There are different types of research formats but that which is followed by the Publication

Manual of the American Psychological Association is widely popular and has been adopted by most of the important research journals. The researcher should never trust own memory for recall of the details of any research article and therefore, all the important and relevant details should be carefully noted down in the index card.

Thus the reviewing and abstracting of the literature on the index card should be done carefully and systematically. Sometimes it has been reported that researchers trust their memory for recalling a particular detail. But this is not a healthy practice because they are apt to forget the details or their memory may be blurred after some time. Researchers should try their best to accommodate every important and relevant detail under the three common headings suggested above.

FORMULATION OF RESEARCH QUESTIONS

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.

2.9.1 Components of 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.

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 tho.se 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 problem s 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 a 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).

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 a]so 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).

Check Your Progress Exercise 7.2

Notes:

I. Use the space given below for your answer

II. Check your answer with given at the end of this unit

How does a researcher choose the area of his research?

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What is an annotated bibliography?

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SUMMARY

A literature review is part of a report. It provides considerable information on the topic being researched and the various works that had gone on in the field over the years. These materials are gathered by the researcher from many sources such as journals, books, documents etc. Literature review differs from an academic research paper in that the main focus of an academic research paper is to develop a new argument whereas a research report will contain the literature review as one of its chapters. To the issue of how many and how much of materials to be included in review of literature, there is no hard and fast rule about this. The researcher has to definitely include the materials from classic and pioneering works in the area. In addition the researcher should also include all the relevant research works published more recently especially in the last 5 to 10 years. As for the types of sources to be consulted for review of literature, this includes books, journal articles, monographs, documents, grey literature such as unpublished documents or research papers read at some conferences etc. In addition the internet is an important source from where articles and abstracts could be downloaded for this purpose. The specific purposes of a Review of the Literature are identifying variables relevant for research, avoidance of repetition, synthesis of prior works and determining meaning and relationship among variables. There are diverse sources of the Review of the Literature, which includes, journals and books, reviews, abstracts, and indexes. Internet, doctoral dissertations are other sources. As for the types of literature available for write up, this includes, subject specific books, grey literature, official publications, writing aids and journal articles. Since the Review of Literature may be a very long chapter, it does need some form of structure. The simplest way of organising the research works is to discuss them in chronological order.

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.

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. This results in a well-defined research problem that is not only meaningful from an operational point of view, but also equally capable of paving the way for the development of a working hypothesis and for means of solving the problem itself.

GLOSSARY

Empirical evidence: evidence that comes from direct experience, scientifically gathered data, or experimentation

Literature review: a scholarly research step that entails identifying and studying all existing studies on a topic to create a basis for new research

Meta-analysis: a technique in which the results of virtually all previous studies on a specific subject are evaluated together

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: a) To locate important independent and dependent variables of the research.

b) To find out the research gap.

c) To study the implications of the findings variables involved in the research study.

d) To provide a frame of reference for the research study.

e) To appropriate the significance of the research study.

Answer to Q.2: a) Survey of Research published by National Council of Educational Research and Training.

b) Dissertation Abstracts International

Answer to Q.3: a) Audio-video programmes containing interviews, presentations, real case studies, process of an event, contextual happening of a phenomenon, etc.

b) Web-based documents available with the help of search engines like *www.google.com*

Answer to Q.4: The first thing a researcher does, while choosing the area of his research, is to identify his area of interest and define the different variables that would form the part of his research study. With the help of a matrix which has two major dimensions, namely, area of study and variables to be studied, the researcher can locate his research study.

Answer to Q.5: Annotated bibliography contains the title of the research paper, project dissertation, the research problem, sample of the study, procedures or design of the study and results and conclusion of the study.

EXERCISE

1. Discuss the purposes of review of literature.
2. What are the different types of literature?
3. Discuss the writing process of review of literature.
4. What are the technological sources of literature search?

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UNIT 11 HYPOTHESIS: CHARACTERISTICS AND TYPES

STRUCTURE

INTRODUCTION

Once the selection and definition of the research problem have been accomplished, the derivation of the hypothesis is the next most important step in the research process. From the research scholar's point of view, the hypothesis may be conveniently considered as a tentative or working assumption, and the theory as surviving or final hypothesis, which is most defensively supported by all evidences. Hypothesis is generally derived after the selection and definition of the problem. But since the knowledge arrived through scientific method is objective in the light of new data, a theory is in only one sense a working assumption, so that the conventional distinction between hypothesis and theory, on the basis of increasing adequacy of

evidence and hence greater certainty, is an only relative. This unit describes the nature, importance and formulation of hypothesis. It also deals with various ways of stating a hypothesis and explains how it can be tested. Various sources of hypothesis along with the characteristics and significance of hypothesis have also been explained.

LEARNING OBJECTIVES

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

- Define hypothesis;
- List the sources which are helpful in hypothesis formulation;
- Differentiate between various types of hypotheses;
- Discuss various methods to test hypotheses; and
- Describe the significance of hypothesis.

MEANING OF A HYPOTHESIS

As soon as a research question is formulated, it makes the hypothesis formulation imperative since it is a tentative solution or an intelligent guess about a research question under study. It is an assumption or proposition whose tenability is to be tested on the basis of its implications with empirical evidence and with the previous knowledge. Modem investigators agree that, whenever possible, the research should proceed from a hypothesis. In the words of Van Dalen (1973) 'A hypothesis serves as a powerful beacon that light the way for the research worker. Etymologically, hypothesis is made up of two words 'hypo' (less than) and 'thesis', which means less than a thesis. It is the presumptive statement of a proposition or a reasonable guess, based upon the available evidences, which the researcher seeks to prove through his1 her study. Hypothesis is an assumption or proposition whose testability is to be tested on the basis of the compatibility of its implications with empirical evidence with previous knowledge (Mouly, 1963). It is also a declarative statement in which the investigator makes a prediction or a conjecture about the outcome of the relationship. The conjecture or the prediction is not simply an "educated guess"; rather it is typically based on past researches, which investigators gathered as evidences to advance the hypothesized relationship between variables. In the formulation of hypothesis, the investigator looks for the statements where she/he relates one or more variables to make predictions about the relationships. The hypothesis tells the researcher what to do and why to do in the context of the problem.

For example, the researcher is interested to study a problem 'Why does a gifted child becomes a poor achiever in his class'? The researcher then, moves towards finding out the causes and factors that have been responsible for his poor achievement. He makes a conjecture that he might be suffering with some disease at the time of the examination. Conjecture is in the form of a hypothesis and this now determines what researcher should do to verify whether it is a fact or not. He shall go to the house of

the student, meet his parents and enquire about student's health. All that which investigator is doing is by the hypothesis he had developed.

Hypothesis thus, refers to conjecture statement about the solution of a problem, which the researcher goes on to verify on the basis of the relevant information collected by him. It is said to be a hunch, shrewd guess or supposition about what may be the answer to a problem. It is a statement which is tested in terms of the relationship or prediction etc., which after testing is either accepted or rejected.

The terms hypothesis, theory or conclusion occur frequently in research literature, but differs lightly from each other. 'Hypothesis' is defined as a tentative solution or working proposition suggested as a solution to problem, and the 'theory' as the final hypothesis, which is defensibly supported by all evidence. The final hypothesis, which fits all the evidences, becomes the chief 'conclusion' inferred from the study (Hilly, 1964). The hypothesis relates theory to observation and vice-versa. Hypotheses when tested are either rejected or accepted, and help to infer the conclusion, which helps in theory building.

SOURCES OF A HYPOTHESIS

The formulation of a good hypothesis is a difficult task. The value of research is determined by the results/conclusions arrived at after testing the hypothesis. It requires a researcher to be speculative, imaginative having good knowledge, deep insight and an analytical mind. The sources that are available with a researcher for deriving a tenable hypothesis are as follows:

Experience and Creativity of the Researcher

Both creativity and experience are capable of deriving adequate hypothesis. While working in an environment, a researcher comes across many problems, some of which are serious enough and requires hard work to solve them. For example, a researcher who is working on the 'Classroom Correlates of Effective Teaching' can think of a host of factors such as teacher's mastery over the subject, effective use of teaching skills, decision-making, capability, perception of his competence, perception of student's capacity for better interaction, use of communication skills etc. A critical analysis of these factors may facilitate the task of studying the relationship among the variables. Personal experiences of the researcher as a result of his personal readings of biographies, autobiographies, newspapers, research activities, relevant literature, and informal talks with friends, socio-political speeches, etc. can be the potential sources in the generation of a hypothesis.

Background Knowledge

It is necessary for a researcher to be thoroughly familiar with established facts, existing theories and previous researches relating to the problem. The related literature is an important source of hypothesis formulation. It sharpens the perspective

of a researcher as to how to hypothesize the relationship among the variables, which aspects of relationship have been already studied and which still remain to be tested. A rich background of knowledge enables the researcher to locate the key association among the variables and to find out the missing data needed to explain a phenomenon. The researcher should have intensive knowledge in the area in which he is carrying out an investigation and should be insightful so that she/he may deduce a hypothesis inductively after making observation of behaviour noticing trends or probable relationships. Hypothesis is the product of considerable speculation and imaginative guess work. It is based partly on known facts and explanations. In formulating hypothesis, rich experiences and profound academic background of a researcher are helpful. Significant researches have not taken place accidentally but are the result of hard work. A researcher must have a rich background knowledge which may enable him/ her to perceive relationships among the variables.

Versatility of Intellect

A researcher must possess a versatile intellect to understand a theory, to deduce a hypothesis from theories, to be able to spot very quickly the contributing variables in a study, to creatively imagine the output or solution to the problem and to have an adventurous and heuristic attitude, all of which depend upon the expenditure of considerable time and effort along with the persistence of the researcher. It will induce originality in the process of research. Thus, an alert mind is capable of deriving a meaningful hypothesis and rejecting a faulty hypothesis. With his versatile intellect, the researcher may restructure his experiences and deduce the hypothesis from a theory using logic.

Analogies

Analogies are a strong source for the formulation of hypothesis and finding out solutions to the problem. Reasoning by analogy is based on similarities and differences between two situations in which a similar or the same phenomenon or event takes place. For example, in a research problem like the 'Studying the Causes of Bum out Tendencies among College Students', the researcher insightfully thinks, "Why were bum out tendencies not found among college students 20-30 years back as they are today?, What has changed them: quality of teaching or quality of leadership?' Arguing analogically in this way may lead the investigator to some conclusions which may be used for identifying variables and relationships, which form the basis of hypothesis construction. If a researcher knows from previous experience that the old situation is related to other factors Y and Z as well as to X, he may reason out that the new situation may also be related to Y and Z.

Scientific Theories

A systematic review and analysis of theories developed in field of psychology, sociology, political science and even in biological sciences may help the researcher to

provide a suggestive base to formulate a hypothesis. For example, a researcher working on 'Modification of Teacher Behaviour' may be benefited by the Skinnerian theory of behaviour shaping.

Authentic Knowledge

Since the hypothesis offers a solution to the problem, it must be formulated in consonance with authentic knowledge and irrefutable analysis available. If the hypothesized relationship among the variables involved is substantiated, then the researcher proceeds in a meaningful and scientific manner. The analysis and interpretations provide a sound base to deduce the hypothesis. For example, if researcher is working on motivation, then Maslow's Hierarchy of Needs will provide an authentic source for hypothesis formulation.

Check Your Progress Exercise 8.1

Notes:

I. Space is given below for writing your answers.

II. Compare your answers with those given at the end of the unit.

What is the meaning of hypothesis?

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List various sources of hypothesis.

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TYPES OF HYPOTHESIS

Directional and Non-directional

A research hypothesis must be stated in a testable form for its proper evaluation. This form should indicate a relationship between the variables in clear, concise, and understandable language. Research hypotheses are as being directional or non-directional. The hypotheses which stipulate the direction of the expected differences or relationships are termed as directional hypotheses. For example, "There is positive relationship between the academic achievement and study habit of students" is a directional hypothesis. This hypothesis stipulates that students with good study habits

will have high academic achievement. Similarly, the hypothesis: "Students with high test anxiety will score badly in examinations as compared to students with low anxiety" is a directional research hypothesis because it stipulates the direction of the difference between the groups.

A research hypothesis, which does not specify the direction of expected differences or relationships, is a non-directional research hypothesis. For example, the hypothesis: "There is a difference in the academic achievement of B.Ed. students enrolled in open and conventional universities" is a non-directional research hypothesis. Although the hypothesis stipulates that there is a difference in the academic achievement, the direction of the difference is not specified.

A hypothesis can take the 'declarative' form, the 'null form' or the 'question form.

When the researcher makes a positive statement about the outcome of the study, the hypothesis takes the declarative form. It is more or less a directional hypothesis. For example, the hypothesis: "The attitude of parents in the rural areas towards co-education at the primary level is significantly negative in comparison to the attitude of parents of urban areas" is stated in the declarative form.

In the null form, the researcher makes a statement that no relationship exists. The hypothesis: "There is no difference in the attitude of parents of rural and urban areas towards co-education at the primary level", is an example of null hypothesis. Null hypothesis is used to test statistically the research hypothesis, which has been stated in directional or non-directional form. Null hypothesis is also called 'testing hypothesis' when a directional (declarative) or non-directional hypothesis is tested statistically by converting it into null form. A null hypothesis challenges the assertion of a declarative hypothesis.

In the question form hypothesis, a question is asked as to what the outcome will be, instead of stating what outcome is expected. For example, the hypothesis: “Will teaching students through mastering learning approach decrease their test anxiety?' is a question form hypothesis.

Research Hypothesis and Null Hypothesis

The research or scientific hypothesis is a formal affirmative statement that predicts the tentative explanation of the relationship between two or more variables. A research hypothesis describes what operations were conducted and tools were used to measure each variable. Thus, the focus of a hypothesis depends on the type of target population, how the data are collected and what measures to be used. The whole research process is built on a research hypothesis which illustrates a theory. It is a positive and general kind of a statement, for example, 'There is a difference between the learning styles of boys’ and girls'. This hypothesis is also known as (H_1) or general hypothesis, empirical hypothesis, experimental or theory or substantive or operation hypothesis. This hypothesis, however, cannot be tested, proved or

disproved. It constitutes the prediction derived from a theory under test. It is also called an alternative hypothesis, as the conclusions are drawn only after accepting or rejecting null hypothesis (H_0). Siegel (1956) states that if the null hypothesis is rejected, then the alternative hypothesis (H_1) may be accepted. Thus, the alternative hypothesis is a prediction derived from a theory under test.

Whereas, the null hypothesis is a hypothesis of indicating 'no difference' or 'no relationship', it is a neutral type of hypothesis. It denies the existence of any systematic principles apart from the effect of chance. It assumes that none or zero difference exists between two population means or treatments. Null hypothesis is a statistical hypothesis, which is tested within the framework of the probability theory. The alternative hypothesis is an operational statement of research hypothesis. The research hypothesis is the prediction derived from the theory under test. By rejecting or accepting null hypothesis, one arrives at the conclusions about the research hypothesis.

Thus, the relationship between research hypothesis (H_1) and the null hypothesis (H_0) is that, if null hypothesis (H_0) is rejected then research hypothesis (H_1) is accepted. But in the beginning stage, the researcher makes an affirmative statement, as a prediction of solution that she/he proposes to test later. At the stage of statistical analysis of data, the research hypothesis is converted into null hypothesis. All statistical tests are the tests for null hypothesis. Rejecting or accepting null hypothesis asserts that observed difference or relationship may result from chance errors due to sampling procedure.

CHARACTERISTICS OF A GOOD HYPOTHESIS

It is essential that a hypothesis is carefully formulated. A good hypothesis has several basic characteristics:

i) It must be testable. If a hypothesis is not testable, then it becomes difficult for a researcher to either confirm or contradict the relationship among the variables or the deduced consequences. For example, 'Education brings all round development' is difficult to test because it is not easy to operationally isolate the other factors that might contribute towards all round development. Since, a hypothesis predicts the outcome of a study it must relate variables that are capable of being measured. The hypothesis stated as 'There is a positive relationship between the learning style and academic achievement of 8^{th} grade students' can be tested because the variables in the hypothesis are operationally defined and therefore can be measured.

ii) It must state the expected relationship between the variables. For example the hypothesis: 'There is a significant effect of frustration on the academic achievement of 10" grade students' states the expected relationship between frustration and achievement, which-can be measured. However, the hypothesis: 'Students who participate in N.S.S. activities show higher degree of moral growth

than those who do not participate in N.S.S. activities', is not a good hypothesis as the term 'moral growth' does not refer to a variable that is measurable.

iii) It must suggest a tentative solution to the problem under study. For example, 'Academic achievement varies according to the level of intelligence.' This hypothesis suggests that intelligence influences the academic achievement.

iv) It must be clear and stated in a precise manner. A clear statement of hypothesis generally involves concise technical language and definition of terms that are better defined than those in common language. Vague terms or constructs are difficult to define operationally. Use of general terms and words such as good, bad, poor, personality, social class etc. make a hypothesis vague. The researcher should use 'personality' as measured by 16 PF (16 personality factors), 'Intelligence' as measured by Raven's Progressive Matrices (intelligence test) etc. in the statement of a hypothesis.

v) The hypothesis should be limited in scope. The hypothesis of global significance may not yield the usual consequences. Sometimes an over-ambitious researcher formulates an ambiguous hypothesis of global significance. It is partly because of his earnestness and partly because it takes maturity of view point to realize how little can be accomplished in a specified time. It is desirable to formulate hypotheses that are simple to test, and yet are highly significant.

vi) A hypothesis must be consistent with known facts. It must be consistent with a substantial body of established facts. A good hypothesis is grounded in well-established theories and laws.

vii) A hypothesis must explain what it intends to explain.

viii) The variables should be defined operationally so that the predicted relations among them can be tested empirically. A good hypothesis is capable of explaining and testing significantly large number of consequences.

ix) It must be based on some relevant theory or discovered truth. For example the hypothesis, 'There is a significant relationship between the contingencies of reinforcement and behaviour shaping', derives its source from the theory of Skinner. The relationship between independent and dependent variables in this hypothesis is supported by the behaviouristic view of learning by Skinner.

x) The hypothesis should be amenable to testing within a reasonable time. The researcher should not select a problem which involves hypotheses that are not amenable to testing within a reasonable and specified time. The researcher must know the problems which cannot be solved for a long time because of the lack of data, non-availability of tools and techniques.

SIGNIFICANCE AND IMPORTANCE OF A HYPOTHESIS

i) A hypothesis directs monitors and controls the research efforts. It provides tentative explanations of facts and phenomena and can be tested and validated. Such explanations, if held valid, lead to generalizations, which help significantly in understanding a problem, and thereby extend the existing knowledge in the

area to which they pertain and thus help in theory building and facilitate extension of knowledge in an area.

ii) The hypothesis not only indicates what to look for in an investigation but how to select a sample, choose a design of research, how to collect data and how to interpret the results to draw valid conclusions.

iii) The hypothesis orients the researcher to be more sensitive to certain relevant aspects of problem so as to focus on specific issues and pertinent facts. It helps the researcher to delimit his study in scope so that it does not become broad and unwieldy.

iv) The hypothesis provides the researcher with rational statements, consisting of elements expressed in a logical order of relationships, which seek to describe or to explain conditions or events that have not yet been confirmed by facts. Some relationships between elements or variables in hypotheses are known facts and others transcend the known facts to give reasonable explanations for known conditions. The hypothesis helps the researcher relate logically known facts to intelligent guesses about unknown conditions (Ary, et. al 1972, pp. 73-74).

v) Hypothesis formulation and its testing add a scientific rigour to all type of researches. A well thought set of hypothesis places a clear and specific goal before the researcher and equips him with understanding. It provides the basis for reporting the conclusions of the study on the basis of these conclusions. The researcher can make the research report interesting and meaningful to the reader.

The importance of a hypothesis is generally recognized more in the studies which aim to make predictions about some outcome. In an experimental study, the researcher is interested in making prediction about the expected outcomes and, therefore the role of hypothesis is considered to be of utmost importance. In historical or descriptive studies, on the other hand, the researcher is investigating the history of an event, life of a man, or is seeking facts to determine the status quo of some situation and thus may not have a basis for making a basis for making a prediction of results. In such studies when fact finding alone is the aim of the study, a hypothesis may not be required.

Most historical or descriptive studies, however, involve not only fact-finding but interpretation of facts to draw generalizations. For all such major studies, a hypothesis is recommended so as to explain observed facts, conditions, or behaviour and to serve as a guide in the research process. If a hypothesis is not formulated, a researcher may waste time and energy in gathering extensive empirical data and then find that he cannot state facts clearly and detect relevant relationships between variables as there is no hypothesis to guide her/him.

Check Your Progress Exercise 8.2

Notes:

I. Space is given below for writing your answers.

II. Compare your answers with those given at the end of the unit.

Q.3. List the characteristics of a good (usable) hypothesis.

……
……
……
……
……....

SUMMARY

Hypothesis is tentative solution or an intelligent guess about a research problem under study. It is not simply an educated guess; rather it is based on past research where the researcher gathers the evidence to advance a hypothesized relationship between variables. Thus, it is a conjecture statement about the solution of a problem, which the researcher goes on to verify on the basis of relevant information. Various sources, namely, experience, creativity, background knowledge, scientific theories etc. are important sources, which are important sources which are helpful in the formulation of a hypothesis.

Based on these sources, hypotheses are of various types: i) Directional and non-directional, and ii) Research and null hypothesis.

After the hypothesis is formulated, it is subjected to testing. Some hypotheses are simple and can be tested directly. In most situations, however, they are complex and cannot be so tested. They are tested in terms of their deduced consequences.

A good hypothesis is one which is testable, and states the expected relationship between variables. It is clearly and precisely stated. A good hypothesis should state the expected relationship between the variables. It is limited in scope and should be consistent with the most known facts.

A hypothesis has great significance in the research process. It (i)directs, monitors and controls the research effort, (ii) helps in drawing generalizations to build theories, (iii) suggests the method of problem solving, (iv) helps in studying cause-effect relationship between the variables, (v) facilitates extension of knowledge in an area, and (vi) provides a basis for reporting the conclusions of the study.

GLOSSARY

Alternative hypothesis: a set of hypothesis (research and null) which states the opposite of null hypothesis

Hypothesis: a testable proposition

Null Hypothesis: a hypothesis of no relationship.

Theory: a coherent set of internal propositions explaining apparent relationship of certain observed phenomena.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: Hypothesis is the presumptive statement of a proposition or a reasonable guess, based upon the available evidence, which the researcher seeks to prove through his study.

Answer to Q.2: Experience, background knowledge, versatility of intellect and analogies, scientific, theories are importance sources which help in the hypothesis formulation.

Answer to Q.3: A good hypothesis should (i) be clearly and precisely stated, (ii) be testable; (iii) state the expected relationship between variables; (iv) be limited in scope; and (v) be consistent with most known facts.

EXERCISE

1. What is hypothesis?
2. Discuss the various types of hypotheses.
3. What are the various method to test hypotheses?
4. Explain the significance of hypotheses in the research.

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UNIT- 12 HYPOTHESIS TESTING: LOGIC AND IMPORTANCE

STRUCTURE

INTRODUCTION

In previous Unit of this Block, we have discussed the concept of hypothesis and its characteristics. In this Unit, we will focus on the **testing of hypothesis**. In our day-to-day life, we see different commercials advertisements in television, newspapers, magazines, etc. such as

a. The refrigerator of certain brand saves up to 20% electric bill,
b. The motorcycle of certain brand gives 60 km/liter mileage,
c. A detergent of certain brand produces the cleanest wash,
d. Ninety nine out of hundred dentists recommend brand 'A' toothpaste for their patients to save the teeth against cavity, etc.

Now, the question may arise in our mind "can such types of claims be verified statistically?" Fortunately, in many cases the answer is "yes".

The technique of testing such type of claims or statements or assumptions is known as testing of hypothesis. The truth or falsity of a claim or statement is never known

unless we examine the entire population. But practically it is not possible in mostly situations so we take a random sample from the population under study and use the information contained in this sample to take the decision whether a claim is true or false.

LEARNING OBJECTIVES

After reading this Unit, you will be able to;

- Define a hypothesis;
- Explain what we mean by type-I and type-II errors;
- Explore the concept of critical region and level of significance;
- Define one-tailed and two-tailed tests;
- Describe the general procedure of testing a hypothesis;
- Concept of p-value; and
- Test a hypothesis by using confidence interval

HYPOTHESIS

As we have discussed in previous section that in our day-to-day life, we see different commercials advertisements in television, newspapers, magazines, etc. and if someone may be interested to test such type of claims or statement then we come across the problem of testing of hypothesis. For example,

a. a customer of motorcycle wants to test whether the claim of motorcycle of certain brand gives the average mileage 60 km/liter is true or false,
b. the businessman of banana wants to test whether the average weight of a banana of Kerala is more than 200 gm,
c. a doctor wants to test whether new medicine is really more effective for controlling blood pressure than old medicine,
d. an economist wants to test whether the variability in incomes differ in two populations,
e. a psychologist wants to test whether the proportion of literates between two groups of people is same, etc.

In all the cases discussed above, the decision maker is interested in making inference about the population parameter(s). However, he/she is not interested in estimating the value of parameter(s) but he/she is interested in testing a claim or statement or assumption about the value of population parameter(s). Such claim or statement is postulated in terms of hypothesis.

In statistics, a hypothesis is a statement or a claim or an assumption about the value of a population parameter (e.g., mean, median, variance, proportion, etc.).

Similarly, in case of two or more populations a hypothesis is comparative statement or a claim or an assumption about the values of population parameters. (e.g., means of two populations are equal, variance of one population is greater than other, etc.). The plural of hypothesis is hypotheses.

In hypothesis testing problems first of all we should being identifying the claim or statement or assumption or hypothesis to be tested and write it in the words. Once the claim has been identified then we write it in symbolical form if possible. As in the above examples,

(i) Customer of motorcycle may write the claim or postulate the hypothesis "the motorcycle of certain brand gives the average mileage 60 km/liter." Here, we are concerning the **average** mileage of the motorcycle so let μ represents the average mileage then our hypothesis becomes $\mu = 60$ km / liter.

(ii) Similarly, the businessman of banana may write the statement or postulate the hypothesis "the average weight of a banana of Kerala is greater than 200 gm." So our hypothesis becomes $\mu > 200$ gm.

(iii) Doctor may write the claim or postulate the hypothesis "the new medicine is really more effective for controlling blood pressure than old medicine." Here, we are concerning the **average** effect of the medicines so let μ_1 and μ_2 represent the average effect of new and old medicines respectively on controlling blood pressure then our hypothesis becomes $\mu_1 > \mu_2$.

(iv) Economist may write the statement or postulate the hypothesis "the variability in incomes differs in two populations." Here, we are concerning the **variability** in income so let σ_1^2 and σ^2_2 represent the variability in incomes in two populations respectively then our hypothesis becomes $\sigma^2_1 \neq \sigma^2_2$.

(v) Psychologist may write the statement or postulate the hypothesis "the proportion of literates between two groups of people is same." Here, we are concerning the **proportion** of literates so let P_1 and P_2 represent the proportions of literates of two groups of people respectively then our hypothesis becomes $P_1 = P_2$ or $P_1 - P_2 = 0$.

The hypothesis is classified according to its nature and usage as we will discuss in subsequent subsections.

Simple and Composite Hypothesis

In general sense, if a hypothesis specifies only one value or exact value of the population parameter then it is known as simple hypothesis. And if a hypothesis specifies not just one value but a range of values that the population parameter may assume is called a composite hypothesis.

As in the above examples, the hypothesis postulated in

(i) $\mu = 60$ km/liter is simple hypothesis because it gives a single value of parameter ($\mu = 60$) whereas the hypothesis postulated in

(ii) $\mu > 200$ gm is composite hypothesis because it does not specify the exact average value of weight of a banana. It may be 260, 350, 400 gm or any other.

(iii) $\mu_1 > \mu_2$ or $\mu_1 - \mu_2 > 0$ and

(iv) $\sigma_1^2 \neq \sigma_2^2$ or $\sigma_1^2 - \sigma^2_2 \neq 0$ are not simple hypotheses because they specify more than one value as $\mu_1 - \mu_2 = 4, \mu_1 - \mu_2 = 7$, $\sigma_1^2 - \sigma^2_2 = 2$, $\sigma_1^2 - \sigma^2_2 = -5$, etc. and

(v) $P_1 = P_2$ or $P_1 - P_2 = 0$ is simple hypothesis because it gives a single value of parameter as $P_1 - P_2 = 0$.

Null and Alternative Hypothesis

As we have discussed in last page that in hypothesis testing problems first of all we identify the claim or statement to be tested and write it in symbolical form. After that we write the complement or opposite of the claim or statement in symbolical form. In our example of motorcycle, the claim is $\mu = 60$ km/liter then its complement is $\mu \neq 60$ km/liter. In (ii) the claim is $\mu > 200$ gm then its complement is $\mu \leq 200$ gm. If the claim is $\mu < 200$ gm then its complement is $\mu \geq 200$ gm. The claim and its complement are formed in such a way that they cover all possibility of the value of population parameter.

Once the claim and its compliment have been established then we decide of these two which is the null hypothesis and which the alternative hypothesis is. The thump rule is that the statement containing equality is the null hypothesis. That is, the hypothesis which contains symbols $=$ or $\leq$ or $\geq$ is taken as null hypothesis and the hypothesis which does not contain equality i.e. contains $\neq$ or $<$ or $>$ is taken as alternative hypothesis. The null hypothesis is denoted by H_0 and alternative hypothesis is denoted by H_1 or HA.

In our example of motorcycle, the claim is $\mu = 60$ km/liter and its complement is $\mu \neq 60$ km/liter. Since claim $\mu = 60$ km/liter contains equality sign so we take it as a null hypothesis and complement $\mu \neq 60$ km/liter as an alternative hypothesis, that is,

H_0: $\mu = 60$ km/liter and H_1: $\mu \neq 60$ km/liter

In our second example of banana, the claim is $\mu > 200$ gm and its complement is $\mu \leq 200$ gm. Since complement $\mu \leq 200$ gm contains equality sign so we take complement as a null hypothesis and claim $\mu > 200$ gm as an alternative hypothesis, that is,

H_0: $\mu \leq 200$ gm and H_1: $\mu > 200$ gm

Formally these hypotheses are defined as the hypothesis which we wish to test is called as the null hypothesis. According to Prof. R.A. Fisher, "A null hypothesis is a hypothesis which is tested for possible rejection under the assumption that it is true."

The hypothesis which complements to the null hypothesis is called alternative hypothesis.

Note 1: Some authors use equality sign in null hypothesis instead of $\geq$ and $\leq$ signs. The alternative hypothesis has two types:

i. Two-sided (tailed) alternative hypothesis
ii. One-sided (tailed) alternative hypothesis

If the alternative hypothesis gives the alternate of null hypothesis in both directions (less than and greater than) of the value of parameter specified in null hypothesis then it is known as two-sided alternative hypothesis and if it gives an alternate only in one direction(less than or greater than) only then it is known as one-sided alternative hypothesis. For example, if our alternative hypothesis is H_1: $\theta \neq 60$ then it is a two-sided alternative hypothesis because its means that the value of parameter θ is greater than or less than 60. Similarly, if H_1: $\theta > 60$ then it is a right-sided alternative hypothesis because its means that the value of parameter θ is greater than 60 and if H_1: $\theta < 60$ then it is a left-sided alternative hypothesis because its means that the value of parameter θ is less than 60.

In testing procedure, we assume that the null hypothesis is true until there is sufficient evidence to prove that it is false. Generally, the hypothesis is tested with the help of a sample so evidence in testing of hypothesis comes from a sample. If there is enough sample evidence to suggest that the null hypothesis is false then we reject the null hypothesis and support the alternative hypothesis. If the sample fails to provide us sufficient evidence against the null hypothesis we are not saying that the null hypothesis is true because here, we take the decision on the basis of a random sample which is a small part of the population. To say that null hypothesis is true we must study all observations of the population under study. For example, if someone wants to test that the person of India has two hands then to prove that this is true we must check all the persons of India whereas to prove that it is false we require a person he / she has one hand or no hand. So we can only say that there is not enough evidence against the null hypothesis.

Note 2: When we assume that null hypothesis is true then we are actually assuming that the population parameter is equal to the value in the claim. In our example of motorcycle, we assume that $\mu = 60$ km/liter whether the null hypothesis is $\mu = 60$ km/liter or $\mu \leq 60$ km/liter or $\mu \geq 60$ km/liter. Now, you can try the following exercises.

A. A company manufactures car tyres. Company claims that the average life of its tyres is 50000 miles. To test the claim of the company, formulate the null and alternative hypotheses.
B. Write the null and alternative hypotheses in case (iii), (iv) and (v) of our example given in Section 4.3.2.

C. A businessman of orange formulates different hypotheses about the average weight of the orange which are given below: (i) H_0: $\mu = 100$ (ii) H_1: $\mu > 100$ (iii) H_0: $\mu \leq 100$ (iv) H_1: $\mu \neq 100$ (v) H_1: $\mu > 150$ (vi) H_0: $\mu = 130$ (vii) H_1: $\mu \mu 0$

Categorize the above cases into simple and composite hypotheses.

After describing the hypothesis and its types our next point in the testing of hypothesis is critical region which will be described in next section.

CRITICAL REGION

As we have discussed in the previous section that generally, null hypothesis is tested by the sample data. Suppose X_1, X_2,… X_n be a random sample drawn from a population having unknown population parameter θ. The collection of all possible values of X_1, X_2,…, X_n is a set called sample space(S) and a particular value of X_1, X_2,…, X_n represents a point in that space. In order to test a hypothesis, the entire sample space is partitioned into two disjoint sub spaces, say, ω and $S- \omega = \varpi$. If calculated value of the test statistic lies in ω , then we reject the null hypothesis and if it lies in ϖ, then we do not reject the null hypothesis. The region ω is called a **"rejection region or critical region"** and the region ϖ is called a **"non-rejection region"**. Therefore, we can say that

> "A region in the sample space in which if the calculated value of the test statistic lies, we reject the null hypothesis then it is called critical region or rejection region."

This can be better understood with the help of an example. Suppose, 100 students appear in total 10 papers two of each in English, Physics, Chemistry, Mathematics and Computer Science of a Programme. Suppose the scores in these papers are denoted by X1, X2, …, X10 and maximum marks =100 for each paper. For obtaining the distinction award in this Programme, a student needs to have total score equal to or more than 750 which is a rule.

Suppose, we select one student randomly out of 100 students and we want to test that the selected student is a distinction award holder. So we can take the null and alternative hypotheses as

H_0: Selected student is a distinction award holder

H_1: Selected student is not a distinction award holder

For taking the decision about the selected student, we define a statistic

$$T_{10} = \sum_{i=1}^{10} X_i$$

as the sum of the scores in all the 10 papers of the student. The range of T_{10} is $0 \leq T_{10} \leq 1000$. Now, we divide the whole space (0-1000) into two

regions as no-distinction awarded region (less than 750) and distinction awarded region (greater than or equal to 750). Here, 750 is the critical value which separates the no-distinction and distinction awarded regions.

On the basis of scores in all the papers of the selected student, we calculate the value of the statistic

$T_{10} = \sum_{i=1}^{10} X_i$. And calculated value may fall in distinction award region or not, depending upon

For making a decision to reject or do not reject H_0, we use test statistic,

$T_{10} = \sum_{i=1}^{10} X_i$ (sum of scores of 10 papers). If calculated value of test statistic T_{10} lies in No-distinction awarded region (critical region), that is, $T_{10} < 750$ then we reject H_0 and if calculated value of test statistic T_{10} lies in distinction awarded region (non-rejection region), that is, $T_{10} \geq 750$ then we do not reject H_0. It is a basic structure of the procedure of testing of hypothesis which needs two regions like:

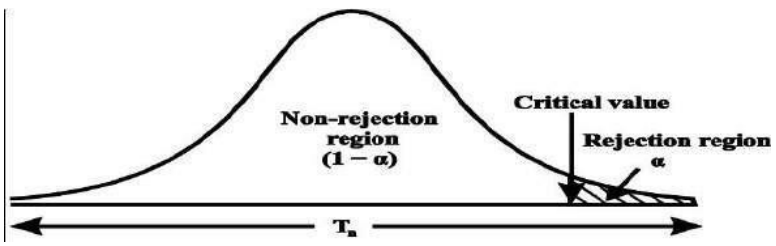
(i) Region of rejection of null hypothesis H_0
(ii) Region of non-rejection of null hypothesis H_0

The point of discussion in this test procedure is "**how to fix the cut off value 750"**? What is the justification for this value? The distinction award region may be like $T_{10} \geq 800$ or at $T_{10} \geq 850$ or at $T_{10} \geq 900$. So, there must be a scientific justification for the cut-off value 750. In a statistical test procedure it is obtained by using the probability distribution of the test statistic.

The region of rejection is called critical region. It has a pre-fixed area generally denoted by α, corresponding to a cut-off value in a probability distribution of test statistic. The rejection (critical) region lies in one-tail or two-tails on the probability curve of sampling distribution of the test statistic its depends upon the alternative hypothesis. Therefore, three cases arise:

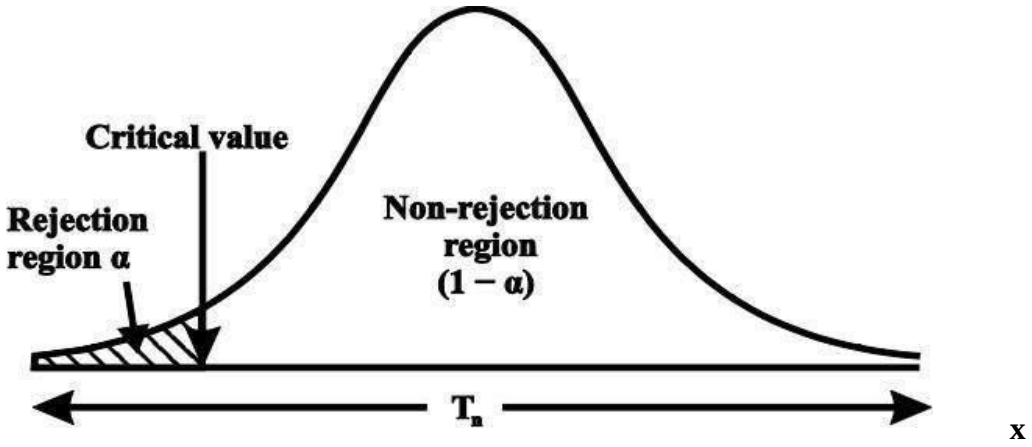
Case I: If the alternative hypothesis is right-sided such as $H_1: \theta > \theta_0$ or $H_1: \theta_1 > \theta_2$ then the entire critical or rejection region of size α lies on right tail of the probability curve of sampling distribution of the test statistic in figure 9.1

Figure 9.1



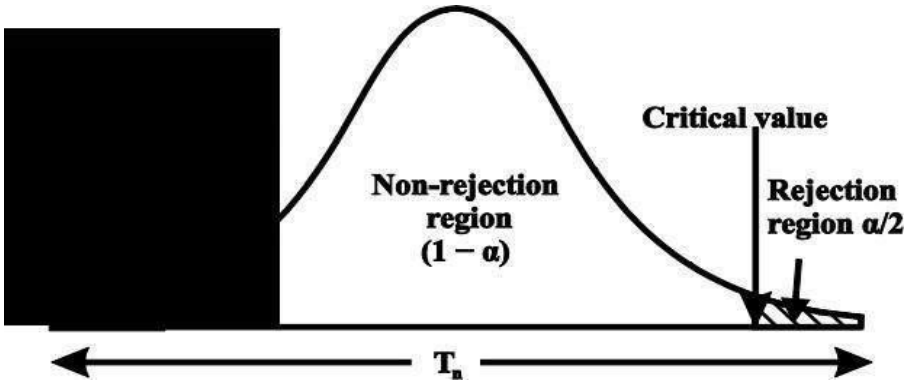
Case II: If the alternative hypothesis is left-sided such as $H_1: \theta < \theta_0$ or $H_1: \theta_1 < \theta_2$ then the entire critical or rejection region of size α lies on left tail of the probability curve of sampling distribution of the test statistic in figure 9.2

Figure 9.2



Case III: If the alternative hypothesis is two sided such as $H_1: \theta \neq \theta_0$ or $H_1: \theta_1 \neq \theta_2$ then critical or rejection regions of size $\alpha/2$ lies on both tails of the probability curve of sampling distribution of the test statistic in figure 9.3

Figure 9.3



TYPE-I AND TYPE-II ERRORS

In Section 4.4, we have discussed a rule that if the value of test statistic falls in rejection (critical) region then we reject the null hypothesis and if it falls in the non-rejection region then we do not reject the null hypothesis. A test statistic is calculated on the basis of observed sample observations. But a sample is a small part of the population about which decision is to be taken. A random sample may or may not be a good representative of the population.

A faulty sample misleads the inference (or conclusion) relating to the null hypothesis. For example, an engineer infers that a packet of screws is substandard when actually it is not. It is an error caused due to poor or inappropriate (faulty) sample. Similarly, a packet of screws may infer good when actually it is sub-standard. So we can commit two kinds of errors while testing a hypothesis which are summarised in Table 9.1 which is given below:

Table 9.1: Type of Errors

Decision	**H_0 True**	**H_1 True**
Rejection H_0	Type-I Error	Correct Decision
Do not reject H_0	Correct Decision	Type-II Error

Let us take a situation where a patient suffering from high fever reaches to a doctor. And suppose the doctor formulates the null and alternative hypotheses as

H_0: The patient is a malaria patient

H_1: The patient is not a malaria patient

Then following cases arise:

Case I: Suppose that the hypothesis H_0 is really true, that is, patient actually a malaria patient and after observation, pathological and clinical examination, the doctor rejects H_0, that is, he / she declares him / her a non-malaria-patient. It is not a correct decision and he / she commits an error in decision known as type-I error.

Case II: Suppose that the hypothesis H_0 is actually false, that is, patient actually a non-malaria patient and after observation, the doctor rejects H_0, that is, he / she declares him / her a non-malaria-patient. It is a correct decision.

Case III: Suppose that the hypothesis H_0 is really true, that is, patient actually a malaria patient and after observation, the doctor does not reject H_0, that is, he / she declares him / her a malaria-patient. It is a correct decision.

Case IV: Suppose that the hypothesis H_0 is actually false, that is, patient actually a non-malaria patient and after observation, the doctor does not reject H_0, that is, he / she declares him / her a malaria-patient. It is not a correct decision and he / she commits an error in decision known as type-II error.

Thus, we formally define type-I and type-II errors as below:

Type-I Error:

The decision relating to rejection of null hypothesis H0 when it is true is called type-I error. The probability of committing the type-I error is called size of test, denoted by α and is given by

$$\alpha = P[\text{Reject } H_0 \text{ when } H_0 \text{ is true}] = P[\text{Reject } H_0 / H_0 \text{ is true}]$$

We reject the null hypothesis if random sample / test statistic falls in rejection region, therefore,

$$\alpha = P[X \in \omega / H_0]$$

where $X = (X_1, X_2, \ldots, X_n)$ is a random sample and ω is the rejection region and

$$1-\alpha = 1-P[\text{Reject } H_0 / H_0 \text{ is true}]$$

$$= P[\text{Do not reject } H_0 / H_0 \text{ is true}] = P[\text{Correct decision}]$$

The $(1-\alpha)$ is the probability of correct decision and it correlates to the concept of $100(1-\alpha)\%$ confidence interval used in estimation.

Type-II Error:

The decision relating to non-rejection of null hypothesis H_0 when it is false (i.e. H_1 is true) is called type-II error. The probability of committing type-II error is generally denoted by β and is given by

$$\beta = P[\text{Do not reject } H_0 \text{ when } H_0 \text{ is false}]$$
$$= P[\text{Do not reject } H_0 \text{ when } H_1 \text{ is true}]$$
$$= P[\text{Do not reject } H_0 / H_1 \text{ is true}]$$
$$= P[X \in \varpi / H_1] \text{ where, } \varpi \text{ is the non-rejection region.}$$

and

$$1-\beta = 1-P[\text{Do not reject } H_0 / H_1 \text{ is true}]$$
$$= P[\text{Reject } H_0 / H_1 \text{ is true}] = P[\text{Correct decision}]$$

The $(1-\beta)$ is the probability of correct decision and also known as **"power of the test"**. Since it indicates the ability or power of the test to recognize correctly that the null hypothesis is false, therefore, we wish a test that yields a large power.

We say that a statistical test is ideal if it minimizes the probability of both types of errors and maximizes the probability of correct decision. But for fix sample size, α and β are so interrelated that the decrement in one results into the increment in other. So minimization of both probabilities of type-I and type-II errors simultaneously for fixed sample size is not possible without increasing sample size. Also both types of errors will be at zero level (i.e. no error in decision) if size of the sample is equal to

the population size. But it involves huge cost if population size is large. And it is not possible in all situations such as testing of blood.

Depending on the problem in hand, we have to choose the type of error which has to minimize. For this, we have to look at a situation, suppose there is a decision making problem and there is a rule that if we make type-I error, we lose10 rupees and if we make type-II error we lose 1000 rupees. In this case, we try to eliminate the type-II error, since it is more expensive.

In another situation, suppose the Delhi police arrests a person whom they suspect is a murderer. Now, policemen have to test hypothesis:

H_0: Arrested person is innocent (not murderer)
H_1: Arrested person is a murderer

The type-I error is

α = P [Reject H_0 when it is true]

That is, suspected person who is actually an innocent will be sent to jail when H_0 rejects, although H_0 being a true.

The type-II error is

β = P [Do not reject H_0 when H_1 is true]

That is, when arrested person truly a murderer but released by the police. Now, we see that in this case type-I error is more serious than type-II error because a murderer may be arrested / punished later on but sending jail to an innocent person is serious.

Consider another situation, suppose we want to test the null hypothesis H_0: p = 0.5 against H_1: p $\neq$ 0.5 on the basis of tossing a coin once, where p is the probability of getting a head in a single toss (trial). And we reject the null hypothesis if a head appears and do not reject otherwise. The type-I error, that is, the probability of Reject H_0 when it is true can be calculated easily(as shown in Example 1) but the computation of type-II error is not possible because there are infinitely many alternatives for p such as p = 0.6, p = 0.1, etc.

Generally, strong control on α is necessary. It should be kept as low as possible. In test procedure, we prefix it at very low level like α = 0.05 (5%) or 0.01 (1%).

Now, it is time to do some examples relating to α and β.

Example 1: It is desired to test a hypothesis H_0: P = P_0 = 1/ 2 against the alternative hypothesis H_1 : P = P_1 = 1/ 4 on the basis of tossing a coin once, where p is the probability of "getting a head" in a single toss (trial) and agreeing to reject H_0 if a head appears and accept H_0 otherwise. Find the value of α and β.

Solution: In such type of problems, first of all we search for critical region. Here, we have critical region ω = {head}

Therefore, the probability of type-I error can be obtained as

$$\alpha = P[\text{Reject } H_0 \text{ when } H_0 \text{ is true}]$$

$$= P[X \in \omega / H_0] = P[\text{Head appears} / H_0]$$

$$= P[\text{Head appears}]_{p=\frac{1}{2}} = \frac{1}{2} \quad \left[\because H_0 \text{ is true so we take value of parameter p given in } H_0\right]$$

Also,

$$\beta = P[\text{Do not reject } H_0 \text{ when } H_1 \text{ is true}]$$

$$= P[X \notin \omega / H_1] = P[\text{Tail appears} / H_1]$$

$$= P[\text{Tail appears}]_{p=\frac{1}{4}} \quad \left[\because H_1 \text{ is true so we take value of parameter p given in } H_1\right]$$

$$= 1 - P[\text{Head appears}]_{p=\frac{1}{4}} = 1 - \frac{1}{4} = \frac{3}{4}$$

Example 2: For testing H_0: $\theta = 1$ against H_1: $\theta = 2$, the pdf of the variable is given by

$$f(x,\theta) = \begin{cases} \frac{1}{\theta}; & 0 \le x \le \theta \\ 0; & \text{elsewhere} \end{cases}$$

Obtain type-I and type-II errors when critical region is X 0.4. ≥ Also obtain power function of the test.

Solution: Here, we have critical (rejection) and non-rejection regions as

$$\omega = \{X : X \ge 0.4\} \text{ and } \bar{\omega} = \{X : X < 0.4\}$$

We have to test the null hypothesis

$$H_0 : \theta = 1 \text{ against } H_1 : \theta = 2$$

The size of type-I error is given by

$$\alpha = P[X \in \omega / H_0] = P[X \ge 0.4 / \theta = 1]$$

$$= \left[\int_{0.4}^{\theta} f(x,\theta)\,dx\right]_{\theta=1} \quad \left[\because P[X \ge a] = \int_a^{\infty} f(x,\theta)\,dx\right] \qquad \ldots (1)$$

Now, by using $f(x,\theta) = \frac{1}{\theta};\ 0 \le x \le \theta$, we get from equation (1)

$$\alpha = \left[\int_{0.4}^{\theta} \frac{1}{\theta}\,dx\right]_{\theta=1} = \int_{0.4}^{1} dx = (x)_{0.4}^{1} = 1 - 0.4 = 0.6$$

Similarly, the size of type-II error is given by

$$\beta = P[X \in \bar{\omega} / H_1] = P[X < 0.4 / \theta = 2]$$

$$\beta = \left[\int_{0}^{0.4} \frac{1}{\theta}\,dx\right]_{\theta=2} = \int_{0}^{0.4} \frac{1}{2}\,dx = \frac{1}{2}(x)_0^{0.4} = \frac{1}{2}(0.4 - 0) = 0.2$$

The power function of the test = 1 - β = 1 - 0.2 = 0.8.

LEVEL OF SIGNIFICANCE

So far in this unit, we have discussed the hypothesis, types of hypothesis, critical region and types of errors. In this section, we shall discuss very useful concept "level of significance", which play an important role in decision making while testing a hypothesis.

The probability of type-I error is known as level of significance of a test. It is also called the size of the test or size of critical region, denoted by α. Generally, it is pre-fixed as 5% or 1% level ($\alpha = 0.05$ or 0.01). As we have discussed in Section 4.4 that if calculated value of the test statistic lies in rejection(critical) region, then we reject the null hypothesis and if it lies in non-rejection region, then we do not reject the null hypothesis. Also we note that when H_0 is rejected then automatically the alternative hypothesis H_1 is accepted. Now, one point of our discussion is that how to decide critical value(s) or cut-off value(s) for a known test statistic.

If distribution of test statistic could be expressed into some well-known distributions like Z, χ^2, t, F etc. then our problem will be solved and using the probability distribution of test statistic, we can find the cut-off value(s) that provides us critical area equal to 5% (or 1%).

Another viewpoint about the level of significance relates to the trueness of the conclusion. If H0 do not reject at level, say, $\alpha = 0.05$ (5% level) then a person will be confident that "concluding statement about H_0" is true with 95% assurance. But even then it may false with 5% chance. There is no cent-percent assurance about the trueness of statement made for H_0.

As an example, if among 100 scientists, each draws a random sample and use the same test statistic to test the same hypothesis H_0 conducting same experiment, then 95 of them will reach to the same conclusion about H_0. But still 5 of them may differ (i.e. against the earlier conclusion). Similar argument can be made for, say, $\alpha = 0.01$ (=1%). It is like when H_0 is rejected at $\alpha = 0.01$by a scientist , then out of 100 similar researchers who work together at the same time for the same problem, but with different random samples, 99 of them would reach to the same conclusion however, one may differ.

ONE-TAILED AND TWO-TAILED TESTS

We have seen in Section 4.4 that rejection (critical) region lies at one-tail or two-tails on the probability curve of sampling distribution of the test statistic its depend upon the form of alternative hypothesis. Similarly, the test of testing the null hypothesis also depends on the alternative hypothesis.

A test of testing the null hypothesis is said to be two-tailed test if the alternative hypothesis is two-tailed whereas if the alternative hypothesis is one-tailed then a test of testing the null hypothesis is said to be one-tailed test.

For example, if our null and alternative hypothesis are

$$H_0: \theta = \theta_0 \text{ and } H_1: \theta \neq \theta_0$$

then the test for testing the null hypothesis is two-tailed test because the alternative hypothesis is two-tailed that means, the parameter θ can take value greater than θ_0 or less than θ_0.

If the null and alternative hypotheses are

$$H_0: \theta \leq \theta_0 \text{ and } H_1: \theta > \theta_0$$

then the test for testing the null hypothesis is right-tailed test because the alternative hypothesis is right-tailed.
Similarly, if the null and alternative hypotheses are

$$H_0: \theta \geq \theta_0 \text{ and } H_1: \theta < \theta_0$$

then the test for testing the null hypothesis is left-tailed test because the alternative hypothesis is left-tailed.

The above discussion can be summarised in Table 9.2.

Table 9.2: Null and Alternative Hypotheses and Corresponding One-tailed and Two-tailed Tests

Null Hypothesis	Alterative Hypothesis	Types of Critical Region / Test
$H_0 : \theta = \theta_0$	$H_1: \theta \neq \theta_0$	Two-tailed test having critical regions under both tails.
$H_0: \theta \leq \theta_0$	$H_1: \theta > \theta_0$	Right-tailed test having critical region under right tail only.
$H_0: \theta \geq \theta_0$	$H_1: \theta < \theta_0$	Left- tailed test having critical region under left tail only.

Let us do one example based on type of tests.

Example 3: A company has replaced its original technology of producing electric bulbs by CFL technology. The company manager wants to compare the average life of bulbs manufactured by original technology and new technology CFL. Write appropriate null and alternate hypotheses. Also say about one tailed and two tailed tests.

Solution: Suppose the average lives of original and CFL technology bulbs are denoted by μ_1 and μ_2 respectively.

If company manager is interested just to know whether any significant difference exists in average-life time of two types of bulbs then null and alternative hypotheses will be:

H_0: $\mu_1 = \mu_2$ [average lives of two types of bulbs are same]

H_1: $\mu_1 \neq \mu_2$ [average lives of two types of bulbs are different]

Since alternative hypothesis is two-tailed therefore corresponding test will betwo-tailed.

If company manager is interested just to know whether average life of CFL is greater than original technology bulbs then our null and alternative hypotheses will be

H_0: $\mu_1 \geq \mu_2$

H_1: $\mu_1 < \mu_2$ [average life of CFL technology bulbs is greater than average life of original technology.

Since alternative hypothesis is left-tailed therefore corresponding test will be left-tailed test.

GENERAL PROCEDURE OF TESTING A HYPOTHESIS

Testing of hypothesis is a huge demanded statistical tool by many discipline and professionals. It is a step by step procedure as you will see in next three units through a large number of examples. The aim of this section is just give you flavour of that sequence which involves following steps:

Step I: First of all, we have to setup null hypothesis H_0 and alternative hypothesis H_1. Suppose, we want to test the hypothetical / claimed / assumed value θ_0 of parameter θ. So we can take the null and alternative hypotheses as

H_0: $\theta = \theta_0$ and H_1: $\theta \neq \theta_0$ [for two-tailed test]

H_0: $\theta \leq \theta_0$ and H_1: $\theta > \theta_0$ [for one-tailed test]

or

H_0: $\theta \geq \theta_0$ and H_1: $\theta < \theta_0$ [for one-tailed test]

In case of comparing same parameter of two populations of interest, say, θ_1 and θ_2, then our null and alternative hypotheses would be

H_0: $\theta_1 = \theta_2$ and H_1: $\theta_1 \neq \theta_2$ [for two-tailed test]

$H_0: \theta_1 \leq \theta_2$ and $H_1: \theta_1 > \theta_2$ [for one-tailed test]

or

$H_0: \theta_1 \geq \theta_2$ and $H_1: \theta_1 < \theta_2$ [for one-tailed test]

Step II: After setting the null and alternative hypotheses, we establish criteria for rejection or non-rejection of null hypothesis, that is, decide the level of significance (α), at which we want to test our hypothesis. Generally, it is taken as 5% or 1% ($\alpha = 0.05$ or 0.01).

Step III: The third step is to choose an appropriate test statistic under H_0 for testing the null hypothesis as given below:

$$\text{Test statistic} = \frac{\text{Statistic} - \text{Value of the parameter under } H_0}{\text{Standard error of statistic}}$$

After that, specify the sampling distribution of the test statistic preferably in the standard form like Z (standard normal), χ^2, t, F or any other well-known in literature.

Step IV: Calculate the value of the test statistic described in Step III on the basis of observed sample observations.

Step V: Obtain the critical (or cut-off) value(s) in the sampling distribution of the test statistic and construct rejection (critical) region of size α. Generally, critical values for various levels of significance are putted in the form of a table for various standard sampling distributions of test statistic such as Z-table, χ2-table, t-table, etc.

Step VI: After that, compare the calculated value of test statistic obtained from Step IV, with the critical value(s) obtained in Step V and locates the position of the calculated test statistic, that is, it lies in rejection region or non-rejection region.

Step VII: In testing of hypothesis ultimately we have to reach at a conclusion. It is done as explained below:

(i) If calculated value of test statistic lies in rejection region at α level of significance then we reject null hypothesis. It means that the sample data provide us sufficient evidence against the null hypothesis and there is a significant difference between hypothesized value and observed value of the parameter.

(ii) If calculated value of test statistic lies in non-rejection region at α level of significance then we do not reject null hypothesis. Its means that the sample data fails to provide us sufficient

evidence against the null hypothesis and the difference between hypothesized value and observed value of the parameter due to fluctuation of sample.

Note 3: Nowadays the decision about the null hypothesis is taken with the help of p-value. The concept of p-value is very important, because computer packages and statistical software such as SPSS, SAS, STATA, MINITAB, EXCEL, etc. all provide p-value. So, Section 4.9 is devoted to explain the concept of p-value.
Now, with the help of an example we explain the above procedure.

Example 4: Suppose, it is found that average weight of a potato was 50 gm and standard deviation was 5.1 gm nearly 5 years ago. We want to test that due to advancement in agricultural technology, the average weight of a potato has been increased. To test this, a random sample of 50 potatoes is taken and calculate the sample mean ($\bar{X}$) as 52gm. Describe the procedure to carry out this test.

Solution: Here, we are given that
Specified value of population mean = $\mu_0 = 50$ gm,
Population standard deviation = $\sigma = 5.1$ gm,
Sample size = $n = 50$,
Sample mean = $\bar{X} = 52$ gm
To carry out the above test, we have to follow up the following steps:

Step I: First of all, we setup null and alternative hypotheses. Here, we want to test that the average weight of potato is increased. So our claim is "average weight of potato has increased" i.e. $\mu > 50$ and its complement is $\mu \leq 50$. Since complement contains equality sign so we can take the complement as the null hypothesis and claim as the alternative hypothesis, that is,

H_0: $\mu \leq 50$ gm and H_1: $\mu > 50$ gm [Here, $\theta = \mu$]

Since the alternative hypothesis is right-tailed, so our test is right tailed.

Step II: After setting the null and alternative hypotheses, we fix level of significance α. suppose, $\alpha = 0.01$ (= 1 % level).

Step III: Define a test statistic to test the null hypothesis as

$$\text{Test staistic} = \frac{\text{Statistic} - \text{Value of the parameter under } H_0}{\text{Standard error of statistic}}$$

$$T = \frac{\bar{X} - 50}{\sigma/\sqrt{n}}$$

Since sample size is large (n = 50 > 30) so by central limit theorem the sampling distribution of test statistic approximately follows standard normal distribution (as explained in Unit 1 of this course), i.e. T ~ N(0,1)

Step IV: Calculate the value of test statistic on the basis of sample observations as

$$T = \frac{52 - 50}{5.1/\sqrt{50}} = \frac{2}{0.72} = 2.78$$

Step V: Now, we find the critical value. The critical value or cut-off value for standard normal distribution is given in **Table I (Z-table)** in the Appendix at the end of Block 1 of this course. So from this table, the critical value for right-tailed test at $\alpha = 0.01$ is $z_\alpha = 2.33$.

Step IV: Now, to take the decision about the null hypothesis, we compare the calculated value of test statistic with the critical value. Since calculated value of test statistic (= 2.78) is greater than critical value (= 2.33), that means calculated value of test statistic lies in rejection region at 1% level of significance. So we reject null hypothesis and support the alternative hypothesis. Since alternative hypothesis is our claim, so we support the claim. Thus, we conclude that sample does not provide us sufficient evidence against the claim so we may assume that the average weight of potato has increased.

CONCEPT OF P-VALUE

In Note 3 of Section 4.7, we promised that p-value will be discussed in Section 4.9. So, it is the time to keep our promise. Nowadays use of p-value is becoming more and more popular because of the following two reasons:

- most of the statistical software provides p-value rather than critical value.
- p-value provides more information compared to critical value as far as rejection or do not rejection of H_0 .

The first point listed above needs no explanation. But second point lies in the heart of p-value and needs to explain more clearly. Moving in this direction, we note that in scientific applications one is not only interested simply in rejecting or not rejecting the null hypothesis but he/she is also interested to assess how strong the data has the evidence to reject H0. For example, as we have seen in Example 4 based on general procedure of testing a hypothesis where we tested the null hypothesis

$H_0: \theta \leq 50$ gm against $H_1: \theta > 50$ gm

To test the null hypothesis, we calculated the value of test statistic as 2.78 and the critical value (z_α) at $\alpha = 0.01$ was $z\alpha = 2.33$. Since calculated value of test statistic (= 2.78) is greater than critical (tabulated) value (= 2.33), therefore, we reject the null hypothesis at 1% level of significance.

Now, if we reject the null hypothesis at this level (1%) surely we have to reject it at higher level because at $\alpha = 0.05$, $z_\alpha = 1.645$ and at $\alpha = 0.10$, $z_\alpha = 1.28$. However, the calculated value of test statistic is much higher than 1.645 and 1.28; therefore, the question arises "could the null hypothesis also be rejected at values of α smaller than 0.01?" The answer is "yes" and we can compute the smallest level of significance (α) at which a null hypothesis can be rejected. This smallest level of significance (α) is known as "p-value".

The p-value is the smallest value of level of significance(α) at which a null hypothesis can be rejected using the obtained value of the test statistic and can be defined as:

> The p-value is the probability of obtaining a test statistic equal to or more extreme (in the direction of sporting H1) than the actual value obtained when null hypothesis is true.

The p-value also depends on the type of the test. If test is one-tailed then the p-value is defined as:

For right-tailed test:

p-value = P[Test Statistic (T) ≥ observed value of the test statistic]

For left-tailed test:

p-value = P[Test Statistic (T) ≤ observed value of the test statistic]

If test is two-tailed then the p-value is defined as:

For two-tailed test:

p-value = 2P [T ≥ |observed value of the test statistic |]

Procedure of taking the decision about the null hypothesis on the basis of p-value:

To take the decision about the null hypothesis based on p-value, the p-value is compared with level of significance (α) and if p-value is equal or less than α then we reject the null hypothesis and if the p-value is greater than α we do not reject the null hypothesis.

But if we test our hypothesis with the help of computer packages or soft wares such as SPSS, SAS, MINITAB, STATA, EXCEL, etc. then these types of computer packages or software present the p-value as part of the output for each hypothesis

testing procedure. Therefore, in this Unit, we will also describe the procedure to take the decision about the null hypothesis on the basis of critical value as well as p-value concepts.

RELATION BETWEEN CONFIDENCE INTERVAL AND TESTING OF HYPOTHESIS

In Section 4.8, we have discussed the general procedure of testing a hypothesis which has been used in making decision about the specified/ assumed/ hypothetical values of population parameters. Both confidence interval and hypothesis testing have been used for different purposes but have been based on the same set of concepts. Therefore, there is an extremely close relationship between confidence interval and hypothesis testing. In confidence interval, if we construct (1-α) 100% confidence interval for an unknown parameter then this interval contained all probable values for the parameter being estimated and relatively improbable values are not contained by this interval. So this concept can also be used in hypothesis testing. For this, we contract an appropriate (1-α) 100% confidence interval for the parameter specified by the null hypothesis and if the value of the parameter specified by the null hypothesis lies in this confident interval then we do not reject the null hypothesis and if this specified value does not lie in this confidence interval then we reject the null hypothesis. Therefore, three cases may arise:

Case I: If we want to test the null hypothesis H_0: $\theta = \theta_0$ against the alternative hypothesis H_1: $\theta \neq \theta_0$ at 5% or 1% level of significance then we construct two sided $(1-\alpha)$ 100% = 95% or 99% confidence interval for the parameter θ. And we have 95% or 99% (as may be the case) confidence that this interval will include the parameter value θ_0. If the value of the parameter specified by the null hypothesis i.e. θ_0 lies in this confidence interval then we do not reject the null hypothesis otherwise we reject the null hypothesis.

Case II: If we want to test the null hypothesis H_0: $\theta \leq \theta_0$ against the alternative hypothesis H_1: $\theta > \theta_0$ then we construct the lower one-sided confidence bound for parameter θ. If the value of the parameter specified by the null hypothesis i.e. θ_0 is greater than or equal to this lower bound then we do not reject the null hypothesis otherwise we reject the null hypothesis.

Case III: If we want to test the null hypothesis H_0: $\theta \geq \theta_0$ against the alternative hypothesis H_1: $\theta < \theta_0$ then we construct the upper one-sided confidence bound for parameter θ. If the value of the parameter specified by the null hypothesis i.e. θ_0 is less than or equal to this upper bound then we do not reject the null hypothesis otherwise we reject the null hypothesis.

For example, referring back to Example 4 of this unit, here we want to test the null hypothesis

$$H_0 : \mu \leq 50\,\text{gm} \text{ against } H_1 : \mu > 50\,\text{gm}$$

This was tested with the help of test statistic

$$T = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \quad [\text{Here}, \theta = \mu]$$

and we reject the null hypothesis at $\alpha = 0.01$.

This problem could also have been solved by obtaining confidence interval estimate of population mean which is described in Section 7.4 of Unit 7.

Here, we are given that

$$n = 50,\ \bar{X} = 50 \text{ and } \sigma = 5.1$$

Since alternative hypothesis is right-tailed, therefore, we construct lower one-sided confidence bound for population mean.

Since population variance is known so lower one-sided $(1-\alpha)$ 100 % confidence bound for population mean when population variance is known is given by

$$\bar{X} - z_\alpha \frac{\sigma}{\sqrt{n}}$$

Since we test our null hypothesis at $\alpha = 0.01$ therefore, we contract 99% lower confidence bound and for $\alpha = 0.01$, we have $z_\alpha = z_{0.01} = 2.33$.

Thus, lower one-sided 99% confidence bound for average weight of potatoes is

$$52 - 2.33\frac{5.1}{\sqrt{50}} = 52 - 1.68 = 50.32$$

Since the value of the parameter specified by the null hypothesis i.e. $\mu = 50$ is less than lower bound for average weight of potato so we reject the null hypothesis. Thus, we can use three approaches (critical value, p-value and confidence interval) for taking decision about null hypothesis.

SUMMARY

In this unit, we have covered the following points:

- Statistical hypothesis, null hypothesis, alternative hypothesis, simple & composite hypotheses.
- Type-I and Type-II errors.
- Critical region.
- One-tailed and two-tailed tests.
- General procedure of testing a hypothesis.
- Level of significance.
- Concept of p-value.
- Relation between confidence interval and testing of hypothesis.

EXERCISE

1. Define the type-I and type-II errors.
2. What is one tailed and two tailed tests?
3. Discuss the general procedure of testing a hypothesis?
4. What is the concept of p value?

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UNIT -13 CONCEPT AND IMPORTANCE OF RESEARCH DESIGN

STRUCTURE

INTRODUCTION

Having decided what you want to study about, the next question comes up as to how are you going to conduct your study? What procedures will you adopt to obtain answers to research questions? How will you carry out the tasks needed to complete the different components of the research process? What should you do and what should you not do in the process of undertaking the study?

These are some of the questions that need to be answered before we proceed to conduct the study. Basically, answers to these questions constitute the core of a

research design. This unit therefore begins with the definition and the description of the research design. Then the purpose of the research design is highlighted in which you will study how a research can maximize the systematic variance, control extraneous variance through the various controlling techniques i.e. randomization, matching, elimination and statistical control. Further you will find how a researcher can minimize the error variance. Moreover, research cannot ignore the criteria of good design. This unit acquaints you with the basic criteria of research through which you can distinguish good design from weak design. Finally, the qualities of research design are indicated and described.

LEARNING OBJECTIVES

After reading this unit, you will be able to:

- Define research design;
- Describe the features and purposes of research design;
- Discuss various objectives/purpose of research design;
- Describe the functions of research design;
- Explain the criteria of research design; and
- State the qualities of research design.

RESEARCH DESIGN: MEANING AND DEFINITION

Research is an important activity affecting the society as a whole therefore; it involves a lot of decision making. Research design also involves a lot of decision - making. It provides a structure and shape to your research project. After finalising your topic, you decide about how you are going to conduct your study. It involves formulation of strategy for all the stages starting from formulation of hypotheses to the analysis of data.

Winner (1971) compared the research design to an architect's plan for the structure of a building. The designer of researcher performs a role similar to that of the architect. The owner of the building gives his basic requirements to the architect, who then exercising his expertise, prepares a plan or a blue print outlining the final shape of the structure.

Similarly, researcher has to do planning or prepare a structure before starting data collection and analysis. According to Myers (1980), the research design is the general structure of the experiment, not its specific content. In fact, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data.

According to Thyer (1993) a traditional research design is a blueprint or detailed plan for how to conduct a research study and how to complete the same. Planning such a research design involves,

(i) operationalizing variables so that they can be measured,
(ii) selecting a sample of interest to study,
(iii) collecting data to be used as a basis for testing hypothesis, and
(iv) analysing the results.

According to Matheson (1970) a research design is a basic plan for research, including the assignment of subjects to the levels of the independent variable and the manipulation of the independent variable.

According to Kerlinger (1986) research design is the plan, structure, and strategy of investigation conceived so as to obtain answers to research questions and to control variance.

The definition of Kerlinger reveals three important components, which are i) research design is a plan ii) research design is the structure iii) research design is the strategy. Let us see what these are:

i) Research Design is the Plan: The plan is the overall scheme or program of the research. It includes an outline of what the investigator will do from writing the hypotheses and their operational implications to the final analysis of data.
ii) Research Design is the Structure: The structure of the research is more specific. It is the outline, the scheme, the paradigm, of the operation of the variables. When we draw diagrams that outline the variables and their relation and juxtaposition, we build structural schemes for accomplishing operational research purposes.
iii) Research Design is the Strategy: Strategy as used here is also more specific than plan. It includes the methods to be used to gather and analyse the data. In other words strategy implies how the research objectives will be reached and how the problems encountered in the research will be tackled.

Thus, we can conclude that research design provides us a base on which we conduct our research.

FEATURES OF A GOOD RESEARCH DESIGN

A good design is often characterised by adjectives like flexible, appropriate, efficient, economical, and soon. Generally, the design which minimises bias and maximises the reliability of the data collected and analysed is considered a, good design. The design which gives the smallest experimental error is supposed to be the best design in many investigations. Similarly, a design which yields maximal information and provides an opportunity for considering many different aspects of a problem is considered most appropriate and efficient design in respect of many research problems. Thus, the question of good design is related to the purpose or objective of the research problem and, with the nature of the problem to be studied. A design may be quite suitable in one case, but may be found wanting in one respect or other, in the context of some

other research problem. One single design cannot serve the purpose of all types of research problems. A research design appropriate for a particular research problem, usually involves the consideration of the following factors;

- the means of obtaining information
- the availability and skills of the researcher and his staff, if any
- the objective of the problem to be studied
- the nature of the problem to be studied
- the availability of time and money for the research work

If the research study happens to be an exploratory or a formulative one, where the major emphasis is on the discovery of ideas and insights, the research design most appropriate must be flexible enough to permit the consideration of many different aspects of a phenomenon. But, when the purpose of a study is to accurately describe a situation, or an association between variables (or, in what are called descriptive studies), accuracy becomes a major consideration and a research design which minimizes bias and maximizes the reliability of the evidence collected is considered a good design. Studies involving the testing of a hypothesis of a causal relationship between variables require a design which will permit inferences about causality in addition to the minimisation of bias and maximisation of reliability. But, in practice it the most difficult task is to put a particular study in a particular group, for a given research may have in it elements of two or more of the functions of different studies. It is only on the basis of its primary function that a study can be categorised, either as an exploratory or descriptive, or hypothesis testing study, and, accordingly, the choice of a research design may be made in case of a particular study. Besides, the availability of time, money, the skills of the research staff, and the means of obtaining the information must be given due weightage while working out the relevant details of the research design, such as experimental design, survey design, sample design, and the like.

FUNCTIONS OF RESEARCH DESIGN

Regardless of the type of research design selected by the social investigator, all plans perform one or more functions outlined and discussed below. The number of functions performed by any design largely depends upon its sophistication, coupled with the researcher's concerns.

A. As a Blue Print

Perhaps the most important function of research designs is that they provide the researcher with a blueprint for studying social questions. Without adequate drawings and plans, a homebuilder would become burdened with insurmountable problems such as where to place the foundation, what kinds and qualities of materials to use, how many workers are required, how large should the home be, and so on. By the same token, a social researcher faces comparable obstacles if he commences his study

without some kind of research plan. To minimize his research problems, there are several decisions he should make before beginning his project. For example, if he chooses to study people directly, some possible considerations might be:

1) a description of the target population about which he seeks information 2) the sampling methods used to obtain his elements (people or things) 3) the size of sample 4) the data collection procedures to be used to acquire the needed information 5) possible ways of analysing the data once collected and 6) whether or not to use statistical tests, and if so, which one(s)? These problems are given strong consideration in a research proposal, prospectus, or study outline that many investigators elect to construct in advance of their research.

B. Directional Function

Research designs dictate boundaries of research activity and enable the investigator to channel his energies in specific directions. Without the delineation of research boundaries and/or objectives, a researcher's activities in a single project could be virtually endless. Many professors directing the work of their graduate students are probably familiar with the problem of dealing with the loose ends of an improperly planned research project. With clear research objectives in view, however, investigators can proceed systematically towards the achievement of certain goals. The structure provided by the research plan enables the investigator to reach closure and consider any given project completed.

C. Anticipatory Function

A third function of a research design is that it enables the investigator to anticipate potential problems in the implementation of the study. It is customary for researchers to review current literature central to the topic under investigation. In the course of the literature review, they may learn about new or alternative approaches to their problems. At the same time they can acquire information concerning what can reasonably be expected to occur in their own investigation. Many articles in the professional journals, as well as specialized monographs, include suggestions for further study. More important, many authors provide criticisms of their own work so that future investigations of the same or similar topics may be improved. In addition, the design can function to provide some estimate of the cost of the research, possible measurement problems, and the optimal allocation of resources such as assistants (manpower) and material.

Check Your Progress Exercise 10.1

Note: I. Write your answer in about 50 words.
II. Check your answer with possible answers given at the end of the unit.

Write the important functions associated with a research design that you havecome across.

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Define research design? Discuss its features.

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PURPOSE OF RESEARCH DESIGN

The purpose of research design is to provide a maximum amount of information relevant to the problem under investigation at a minimum cost. The research design has the toll purposes:

Answers to Research Questions

Research design is formulated to enable the researcher to answer research questions such as validity, objectivity, accuracy, and describe research plans as economically as possible. Any research plan is deliberately and specifically conceived and executed to bring empirical evidence to bear on the research problem. Research design sets up the framework for adequate test of relations among variable. The research design in a way tells us what observations to make, how to make them and how to analyse the quantitative representations of the observations. It also tells us as to what types of statistical analysis to use. Finally, an adequate design outlines possible conclusions to be drawn from statistical analysis. Thus a research design after moving through the sequence of different related steps enables the researcher to draw a valid and objective answer to research questions

Research Design Acts as Variance Control

The main technical function of research design is to control variance. Research design is a set of instructions to the investigator together analyse data in certain ways. Therefore, research design acts as control mechanism and enables the researcher to control unwanted variances. Variance control is a central theme of research design. Variance control as we shall notice throughout this Unit is the central theme of experience design. Variance is a measure of the dispersion or spread of a set of scores. It describes the extent to which the scores differ from each other. Variance and variation, through used by synonymously, are not identical terms. Variation is a

more general term which includes variance as one of the statistical methods of representing methods.

Systematic Variance

The researcher is directly concerned with three types of variance namely experimental variance, extraneous variance and error variance. Main functions of research design are to maximize the effect of systematic variance, control extraneous variance and minimize error variance. A discussion of these variances is presented below.

Systematic Variance: by constructing an efficient research design the investigator attempts to maximize the variance of the variable of substantive research hypotheses. Systematic variance is the variability in the dependent measure due to the manipulation of the experimental variable by the experimenter. An important task of the experimenter is to maximize this variance. This objective is achieved by making the level of the experimental variable as unlike as possible. Suppose an experimenter is interested in studying the effect of intensity of light on visual acuity. The experimenter decides to study the effect by manipulating three levels of light intensity, i.e. 10 ml, 15ml, 20 ml. as the difference between any two levels of the experimental variable is not substantial, and there is little chance of separating its effect from the total variance. Thus, in order to maximize systematic variances, it is desirable to make the experimental conditions (levels) as different as possible. In this experiment it would be appropriate, then to modify the levels of light intensity to 10 ml, 20 ml, and 30 ml so that the difference between any two levels is substantial

Extraneous Variance

Extraneous variance is produced by the extraneous variables or the relevant variables. An experimenter always tries to control the relevant variables and thus, also wants to eliminate the variances produced by these variables. For elimination of extraneous variance it is essential that the extraneous variables be properly controlled. There are four ways to control the extraneous variances. These procedures are elimination, randomization, matching, and statistical control. A discussion of these procedures is given below:

A. Randomization: an important method of controlling extraneous variables is randomization. It is considered to be the most effective way to control the variability due to all possible extraneous sources. If through randomization has been achieved then the treatment groups in the experiment could be considered statistically equal in all possible ways. Randomization is a powerful method of controlling variable. In other words it is a procedure for equating groups with respect to secondary variable. Randomization means random selection of the experimental units from the larger population. Random assignment means that every experimental unit has an equal chance of being placed in any of the treatment conditions or groups. In using

randomization method some problems may be encountered. It is possible to select a random sample from a population, but then assignment of experimental units to groups may get biased. Random assignment of subjects is critical to internal validity. If subjects are not assigned randomly, confounding may occur. Randomized group design and randomized block design are the examples of research design in which randomization is used to control the extraneous variable.

B. Elimination: this procedure is the easiest way to controlling the unwanted extraneous variable through elimination of variable. Suppose, the sex of the subject as unwanted secondary variable, is found to influence the variable in an experiment. Therefore the variable of sex has to be controlled. The researcher may decide to take either all males or all females in an experiment and thus, controlled through elimination the variability due to the sex variable. By using elimination for controlling the extraneous variables, researcher loses the power of generalisation. If the researcher selects the subject from a restricted range then the researcher can generalise the results within restricted range and not outside it. Elimination procedure is used in non-experimental design.

C. Matching: is also a non-experimental design procedure, is used to control the extraneous source of variance. In case of controlling organismic and background variable matching is used in this procedure the relevant variable are equated or held constant across all conditions of experiments. Suppose if the researcher finds that the variable of intelligence is highly correlated with the dependent variable, it is better to control the variance through matching on the variable of intelligence. However as a method of control matching limits the availability of subjects. If the researcher decides to match subjects on two or three variables he may not find enough subjects for the experiment. Besides this the method of matching biases the principles of randomization.

D. Statistical Control: in this approach, no attempt is made to restrain the influence of secondary variables. In this technique, one or more concomitant secondary variables (covariates) are measured and the dependent variable is statistically adjusted to remove the effects of the uncontrolled sources of variation. Analysis of covariance is one such technique. It is used to remove statistically the possible amount of variation in the concomitant secondary variable.

Error Variance

The third function of a research design is to minimize the error variance. The error variance is defined as those variance or viabilities in the measures, which occurs as a function of the factors not controllable by the experimenter. Such factors may be related to the individual differences among the subjects themselves such as to their attitude, motivation, need, ability etc. They may be related to what is commonly called the errors of measurements such as the differences in trials differences in conditions of experiment, temporary emotional state of the subject, fatigability etc.

Statistical controls can be applied to minimize such error variance. For example, repeated measures design can be used to minimize the experimental error. By this technique the variability due to the individual differences is taken out from the total variability, and thus, the error variance is reduced. Analysis of covariance is also a technique to reduce the error variance. Further, error variance can be controlled by increasing the reliability of measurement by giving clear and unambiguously instructions and by using a reliable measuring instrument etc.

DESIGN SELECTION

The selection of a specific type of design depends primarily on both the nature and extent of the information. Complex designs, usually involving a number of "control groups," offer more information than a simple group design. However, not all of the relevant information may be needed can be derived from any given design. Some of the information is based on the assumptions and some information is explicit. Other information derives from a network of knowledge surrounding the project in question. Theories, accepted concepts, hypotheses, principles and empirical evidence from related studies ought to be considered in design selection.

1) What questions will this design answer? To do this, we must also be able to specify many of the questions the design won't answer as well ones it will answer. This should lead to a more realistic approach to experimental design than is usually given. Some simple and useful designs have been labelled as "poor" because they are relatively simple and will not answer some questions. Yet, they may provide clear and economical answers to the major questions of interest. Complex designs are not as useful for some purposes.

2) What is the relative information gain/cost picture? There is no specific formula or strategy for deriving some cut-off point in this regard. The major point here is that the researcher must take a close look at the probable cost before selecting a design.

Besides this, choice of design depends on different factors, such as; Feasibility; reliability; ethical; Cost and time.

CRITERIA OF RESEARCH DESIGN

As you know that there are various types of research design. Some are weak design and some are good design. Behavioural researchers have been able to formulate certain criteria on the basis of which you can distinguish the good design from weak design. These criteria have proved very useful in guiding the researches in right direction. These criteria are mentioned below.

Capability to Answer Research Questions Adequately

A good research design is the design that answers research questions adequately. Sometimes, the researcher selects a design which is not appropriate for answering the

research question in hand. Such designs constitute the example of weak research design. Such a design does not adequately test the hypotheses either. It is a common practice that students while trying to answer a research question by conducting experiment or doing research, often match sex, age intelligence of the subjects on the assumption that such matching would lead to the setting of a better experimental group and control group. The reality is that if there is no relation between say, age and the dependent variable then matching an age will be irrelevant. Therefore, any design based upon matching would be a weak design.

Control of Variable

Another criterion of a good research design is that it should control the effects of extraneous variables which are more or less similar to independent variables that have the capacity to influence dependent variables. If left uncontrolled, such variables are called independent extraneous variables or simply extraneous variables. A design which fails to control the effect of extraneous variables is considered a weak one and the research should avoid such designs. There are various ways to control the effects of extraneous variables. Of these ways randomization is considered by many as one of the best techniques of controlling the extraneous variables. There are three basic phases in randomization-random selection of subjects, random assignment of subjects into control and experimental groups and random assignments of experimental treatments among different groups. Sometimes, it happens that for the researcher it is not possible to make random selection of subjects. In such situations the researcher tries to randomly assign the selected subjects into different experimental groups. When this random assignment is not possible due to any reason, the researcher randomly assigns the different experimental treatments into experimental groups. Randomization has proved very useful in controlling the extraneous variables. This increases the internal validity of the research.

Generalizability

The third criterion of research design is generalizability. Generalizability is the external validity of the research. In other words it refers to the extent to which the results of the experiment or research obtained can be generalised to subjects, groups or conditions not included in sample of the research. If the design is such as the obtained results can be generalised to larger groups or subjects, the design is considered to be a good one.

SUMMARY

We have noticed that research design is a plan, structure and strategies of the collection measurement and analysis of data. Research design purports to obtain answers to research questions and controlling variance. Moreover, research design answers the question as objectively, validly and economically as possible. Main functions of the research design are to maximize the effect of systematic variance,

control extraneous variance through randomization, elimination, matching and statistical control and minimize the error variance. A good research design is characterised by feasibility, flexibility, generalizability, theory base, cost and time.

GLOSSARY

Descriptive Studies: Research studies that are carried out to describe an object, phenomena, process, or organisation in the present.

Experimental Studies: Research studies that are undertaken to study cause and effect relations between variables are called experimental studies.

Research Design: The strategy that a researcher adopts to undertake his/her research. It concerns the operationalization of hypothesis, data collection, and data analysis.

Validity: Validity is a measure of the extent of what you are measuring is what you intend to measure.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: Regardless of the type of research design selected by the social investigator, all plans perform one or more functions outlined and discussed below. Perhaps the most important function of research designs is that they provide the researcher with a blueprint for studying social questions. By the same token, a social researcher faces comparable obstacles if he commences his study without some kind of research plan. To minimize his research problems, there are several decisions he should make before beginning his project.

Directional function: research designs dictate boundaries of research activity, and enable the investigator to channel his energies in specific directions.

Anticipatory function: a third function of a research design is that it enables the investigator to anticipate potentia1 problems in the implementation of the study.

Answer to Q.2: Research design is a plan, structure, and strategy of investigation so conceived as to obtain answers to research questions or problems. It is a blueprint or

detailed plan for a research study - starting from operationalizing variables so that they can be measured, to selecting a sample of interest to study, collecting data to be used as a basis for testing hypotheses, and finally analysing the results. Research is a systematic and organised effort towards quest for new knowledge. It involves spending public money and thus accountability towards them. Thus, it needs to have a well thought of research design.

EXERCISE

1. What is research design?
2. What are the function of research design?
3. Discuss the features and purpose of research design.
4. Explain the criteria of research design.

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UNIT 14 TYPES OF RESEARCH DESIGN

Structure

INTRODUCTION

The previous Unit has discussed about the meaning and definition of research designs. This Unit will explore the types and uses of research design. The research interests of social investigators are virtually unlimited. Any social setting is a potential target for scientific examination. In spite of the diversity of possible social topics and/or situations invested, most contemporary social scientific research is characterized by some type of study plan. This plan is congenitally labelled the research design. Research design decides the fate pf the proposal and its outcome. If the design is defective, the whole outcome and report will be faulty and undependable. It is upon the design that the nature of data to be collected will very much depend. It is, therefore, desirable that research design should be methodologically prepared

LEARNING OBJECTIVES

After reading this Unit, you will be able to:

- Understand the concept of research design;
- know its types; and
- Understand the uses of research design

TYPES OF RESEARCH DESIGN

This unit is intended to give a clear depiction of various categories of research designs. For your better understanding, a brief description is given on various categories of research designs. Exploratory or Formulative Research Design, Descriptive and Diagnostic Research Designs, and Hypothesis testing or Experimental Research Designs, are the three major categories of Research Designs most widely used in social science research.

Exploratory or Formulative Research Design

Exploratory research studies are also termed as formulative research studies. The main purpose of such studies is that of formulating a problem for more precise investigation or of developing the working hypothesis from an operational point of view. The major emphasis in such studies is on the discovery of ideas and insights. As such the research design appropriate for such studies must be flexible enough to provide opportunity for considering different aspects of a problem under study. Inbuilt flexibility in research design is needed because the research problem, broadly defined initially, is transformed into one with more precise meaning in exploratory studies, which in fact may necessitate changes in the research procedure for gathering relevant data.

A pilot study conducted prior to the main investigation is an example. Here, the investigator does not proceed with a pre-planned design, but with a well thought out outline (unstructured instrument) for collection of preliminary data and gain more knowledge and familiarity with the phenomenon, or, the problem, concerned. A nonprobability, i.e., purposive or judgment sampling design is followed.

Generally, the following three methods in the context of research design for such studies are talked about: (a) the survey of concerning literature; (b) the experience survey, and (c) the analysis of in sight- stimulating examples.

i) The survey of concerning literature

Happens to be the most simple and fruitful method of formulating precisely the research problem or developing hypothesis. Hypotheses stated by earlier workers may be reviewed and their usefulness be evaluated as a basis for further research. It may also be considered whether the already stated hypotheses suggest new hypothesis. In this way, the researcher should review and build upon the work already done by others, but in cases where hypotheses have not yet been formulated. His task is to review the available material for deriving the relevant hypotheses from it.

Besides, the bibliographical survey of studies, already made in one's area of interest may as well as made by the researcher for formulating the problem precisely. He should also make an attempt to apply concepts and theories developed in different research contexts to the area in which he is working. Sometimes the works of creative

writers also provide a fertile ground for hypothesis formulation and as such may be looked into by the researcher.

ii) Experience Surveys are surveys of people who have had practical experience with the problem to be studied. The object of such a survey is to obtain insights into the relationships between variables and new ideas relating to the research problem. For such a survey, people who are competent and can contribute new ideas may be carefully selected as respondents to ensure a representation of different types of experience. The respondents so selected may then be interviewed by the investigator. The researcher must prepare an interview schedule for the systematic questioning of informants. But the interview must ensure flexibility in the sense that the respondents should be allowed to raise issues and questions which the investigator has not previously considered. Generally, the experience collecting interview is likely to be long and may last for few hours. Hence, it is often considered desirable to send a copy of the questions to be discussed to the respondents well in advance. This will also give an opportunity to the respondents for doing some advance thinking over the various issues involved so that, at the time of interview, they may be able to contribute effectively. Thus, an experience survey may enable the researcher to define the problem more concisely and help in the formulation of the research hypothesis.

iii) Analysis of in sight- Stimulating Examples is also a fruitful method for suggesting hypothesis for research. It is particularly suitable in areas where there is little experience to serve as a guide. This method consists of the intensive study of selected instances of the phenomenon in which one is interested. For this purpose the existing records, if any, may be examined, the unstructured interviewing may take place, or some other approach may be adopted. The attitude of the investigator, the intensity of the study, and the ability of the researcher to draw together diverse information into a unified interpretation are the main features which make this method an appropriate procedure for evoking insights.

A few examples of in sight- stimulating cases are the reactions of strangers, the reactions of marginal individuals, the study of individuals who are in transition from one stage to another, the reactions of individuals from different social strata, and the like. In general, cases that provide sharp contrasts, or have striking features are considered relatively more useful while adopting this method of hypothesis formulation. Thus, in an exploratory or formulative research study this merely leads to insights or hypotheses, whatever method or research design outlined above is adopted, the only essential is that it must continue to remain flexible so that many different facets of a problem may be considered as and when they arise, and come to the notice of the researcher.

Research Design in Descriptive and Diagnostic Research Studies

Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group, whereas diagnostic research studies determine the frequency with which something occurs, or its association with something else. Studies concerning whether certain variables are associated are examples of diagnostic research studies. As against this, studies concerned with specific predictions with the narration of facts and characteristics concerning individuals, groups, or situations 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 common requirements, and as such, we may group together these two types of research studies. In descriptive, as well as in diagnostic studies, the researcher must be able to define clearly, what is to be measured, and must find adequate methods for measuring it, along with a clear cut definition of the population he wants to study. Since the aim is to obtain complete and accurate information in the said studies, the procedure to be used must be carefully planned. The research design must make enough provision for protection against bias, and must maximise reliability, with due concern for the economical completion of the research study.

The design in such studies must be rigid and not flexible, and must focus attention on the points that follow.

a. Formulating the objectives of the study (what the study is about, and why is it being made.
b. Designing the methods of data collection (what techniques of gathering data will be adopted?
c. Selecting the sample (how much material will be needed?
d. Collecting the data (where can the required data be found, and with what time period should the data be related?
e. Processing and analysing the data.
f. Reporting the findings.

In a descriptive/diagnostic study the first step is to specify the objectives with sufficient precision to ensure that the data collected are relevant. If this is not done carefully, the study may not provide the desired information.

Then comes the question of selecting the methods by which the data are to be obtained. In other words, techniques for collecting the information must be devised. Several methods (viz., observation, questionnaires, interviewing, examination of records), with their merits and limitations, are available for the purpose and the researcher may use one or more of these methods .While designing a data collection procedure, adequate safeguards against bias and unreliability must be ensured. It is always desirable to pre-test the data collection instruments before they are final1y used for the study purposes.

In most descriptive/diagnostic studies the researcher takes out sample(s), and then wishes to make statements about the population on the basis of the simple analysis or analyses. The task of designing samples should be tackled in such a fashion that the samples may yield accurate information with a minimal amount of research effort. Usually, one or more forms of probability sampling, or, what is often described as random sampling, are used.

To obtain data that is free from errors introduced by those responsible for collecting them, it is necessary to supervise the staff of field workers closely as they collect and record information. As data are collected, they should be examined for completeness, comprehensibility, consistency, and reliability. The data collected must be processed and analysed. This includes steps like coding the interview replies, observations; tabulating data; and performing several statistical computations. To the extent possible, the processing and analysing procedure should be planned in detail before actual work is started. The appropriate statistical operations, along with the use of appropriate tests of significance, should be carried out to safeguard the drawing of conclusions concerning the study.

Last of all come the question of reporting the findings. This is the task of communicating the findings to others and the researcher must do it in an efficient manner. The layout of the report needs to be well planned so that all things relating to the research study may be well presented in simple and effective style.

Thus, the research design in case of descriptive/diagnostic studies is a comparative design throwing light on all points narrated above and must be prepared keeping in view the objective(s)of the study and the resources available. However, it must ensure the minimisation of bias and maximisation of reliability of the evidence collected. The said design can be appropriately referred to as a survey design since it takes into account all the steps involved in a survey concerning a phenomenon to be studied.

Hypothesis Testing or Experimental Research Design

These are the designs where the researcher tests the hypotheses of causal relationships between variables. Such studies require procedures that will not only reduce bias and increase reliability, hut also permit drawing inferences about causality. Usually, experiments meet these requirements. Hence, these are better known as experimental research designs.

According to Chapin (1955), 'the fundamental rule of the experimental method is to vary only one variable (condition) at a time maintaining all other variables constant'. There are two reasons for adopting this procedure. Firstly, if more than one variable is varied at a time and an effect is produced, it is not possible to ascertain which variable is responsible or whether they have acted jointly. Second, when no effect is produced, it cannot be said which variable is responsible, or whether one has neutralised the other. The basic condition in experimental method is, therefore,

control over the subjects of study and manipulation of the independent variables to study their effect upon the dependent variable. It is not so much the control as such, but the degree of control that one can exercise that is important.

Professor R.A. Fisher enumerated three principles of experimental designs.

i) The Principle of Replication: the term, replication has been derived from the fusion of two words, namely repetition and duplication. Replication refers to the deliberate repetition of an experiment, using nearly identical procedures, which may sometimes be with a different set of subjects in a different setting, and, at different time periods. It helps to revalidate a previous study, or to raise some questions about the previous studies. As each treatment is applied in many experimental units instead of one the statistical accuracy of the experiments is increased.

ii) The Principle of Randomisation: Randomisation refers to a technique in which each member of the population, or, universe has an equal and independent chance of being selected. This provides for random distribution of the effects of unknown or unspecified extraneous variables over different groups. Thus, balancing their effects to a great extent. This is a method of controlling the extraneous variables and reducing experimental error. Thus randomisation makes the test valid.

iii) The Principle of Local Control: Local Control refers to the amount of balancing, blocking and grouping of the subjects or the experimental units employed in the research design. The term, grouping, refers to the assignment of homogeneous subjects, or experimental units, into a group so that different groups of homogeneous subjects may be available for differential experimental treatments. The term, blocking, refers to the assignment of experimental units to different blocks in such a way that the assigned experimental units within a block may be homogeneous. The term, balancing, in a research design refers to the grouping, blocking, and assignment of experimental units to the different treatments in such a way that the resulting design appears to be a balanced one. A design, to be statistically and experimentally sound, must possess the property of local control.

Quasi Experimental Research Designs

These are less efficient than true experimental designs, where some, but not all extraneous variables can be controlled. For example, there are designs in which subjects cannot be randomly assigned to conditions, but the independent variables can be manipulated, either by the investigator or by someone else. These are known as quasi experimental designs. As the subjects are not randomly assigned to the experimental and the control groups, the equivalence of the groups is not maintained, and, thus, it leaves some uncontrolled threats for validity of the experiment. Some of the important types of quasi experimental research designs are discussed below.

i) Time series design: let us start with an example. A business organisation each year compares its annual sales figures. After consideration of such figures for a number of

years and at the advice of an expert, the management organises a training programme for its sales personnel. In subsequent years, the management, or an investigator, compares the pre-training and post-training sales figures. It may be noted here that the subjects (sales personnel) before and after training were the same, though some persons could have changed positions, or some new recruits could have been inducted. The treatment (training) could have been organized by the investigator or by the management, and there was no control group.

It shall be evident from the example that a series of pre-tests are given, or pre-treatment measurements are made, of the selected group or equivalent groups. Subsequently, the treatment is administered and a series of post tests are given, or post treatment measurements are made of the same group or equivalent groups. A control group or a comparison group is not included in this design. Extraneous variables such as maturation, testing, selection, and experimental mortality are well controlled. However, the variable history is not controlled. A comparison of the entire time series data, rather than figures for two adjacent time periods, better reveals the change due to treatment. This design is most applicable where testing is a regular feature of the setting, as in educational institutions, or, where data are regularly collected, such as in records of production, cost-of-living indices, etc.

ii) Equivalent time samples design: The design is first explained with an illustration. Suppose, the, investigator desires to study the effect of some programmes on attitude change towards the adoption of Integrated Pest Management (IPM) practices for a group of farmers. The investigator shows a film (treatment-a) to the group of students, followed by a measure of attitude towards IPM (post-test-a). After a few days, the investigator briefly discusses the general beneficial effects of IPM (treatment-b) with them, and then measures their attitude (post-test-b). After a lapse of few days, the same film is shown (treatment-c) to the same farmers, and measures of attitude (post-test-c) are obtained. Following this, the investigator discusses in details every aspect of beneficial effects of P M (treatment-d). The attitude of the farmers towards IPM is again measured (post tested). This is an extension of and improvement over the time-series design, because of repeated introduction of the treatments, followed by post-tests every time in a systematic way. A single group is used, and there is no control group. Overall attitude change and attitude change separately, with different treatments, can be measured. As there is a carry- over of experience from one treatment to the other, it cannot be specifically stated which treatment produced what effect. The variable history, which is a major limitation of time series design, is well controlled by presenting treatments on several separate occasions. Other extraneous variables, posing threats to internal validity are also well controlled.

iii) Non-equivalent control group design: There are situations in which the investigator has to work with intact groups which cannot be altered. Suppose a researcher is interested in studying the impact of group discussion (treatment) on

housewives' gain in knowledge about nutrition (effect). For this purpose, the researcher selects all the housewives of two separate blocks in a residential area. They form two intact non-equivalent (but comparable) groups. The treatment, a group discussion on nutrition, is arranged randomly for a block, and the other one, for which no group discussion is, arranged serves as the control. Pre-treatment and post treatment measurements are taken for both the groups. The design is similar to the pre-test and post-test control group design, except that the method of randomisation cannot be applied in the assignment of subjects to experimental and control groups. To find the treatment effect the difference between the post-test and pre-test scores of the experimental and control groups may be computed. The extent to which the non-equivalent experimental and control groups are comparable may he found by comparing the scores of both the groups.

Pre -Experimental Research Designs

Pre-experimental researches are research designs that are characterized by a lack of random selection and assignment. On the surface, (he design below appears to be an adequate design. The subjects are pre tested, exposed to a treatment, and then post tested. It would seem that any differences between the pre-test measures and post-test measures would be due to the program treatment.

a) The One-Group Pre-test and Post-test design experimental Group:

However, there are serious weaknesses in this design. With the exceptions of selection and morality threat to internal validity, which are not factors due to the lack of a control group, this design is subject to five other threats to internal validity. If it is an historical event related to the dependent variable intervenes between the pre-test and the post test, its effects could be confused with those of the independent variable. Maturation changes in the subjects could also produce differences between pre-test and post test scores. If paper-and-pencil measures are used on a pre-test, and a different test measure was used on the post test, a shift of scores from pre-test to post test could occur, resulting in a testing threat. Regardless of the measurement process utilized, instrumentation changes could produce variation in the pre-test and post test scores. Finally, if the subjects were selected because they possessed some extreme characteristic differences between pre-test and post test scores could be due to regression toward the mean. In all of these cases, variation on the dependent variable produced by one or more of the validity threats could easily be mistaken for variation due to the independent variable. The fact that plausible alternative explanation cannot be ruled out makes it very difficult to say, with any kind of confidence, that the treatment given caused the observed effect. The next pre experimental design involves comparing one group that experiences the treatment with another group that does not.

b) Experimental group and Control group:

In considering this design, it is important to recognize that the comparison group that appears to be a control group is not, in the true sense, a control group. The major validity threat to this design is selection. Note that no random assignment (omission of the letter "R") is the indicator that the comparison group non-equivalent. In the above design, the group compared is picked up only for the purpose of comparison. There is no assurance of comparability between it and the experimental group. For example, we might wish to test the impact of a new type of math test by comparing a school in which the program exists with one that does not have the program. Any conclusions we might reach about the effects of the program might be inaccurate because of other differences between the two schools. Despite their weaknesses, pre-experimental designs are used when resources do not permit the development of true experimental designs. The conclusions reached from this type of design should be regarded with the utmost caution, and the results viewed as suggestive at best.

Check Your Progress Exercise 11.1

Notes: I. Space is given below for writing your answers.
II. Compare your answers with those given at the end of the unit.

What is an experimental research design? Describe the various principles of experimental research designs.

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Write the importance of pre experimental research designs in Social Science research with suitable examples.

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USES OF RESEARCH DESIGN

A good design is characterised by flexible; appropriate, efficient, economical and so on. The design which minimizes bias and maximizes the reliability of the data collected and analysed is considered a good design. The design which gives the smallest experimental error is supposed to be the best design in many investigations. Similarly, a design which yields maximal information and provides an opportunity for considering many different aspects of a problem is considered the most appropriate

and efficient design. Thus, the question of good design is related to the purpose or objective of the research problem and also with the nature of the problem to be studied. One single design cannot serve the purpose of all types of research problem. Throughout the design construction task, it is important to have in mind some endpoint, some criteria which are to be achieved before accepting a design strategy. The criteria below are only meant to be suggestive of the characteristics found in good research design.

Theory base: Good research strategies reflect the theories which are being investigated. Where specific theoretical expectations can be hypothesised these are incorporated into the design. For example, where theory predicts a specific treatment effect on one measure but not on another, the inclusion of both in the design improves discriminant validity and demonstrates the predictive power of the theory.

Situational: Good research designs reflect the settings of the investigation. This was illustrated above where a particular need of teachers and administrators was explicitly addressed in the design strategy. Similarly, intergroup rivalry, demoralisation, and competition might be assessed through the use of additional comparison groups who are not in direct contact with the original group.

Feasible: Good designs can be implemented. The sequence and timing of events are carefully thought out. Potential problems in measurement, adherence to assignment, database construction and the like, are anticipated. Where needed, additional groups or measurements are included in the design to explicitly correct for such problems.

Redundant: Good research designs have some flexibility built into them. Often, this flexibility results from duplication of essential design features. For example, multiple replication of a treatment helps to insure that failure to implement the treatment in one setting will not invalidate the entire study.

Efficient: Good designs strike a balance between redundancy and the tendency to overdesign. Where it is reasonable, other, less costly, strategies for ruling out potential threats to validity are utilised. This is by no means an exhaustive list of the criteria by which we can judge good research design. Nevertheless, goals of this sort help to guide the researcher toward a final design choice and emphasise important components which should be included.

SUMMARY

In this unit, we discussed various types of research designs and found that a good research design is possible through different phases. Research design, however, depends on research purpose, and is bound to be different in the case of exploratory or formulative studies from other studies, such as descriptive or diagnostic ones. Each type of research design, however, does not suit all categories of designs and for each category of research. Separate types of designs will be needed. The researcher must decide in advance of collection and analysis of data as to which design would prove

to be more appropriate for his research project. The researcher must give due weight to various points such a? the type of' universe and its nature, the objective of 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 the research project.

GLOSSARY

Descriptive Research Design: to describe events, phenomena and situations.

Experimental Research Design: a design in which some of the variables being studied are manipulated or which seek to control conditions which persons are observed.

Research Design: is planning a strategy of conducting research

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: These are the designs where the researcher tests the hypotheses of causal relationships between variables. Such studies require procedures that will not only reduce bias and increase reliability, but also permit drawing inferences about causality. Usually experiments meet these requirements. Hence, these are better known as experimental research designs.

Answer to Q.2: Pre-experimental research designs are research designs that are characterized by a lack of random selection and assignment. On the surface, the design below appears to be an adequate design. The subjects are pre tested, exposed a treatment, and then post tested.

EXERCISE

1. Explain the concept of research design?
2. What are the types of research design? Discuss.
3. Discuss the significance of research design.

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UNIT 15 TYPES OF RESEARCH DESIGN

Structure

INTRODUCTION

The previous Unit has discussed about the meaning and definition of research designs. This Unit will explore the types and uses of research design. The research interests of social investigators are virtually unlimited. Any social setting is a potential target for scientific examination. In spite of the diversity of possible social topics and/or situations invested, most contemporary social scientific research is characterized by some type of study plan. This plan is congenitally labelled the research design. Research design decides the fate pf the proposal and its outcome. If the design is defective, the whole outcome and report will be faulty and undependable. It is upon the design that the nature of data to be collected will very much depend. It is, therefore, desirable that research design should be methodologically prepared

LEARNING OBJECTIVES

After reading this Unit, you will be able to:

- Understand the concept of research design;
- know its types; and
- Understand the uses of research design

TYPES OF RESEARCH DESIGN

This unit is intended to give a clear depiction of various categories of research designs. For your better understanding, a brief description is given on various categories of research designs. Exploratory or Formulative Research Design, Descriptive and Diagnostic Research Designs, and Hypothesis testing or Experimental Research Designs, are the three major categories of Research Designs most widely used in social science research.

Exploratory or Formulative Research Design

Exploratory research studies are also termed as formulative research studies. The main purpose of such studies is that of formulating a problem for more precise investigation or of developing the working hypothesis from an operational point of view. The major emphasis in such studies is on the discovery of ideas and insights. As such the research design appropriate for such studies must be flexible enough to provide opportunity for considering different aspects of a problem under study. Inbuilt flexibility in research design is needed because the research problem, broadly defined initially, is transformed into one with more precise meaning in exploratory studies, which in fact may necessitate changes in the research procedure for gathering relevant data.

A pilot study conducted prior to the main investigation is an example. Here, the investigator does not proceed with a pre-planned design, but with a well thought out outline (unstructured instrument) for collection of preliminary data and gain more knowledge and familiarity with the phenomenon, or, the problem, concerned. A nonprobability, i.e., purposive or judgment sampling design is followed.

Generally, the following three methods in the context of research design for such studies are talked about: (a) the survey of concerning literature; (b) the experience survey, and (c) the analysis of in sight- stimulating examples.

iv) The survey of concerning literature

Happens to be the most simple and fruitful method of formulating precisely the research problem or developing hypothesis. Hypotheses stated by earlier workers may be reviewed and their usefulness be evaluated as a basis for further research. It may also be considered whether the already stated hypotheses suggest new hypothesis. In this way, the researcher should review and build upon the work already done by others, but in cases where hypotheses have not yet been formulated. His task is to review the available material for deriving the relevant hypotheses from it.

Besides, the bibliographical survey of studies, already made in one's area of interest may as well as made by the researcher for formulating the problem precisely. He should also make an attempt to apply concepts and theories developed in different research contexts to the area in which he is working. Sometimes the works of creative

writers also provide a fertile ground for hypothesis formulation and as such may be looked into by the researcher.

v) Experience Surveys are surveys of people who have had practical experience with the problem to be studied. The object of such a survey is to obtain insights into the relationships between variables and new ideas relating to the research problem. For such a survey, people who are competent and can contribute new ideas may be carefully selected as respondents to ensure a representation of different types of experience. The respondents so selected may then be interviewed by the investigator. The researcher must prepare an interview schedule for the systematic questioning of informants. But the interview must ensure flexibility in the sense that the respondents should be allowed to raise issues and questions which the investigator has not previously considered. Generally, the experience collecting interview is likely to be long and may last for few hours. Hence, it is often considered desirable to send a copy of the questions to be discussed to the respondents well in advance. This will also give an opportunity to the respondents for doing some advance thinking over the various issues involved so that, at the time of interview, they may be able to contribute effectively. Thus, an experience survey may enable the researcher to define the problem more concisely and help in the formulation of the research hypothesis.

vi) Analysis of in sight- Stimulating Examples is also a fruitful method for suggesting hypothesis for research. It is particularly suitable in areas where there is little experience to serve as a guide. This method consists of the intensive study of selected instances of the phenomenon in which one is interested. For this purpose the existing records, if any, may be examined, the unstructured interviewing may take place, or some other approach may be adopted. The attitude of the investigator, the intensity of the study, and the ability of the researcher to draw together diverse information into a unified interpretation are the main features which make this method an appropriate procedure for evoking insights.

A few examples of in sight- stimulating cases are the reactions of strangers, the reactions of marginal individuals, the study of individuals who are in transition from one stage to another, the reactions of individuals from different social strata, and the like. In general, cases that provide sharp contrasts, or have striking features are considered relatively more useful while adopting this method of hypothesis formulation. Thus, in an exploratory or formulative research study this merely leads to insights or hypotheses, whatever method or research design outlined above is adopted, the only essential is that it must continue to remain flexible so that many different facets of a problem may be considered as and when they arise, and come to the notice of the researcher.

Research Design in Descriptive and Diagnostic Research Studies

Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group, whereas diagnostic research studies determine the frequency with which something occurs, or its association with something else. Studies concerning whether certain variables are associated are examples of diagnostic research studies. As against this, studies concerned with specific predictions with the narration of facts and characteristics concerning individuals, groups, or situations 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 common requirements, and as such, we may group together these two types of research studies. In descriptive, as well as in diagnostic studies, the researcher must be able to define clearly, what is to be measured, and must find adequate methods for measuring it, along with a clear cut definition of the population he wants to study. Since the aim is to obtain complete and accurate information in the said studies, the procedure to be used must be carefully planned. The research design must make enough provision for protection against bias, and must maximise reliability, with due concern for the economical completion of the research study.

The design in such studies must be rigid and not flexible, and must focus attention on the points that follow.

a. Formulating the objectives of the study (what the study is about, and why is it being made.
b. Designing the methods of data collection (what techniques of gathering data will be adopted?
c. Selecting the sample (how much material will be needed?
d. Collecting the data (where can the required data be found, and with what time period should the data be related?
e. Processing and analysing the data.
f. Reporting the findings.

In a descriptive/diagnostic study the first step is to specify the objectives with sufficient precision to ensure that the data collected are relevant. If this is not done carefully, the study may not provide the desired information.

Then comes the question of selecting the methods by which the data are to be obtained. In other words, techniques for collecting the information must be devised. Several methods (viz., observation, questionnaires, interviewing, examination of records), with their merits and limitations, are available for the purpose and the researcher may use one or more of these methods .While designing a data collection procedure, adequate safeguards against bias and unreliability must be ensured. It is always desirable to pre-test the data collection instruments before they are final1y used for the study purposes.

In most descriptive/diagnostic studies the researcher takes out sample(s), and then wishes to make statements about the population on the basis of the simple analysis or analyses. The task of designing samples should be tackled in such a fashion that the samples may yield accurate information with a minimal amount of research effort. Usually, one or more forms of probability sampling, or, what is often described as random sampling, are used.

To obtain data that is free from errors introduced by those responsible for collecting them, it is necessary to supervise the staff of field workers closely as they collect and record information. As data are collected, they should be examined for completeness, comprehensibility, consistency, and reliability. The data collected must be processed and analysed. This includes steps like coding the interview replies, observations; tabulating data; and performing several statistical computations. To the extent possible, the processing and analysing procedure should be planned in detail before actual work is started. The appropriate statistical operations, along with the use of appropriate tests of significance, should be carried out to safeguard the drawing of conclusions concerning the study.

Last of all come the question of reporting the findings. This is the task of communicating the findings to others and the researcher must do it in an efficient manner. The layout of the report needs to be well planned so that all things relating to the research study may be well presented in simple and effective style.

Thus, the research design in case of descriptive/diagnostic studies is a comparative design throwing light on all points narrated above and must be prepared keeping in view the objective(s)of the study and the resources available. However, it must ensure the minimisation of bias and maximisation of reliability of the evidence collected. The said design can be appropriately referred to as a survey design since it takes into account all the steps involved in a survey concerning a phenomenon to be studied.

Hypothesis Testing or Experimental Research Design

These are the designs where the researcher tests the hypotheses of causal relationships between variables. Such studies require procedures that will not only reduce bias and increase reliability, hut also permit drawing inferences about causality. Usually, experiments meet these requirements. Hence, these are better known as experimental research designs.

According to Chapin (1955), 'the fundamental rule of the experimental method is to vary only one variable (condition) at a time maintaining all other variables constant'. There are two reasons for adopting this procedure. Firstly, if more than one variable is varied at a time and an effect is produced, it is not possible to ascertain which variable is responsible or whether they have acted jointly. Second, when no effect is produced, it cannot be said which variable is responsible, or whether one has neutralised the other. The basic condition in experimental method is, therefore,

control over the subjects of study and manipulation of the independent variables to study their effect upon the dependent variable. It is not so much the control as such, but the degree of control that one can exercise that is important.

Professor R.A. Fisher enumerated three principles of experimental designs.

iv) The Principle of Replication: the term, replication has been derived from the fusion of two words, namely repetition and duplication. Replication refers to the deliberate repetition of an experiment, using nearly identical procedures, which may sometimes be with a different set of subjects in a different setting, and, at different time periods. It helps to revalidate a previous study, or to raise some questions about the previous studies. As each treatment is applied in many experimental units instead of one the statistical accuracy of the experiments is increased.

v) The Principle of Randomisation: Randomisation refers to a technique in which each member of the population, or, universe has an equal and independent chance of being selected. This provides for random distribution of the effects of unknown or unspecified extraneous variables over different groups. Thus, balancing their effects to a great extent. This is a method of controlling the extraneous variables and reducing experimental error. Thus randomisation makes the test valid.

vi) The Principle of Local Control: Local Control refers to the amount of balancing, blocking and grouping of the subjects or the experimental units employed in the research design. The term, grouping, refers to the assignment of homogeneous subjects, or experimental units, into a group so that different groups of homogeneous subjects may be available for differential experimental treatments. The term, blocking, refers to the assignment of experimental units to different blocks in such a way that the assigned experimental units within a block may be homogeneous. The term, balancing, in a research design refers to the grouping, blocking, and assignment of experimental units to the different treatments in such a way that the resulting design appears to be a balanced one. A design, to be statistically and experimentally sound, must possess the property of local control.

Quasi Experimental Research Designs

These are less efficient than true experimental designs, where some, but not all extraneous variables can be controlled. For example, there are designs in which subjects cannot be randomly assigned to conditions, but the independent variables can be manipulated, either by the investigator or by someone else. These are known as quasi experimental designs. As the subjects are not randomly assigned to the experimental and the control groups, the equivalence of the groups is not maintained, and, thus, it leaves some uncontrolled threats for validity of the experiment. Some of the important types of quasi experimental research designs are discussed below.ime series design: let us start with an example. A business organisation each year compares its annual sales figures. After consideration of such figures for a number of8

years and at the advice of an expert, the management organises a training programme for its sales personnel. In subsequent years, the management, or an investigator, compares the pre-training and post-training sales figures. It may be noted here that the subjects (sales personnel) before and after training were the same, though some persons could have changed positions, or some new recruits could have been inducted. The treatment (training) could have been organized by the investigator or by the management, and there was no control group.

It shall be evident from the example that a series of pre-tests are given, or pre-treatment measurements are made, of the selected group or equivalent groups. Subsequently, the treatment is administered and a series of post tests are given, or post treatment measurements are made of the same group or equivalent groups. A control group or a comparison group is not included in this design. Extraneous variables such as maturation, testing, selection, and experimental mortality are well controlled. However, the variable history is not controlled. A comparison of the entire time series data, rather than figures for two adjacent time periods, better reveals the change due to treatment. This design is most applicable where testing is a regular feature of the setting, as in educational institutions, or, where data are regularly collected, such as in records of production, cost-of-living indices, etc.

iv) Equivalent time samples design: The design is first explained with an illustration. Suppose, the, investigator desires to study the effect of some programmes on attitude change towards the adoption of Integrated Pest Management (IPM) practices for a group of farmers. The investigator shows a film (treatment-a) to the group of students, followed by a measure of attitude towards IPM (post-test-a). After a few days, the investigator briefly discusses the general beneficial effects of IPM (treatment-b) with them, and then measures their attitude (post-test-b). After a lapse of few days, the same film is shown (treatment-c) to the same farmers, and measures of attitude (post-test-c) are obtained. Following this, the investigator discusses in details every aspect of beneficial effects of P M (treatment-d). The attitude of the farmers towards IPM is again measured (post tested). This is an extension of and improvement over the time-series design, because of repeated introduction of the treatments, followed by post-tests every time in a systematic way. A single group is used, and there is no control group. Overall attitude change and attitude change separately, with different treatments, can be measured. As there is a carry- over of experience from one treatment to the other, it cannot be specifically stated which treatment produced what effect. The variable history, which is a major limitation of time series design, is well controlled by presenting treatments on several separate occasions. Other extraneous variables, posing threats to internal validity are also well controlled.

v) Non-equivalent control group design: There are situations in which the investigator has to work with intact groups which cannot be altered. Suppose a researcher is interested in studying the impact of group discussion (treatment) on

housewives' gain in knowledge about nutrition (effect). For this purpose, the researcher selects all the housewives of two separate blocks in a residential area. They form two intact non-equivalent (but comparable) groups. The treatment, a group discussion on nutrition, is arranged randomly for a block, and the other one, for which no group discussion is, arranged serves as the control. Pre-treatment and post treatment measurements are taken for both the groups. The design is similar to the pre-test and post-test control group design, except that the method of randomisation cannot be applied in the assignment of subjects to experimental and control groups. To find the treatment effect the difference between the post-test and pre-test scores of the experimental and control groups may be computed. The extent to which the non-equivalent experimental and control groups are comparable may he found by comparing the scores of both the groups.

Pre -Experimental Research Designs

Pre-experimental researches are research designs that are characterized by a lack of random selection and assignment. On the surface, (he design below appears to be an adequate design. The subjects are pre tested, exposed to a treatment, and then post tested. It would seem that any differences between the pre-test measures and post-test measures would be due to the program treatment.

c) The One-Group Pre-test and Post-test design experimental Group:

However, there are serious weaknesses in this design. With the exceptions of selection and morality threat to internal validity, which are not factors due to the lack of a control group, this design is subject to five other threats to internal validity. If it is an historical event related to the dependent variable intervenes between the pre-test and the post test, its effects could be confused with those of the independent variable. Maturation changes in the subjects could also produce differences between pre-test and post test scores. If paper-and-pencil measures are used on a pre-test, and a different test measure was used on the post test, a shift of scores from pre-test to post test could occur, resulting in a testing threat. Regardless of the measurement process utilized, instrumentation changes could produce variation in the pre-test and post test scores. Finally, if the subjects were selected because they possessed some extreme characteristic differences between pre-test and post test scores could be due to regression toward the mean. In all of these cases, variation on the dependent variable produced by one or more of the validity threats could easily be mistaken for variation due to the independent variable. The fact that plausible alternative explanation cannot be ruled out makes it very difficult to say, with any kind of confidence, that the treatment given caused the observed effect. The next pre experimental design involves comparing one group that experiences the treatment with another group that does not.

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In considering this design, it is important to recognize that the comparison group that appears to be a control group is not, in the true sense, a control group. The major validity threat to this design is selection. Note that no random assignment (omission of the letter "R") is the indicator that the comparison group non-equivalent. In the above design, the group compared is picked up only for the purpose of comparison. There is no assurance of comparability between it and the experimental group. For example, we might wish to test the impact of a new type of math test by comparing a school in which the program exists with one that does not have the program. Any conclusions we might reach about the effects of the program might be inaccurate because of other differences between the two schools. Despite their weaknesses, pre-experimental designs are used when resources do not permit the development of true experimental designs. The conclusions reached from this type of design should be regarded with the utmost caution, and the results viewed as suggestive at best.

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EXERCISE

1. Explain the concept of research design?
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UNIT -16 USES OF RESEARCH DESIGN

INTRODUCTION

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After reading this Unit, you will be able to:

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Generally, the following three methods in the context of research design for such studies are talked about: (a) the survey of concerning literature; (b) the experience survey, and (c) the analysis of in sight- stimulating examples.

vii) The survey of concerning literature

Happens to be the most simple and fruitful method of formulating precisely the research problem or developing hypothesis. Hypotheses stated by earlier workers may be reviewed and their usefulness be evaluated as a basis for further research. It may also be considered whether the already stated hypotheses suggest new hypothesis. In this way, the researcher should review and build upon the work already done by others, but in cases where hypotheses have not yet been formulated. His task is to review the available material for deriving the relevant hypotheses from it.

Besides, the bibliographical survey of studies, already made in one's area of interest may as well as made by the researcher for formulating the problem precisely. He should also make an attempt to apply concepts and theories developed in different research contexts to the area in which he is working. Sometimes the works of creative

writers also provide a fertile ground for hypothesis formulation and as such may be looked into by the researcher.

viii) Experience Surveys are surveys of people who have had practical experience with the problem to be studied. The object of such a survey is to obtain insights into the relationships between variables and new ideas relating to the research problem. For such a survey, people who are competent and can contribute new ideas may be carefully selected as respondents to ensure a representation of different types ofexperience. The respondents so selected may then be interviewed by the investigator. The researcher must prepare an interview schedule for the systematic questioning of informants. But the interview must ensure flexibility in the sense that the respondents should be allowed to raise issues and questions which the investigator has not previously considered. Generally, the experience collecting interview is likely to be long and may last for few hours. Hence, it is often considered desirable to send a copyof the questions to be discussed to the respondents well in advance. This will alsogive an opportunity to the respondents for doing some advance thinking over the various issues involved so that, at the time of interview, they may be able to contribute effectively. Thus, an experience survey may enable the researcher to define the problem more concisely and help in the formulation of the research hypothesis.

ix) Analysis of in sight- Stimulating Examples is also a fruitful method for suggesting hypothesis for research. It is particularly suitable in areas where there is little experience to serve as a guide. This method consists of the intensive study of selected instances of the phenomenon in which one is interested. For this purpose the existing records, if any, may be examined, the unstructured interviewing may take place, or some other approach may be adopted. The attitude of the investigator, the intensity of the study, and the ability of the researcher to draw together diverse information into a unified interpretation are the main features which make this method an appropriate procedure for evoking insights.

A few examples of in sight- stimulating cases are the reactions of strangers, the reactions of marginal individuals, the study of individuals who are in transition from one stage to another, the reactions of individuals from different social strata, and the like. In general, cases that provide sharp contrasts, or have striking features are considered relatively more useful while adopting this method of hypothesis formulation. Thus, in an exploratory or formulative research study this merely leads to insights or hypotheses, whatever method or research design outlined above is adopted, the only essential is that it must continue to remain flexible so that many different facets of a problem may be considered as and when they arise, and come to the notice of the researcher.

Research Design in Descriptive and Diagnostic Research Studies

Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group, whereas diagnostic research studies determine the frequency with which something occurs, or its association with something else. Studies concerning whether certain variables are associated are examples of diagnostic research studies. As against this, studies concerned with specific predictions with the narration of facts and characteristics concerning individuals, groups, or situations 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 common requirements, and as such, we may group together these two types of research studies. In descriptive, as well as in diagnostic studies, the researcher must be able to define clearly, what is to be measured, and must find adequate methods for measuring it, along with a clear cut definition of the population he wants to study. Since the aim is to obtain complete and accurate information in the said studies, the procedure to be used must be carefully planned. The research design must make enough provision for protection against bias, and must maximise reliability, with due concern for the economical completion of the research study.

The design in such studies must be rigid and not flexible, and must focus attention on the points that follow.

a. Formulating the objectives of the study (what the study is about, and why is it being made.
b. Designing the methods of data collection (what techniques of gathering data will be adopted?
c. Selecting the sample (how much material will be needed?
d. Collecting the data (where can the required data be found, and with what time period should the data be related?
e. Processing and analysing the data.
f. Reporting the findings.

In a descriptive/diagnostic study the first step is to specify the objectives with sufficient precision to ensure that the data collected are relevant. If this is not done carefully, the study may not provide the desired information.

Then comes the question of selecting the methods by which the data are to be obtained. In other words, techniques for collecting the information must be devised. Several methods (viz., observation, questionnaires, interviewing, examination of records), with their merits and limitations, are available for the purpose and the researcher may use one or more of these methods .While designing a data collection procedure, adequate safeguards against bias and unreliability must be ensured. It is always desirable to pre-test the data collection instruments before they are final1y used for the study purposes.

In most descriptive/diagnostic studies the researcher takes out sample(s), and then wishes to make statements about the population on the basis of the simple analysis or analyses. The task of designing samples should be tackled in such a fashion that the samples may yield accurate information with a minimal amount of research effort. Usually, one or more forms of probability sampling, or, what is often described as random sampling, are used.

To obtain data that is free from errors introduced by those responsible for collecting them, it is necessary to supervise the staff of field workers closely as they collect and record information. As data are collected, they should be examined for completeness, comprehensibility, consistency, and reliability. The data collected must be processed and analysed. This includes steps like coding the interview replies, observations; tabulating data; and performing several statistical computations. To the extent possible, the processing and analysing procedure should be planned in detail before actual work is started. The appropriate statistical operations, along with the use of appropriate tests of significance, should be carried out to safeguard the drawing of conclusions concerning the study.

Last of all come the question of reporting the findings. This is the task of communicating the findings to others and the researcher must do it in an efficient manner. The layout of the report needs to be well planned so that all things relating to the research study may be well presented in simple and effective style.

Thus, the research design in case of descriptive/diagnostic studies is a comparative design throwing light on all points narrated above and must be prepared keeping in view the objective(s)of the study and the resources available. However, it must ensure the minimisation of bias and maximisation of reliability of the evidence collected. The said design can be appropriately referred to as a survey design since it takes into account all the steps involved in a survey concerning a phenomenon to be studied.

Hypothesis Testing or Experimental Research Design

These are the designs where the researcher tests the hypotheses of causal relationships between variables. Such studies require procedures that will not only reduce bias and increase reliability, hut also permit drawing inferences about causality. Usually, experiments meet these requirements. Hence, these are better known as experimental research designs.

According to Chapin (1955), 'the fundamental rule of the experimental method is to vary only one variable (condition) at a time maintaining all other variables constant'. There are two reasons for adopting this procedure. Firstly, if more than one variable is varied at a time and an effect is produced, it is not possible to ascertain which variable is responsible or whether they have acted jointly. Second, when no effect is produced, it cannot be said which variable is responsible, or whether one has neutralised the other. The basic condition in experimental method is, therefore,

control over the subjects of study and manipulation of the independent variables to study their effect upon the dependent variable. It is not so much the control as such, but the degree of control that one can exercise that is important.

Professor R.A. Fisher enumerated three principles of experimental designs.

vii) The Principle of Replication: the term, replication has been derived from the fusion of two words, namely repetition and duplication. Replication refers to the deliberate repetition of an experiment, using nearly identical procedures, which may sometimes be with a different set of subjects in a different setting, and, at different time periods. It helps to revalidate a previous study, or to raise some questions about the previous studies. As each treatment is applied in many experimental units instead of one the statistical accuracy of the experiments is increased.

viii) The Principle of Randomisation: Randomisation refers to a technique in which each member of the population, or, universe has an equal and independent chance of being selected. This provides for random distribution of the effects of unknown or unspecified extraneous variables over different groups. Thus, balancing their effects to a great extent. This is a method of controlling the extraneous variables and reducing experimental error. Thus randomisation makes the test valid.

ix) The Principle of Local Control: Local Control refers to the amount of balancing, blocking and grouping of the subjects or the experimental units employed in the research design. The term, grouping, refers to the assignment of homogeneous subjects, or experimental units, into a group so that different groups of homogeneous subjects may be available for differential experimental treatments. The term, blocking, refers to the assignment of experimental units to different blocks in such a way that the assigned experimental units within a block may be homogeneous. The term, balancing, in a research design refers to the grouping, blocking, and assignment of experimental units to the different treatments in such a way that the resulting design appears to be a balanced one. A design, to be statistically and experimentally sound, must possess the property of local control.

Quasi Experimental Research Designs

These are less efficient than true experimental designs, where some, but not all extraneous variables can be controlled. For example, there are designs in which subjects cannot be randomly assigned to conditions, but the independent variables can be manipulated, either by the investigator or by someone else. These are known as quasi experimental designs. As the subjects are not randomly assigned to the experimental and the control groups, the equivalence of the groups is not maintained, and, thus, it leaves some uncontrolled threats for validity of the experiment. Some of the important types of quasi experimental research designs are discussed below.

vi) Time series design: let us start with an example. A business organisation each yearcompares its annual sales figures. After consideration of such figures for a number of

years and at the advice of an expert, the management organises a training programme for its sales personnel. In subsequent years, the management, or an investigator, compares the pre-training and post-training sales figures. It may be noted here that the subjects (sales personnel) before and after training were the same, though some persons could have changed positions, or some new recruits could have been inducted. The treatment (training) could have been organized by the investigator or by the management, and there was no control group.

It shall be evident from the example that a series of pre-tests are given, or pre-treatment measurements are made, of the selected group or equivalent groups. Subsequently, the treatment is administered and a series of post tests are given, or post treatment measurements are made of the same group or equivalent groups. A control group or a comparison group is not included in this design. Extraneous variables such as maturation, testing, selection, and experimental mortality are well controlled. However, the variable history is not controlled. A comparison of the entire time series data, rather than figures for two adjacent time periods, better reveals the change due to treatment. This design is most applicable where testing is a regular feature of the setting, as in educational institutions, or, where data are regularly collected, such as in records of production, cost-of-living indices, etc.

vii) Equivalent time samples design: The design is first explained with an illustration. Suppose, the, investigator desires to study the effect of some programmes on attitude change towards the adoption of Integrated Pest Management (IPM) practices for a group of farmers. The investigator shows a film (treatment-a) to the group of students, followed by a measure of attitude towards IPM (post-test-a). After a few days, the investigator briefly discusses the general beneficial effects of IPM (treatment-b) with them, and then measures their attitude (post-test-b). After a lapse of few days, the same film is shown (treatment-c) to the same farmers, and measures of attitude (post-test-c) are obtained. Following this, the investigator discusses in details every aspect of beneficial effects of P M (treatment-d). The attitude of the farmers towards IPM is again measured (post tested). This is an extension of and improvement over the time-series design, because of repeated introduction of the treatments, followed by post-tests every time in a systematic way. A single group is used, and there is no control group. Overall attitude change and attitude change separately, with different treatments, can be measured. As there is a carry- over of experience from one treatment to the other, it cannot be specifically stated which treatment produced what effect. The variable history, which is a major limitation of time series design, is well controlled by presenting treatments on several separate occasions. Other extraneous variables, posing threats to internal validity are also well controlled.

viii) Non-equivalent control group design: There are situations in which the investigator has to work with intact groups which cannot be altered. Suppose a researcher is interested in studying the impact of group discussion (treatment) on

housewives' gain in knowledge about nutrition (effect). For this purpose, the researcher selects all the housewives of two separate blocks in a residential area. They form two intact non-equivalent (but comparable) groups. The treatment, a group discussion on nutrition, is arranged randomly for a block, and the other one, for which no group discussion is, arranged serves as the control. Pre-treatment and post treatment measurements are taken for both the groups. The design is similar to the pre-test and post-test control group design, except that the method of randomisation cannot be applied in the assignment of subjects to experimental and control groups. To find the treatment effect the difference between the post-test and pre-test scores of the experimental and control groups may be computed. The extent to which the non-equivalent experimental and control groups are comparable may he found by comparing the scores of both the groups.

Pre -Experimental Research Designs

Pre-experimental researches are research designs that are characterized by a lack of random selection and assignment. On the surface, (he design below appears to be an adequate design. The subjects are pre tested, exposed to a treatment, and then post tested. It would seem that any differences between the pre-test measures and post-test measures would be due to the program treatment.

e) The One-Group Pre-test and Post-test design experimental Group:

However, there are serious weaknesses in this design. With the exceptions of selection and morality threat to internal validity, which are not factors due to the lack of a control group, this design is subject to five other threats to internal validity. If it is an historical event related to the dependent variable intervenes between the pre-test and the post test, its effects could be confused with those of the independent variable. Maturation changes in the subjects could also produce differences between pre-test and post test scores. If paper-and-pencil measures are used on a pre-test, and a different test measure was used on the post test, a shift of scores from pre-test to post test could occur, resulting in a testing threat. Regardless of the measurement process utilized, instrumentation changes could produce variation in the pre-test and post test scores. Finally, if the subjects were selected because they possessed some extreme characteristic differences between pre-test and post test scores could be due to regression toward the mean. In all of these cases, variation on the dependent variable produced by one or more of the validity threats could easily be mistaken for variation due to the independent variable. The fact that plausible alternative explanation cannot be ruled out makes it very difficult to say, with any kind of confidence, that the treatment given caused the observed effect. The next pre experimental design involves comparing one group that experiences the treatment with another group that does not.

f) Experimental group and Control group:

In considering this design, it is important to recognize that the comparison group that appears to be a control group is not, in the true sense, a control group. The major validity threat to this design is selection. Note that no random assignment (omission of the letter "R") is the indicator that the comparison group non-equivalent. In the above design, the group compared is picked up only for the purpose of comparison. There is no assurance of comparability between it and the experimental group. For example, we might wish to test the impact of a new type of math test by comparing a school in which the program exists with one that does not have the program. Any conclusions we might reach about the effects of the program might be inaccurate because of other differences between the two schools. Despite their weaknesses, pre-experimental designs are used when resources do not permit the development of true experimental designs. The conclusions reached from this type of design should be regarded with the utmost caution, and the results viewed as suggestive at best.

Check Your Progress Exercise 11.1

Notes: I. Space is given below for writing your answers.
II. Compare your answers with those given at the end of the unit.

What is an experimental research design? Describe the various principles of experimental research designs.

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Write the importance of pre experimental research designs in Social Science research with suitable examples.

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USES OF RESEARCH DESIGN

A good design is characterised by flexible; appropriate, efficient, economical and so on. The design which minimizes bias and maximizes the reliability of the data collected and analysed is considered a good design. The design which gives the smallest experimental error is supposed to be the best design in many investigations. Similarly, a design which yields maximal information and provides an opportunity for considering many different aspects of a problem is considered the most appropriate

and efficient design. Thus, the question of good design is related to the purpose or objective of the research problem and also with the nature of the problem to be studied. One single design cannot serve the purpose of all types of research problem. Throughout the design construction task, it is important to have in mind some endpoint, some criteria which are to be achieved before accepting a design strategy. The criteria below are only meant to be suggestive of the characteristics found in good research design.

Theory base: Good research strategies reflect the theories which are being investigated. Where specific theoretical expectations can be hypothesised these are incorporated into the design. For example, where theory predicts a specific treatment effect on one measure but not on another, the inclusion of both in the design improves discriminant validity and demonstrates the predictive power of the theory.

Situational: Good research designs reflect the settings of the investigation. This was illustrated above where a particular need of teachers and administrators was explicitly addressed in the design strategy. Similarly, intergroup rivalry, demoralisation, and competition might be assessed through the use of additional comparison groups who are not in direct contact with the original group.

Feasible: Good designs can be implemented. The sequence and timing of events are carefully thought out. Potential problems in measurement, adherence to assignment, database construction and the like, are anticipated. Where needed, additional groups or measurements are included in the design to explicitly correct for such problems.

Redundant: Good research designs have some flexibility built into them. Often, this flexibility results from duplication of essential design features. For example, multiple replication of a treatment helps to insure that failure to implement the treatment in one setting will not invalidate the entire study.

Efficient: Good designs strike a balance between redundancy and the tendency to overdesign. Where it is reasonable, other, less costly, strategies for ruling out potential threats to validity are utilised. This is by no means an exhaustive list of the criteria by which we can judge good research design. Nevertheless, goals of this sort help to guide the researcher toward a final design choice and emphasise important components which should be included.

SUMMARY

In this unit, we discussed various types of research designs and found that a good research design is possible through different phases. Research design, however, depends on research purpose, and is bound to be different in the case of exploratory or formulative studies from other studies, such as descriptive or diagnostic ones. Each type of research design, however, does not suit all categories of designs and for each category of research. Separate types of designs will be needed. The researcher must decide in advance of collection and analysis of data as to which design would prove

to be more appropriate for his research project. The researcher must give due weight to various points such a? the type of' universe and its nature, the objective of 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 the research project.

GLOSSARY

Descriptive Research Design: to describe events, phenomena and situations.

Experimental Research Design: a design in which some of the variables being studied are manipulated or which seek to control conditions which persons are observed.

Research Design: is planning a strategy of conducting research

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: These are the designs where the researcher tests the hypotheses of causal relationships between variables. Such studies require procedures that will not only reduce bias and increase reliability, but also permit drawing inferences about causality. Usually experiments meet these requirements. Hence, these are better known as experimental research designs.

Answer to Q.2: Pre-experimental research designs are research designs that are characterized by a lack of random selection and assignment. On the surface, the design below appears to be an adequate design. The subjects are pre tested, exposed a treatment, and then post tested.

EXERCISE

1. Explain the concept of research design?
2. What are the types of research design? Discuss.
3. Discuss the significance of research design.

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UNIT 17 INTRODUCTION TO SAMPLING

Structure

INTRODUCTION

The use of sampling in making inferences about a population is possible and has been in operation right from beginning. When one has to make an inference about a lot of large size and it is not practicable to examine each individual unit, then few units of the lot are examined and on the basis of the information of those units, one makes decisions about whole lot. For example, a person would like to purchase a bag of rice may examine a handful of rice from the bag and on the basis of that he/she makes his/her decision about the purchase of full bag.

LEARNING OBJECTIVES

After studying this unit, you would be able to:

- define a population and explain the different kinds of population;
- describe the census and sample survey;
- describe the conditions and principles of sample survey;
- explain the principle steps in sample survey; and
- Describe the characteristics of a good sample.

SAMPLING: MEANING AND CONCEPT

The terminology "sampling" indicates the selection of a part of a group or an aggregate with a view to obtaining information about the whole. This aggregate or the totality of all members is known as Population although they need not be human beings. The selected part, which is used to ascertain the characteristics of the population, is called Sample. While choosing a sample, the population is assumed to be composed of individual units or members, some of which are included in the sample. The total number of members of the population and the number included in the sample are called Population Size and Sample Size respectively. While the definitions of a population and a sample have been introduced in a formal manner in the previous paragraph, the idea of sampling is not really new. The process of generalising on the basis of information collected on a part is really a traditional practice. The annual production of a certain crop in a region is computed on the basis of a sample. The quality of a product coming out of a production process is ascertained on the basis of a sample. The government and its various agencies conduct surveys from time to time to examine various economic and related issues through samples.

According to Levin and Rubin, statisticians use the word, population, to refer not only to people, but, to all items that have been chosen for study. They use the word, sample, to describe a portion chosen from the population.

According to Croach and Housden, a sample is a limited number taken from a large group for testing and analysis, on the assumption that the sample can be taken as representative for the whole group.

According to Boyce, sampling makes an estimate about some of the characteristics of a population. To sample is to make a judgment or a decision about something after experiencing just part of it.

OBJECTIVES OF SAMPLING

Sampling investigation can be performed to fill the following objectives:

i) **Checking of Validity of Census**
Validity of results obtained from census investigation is to be checked by sampling. To check the validity of the census results the sample survey are to be organized after census.

ii) **Checking of Difference between the Measurements of a Sample and Population**
There is always a difference between the measurements of population and its sample whether the sample is suitable enough. Even, there is always difference between the measures of two samples of the same population.

Inspection of authenticity of these differences is the main objective of sampling.

iii) Checking of Characteristics of Population

This is the main objective of a sampling study that all the characteristics of the population can be found in less time, through less effort and with least cost. More information can be obtained about the whole population through sampling.

iv) Find Estimate of Parameters of Population

The measure of the population is to be obtained on the basis of statistical measures of sample mean; sample standard deviation, sample correlation, etc. In this way the objective of the sampling is to find out the most probable values of the parameters. The measures of the population are called parameters and the measures of sample are called statistic.

v) Fulfilment of Special Objective and for Continuous

Information Sampling methods are applied to fulfil the specific objective. Social, economic and behavioural surveys come under this. Continuous information about the behaviour of the unit is needed for some population. Through sampling, corrections are to be done regularly in the results of the previous sample survey as in Medical Sciences and Quality Control.

POPULATION AND SAMPLE

A group of individuals having same characteristics in same surrounding is known as population. According to A.C.Rosander "A population is the totality of objects under consideration". In short, group of all objects which are coming under the definition of investigation unit. For example, the group of employees of a institute shall be the population for every investigation related to the employees. Individuals of the population are known as a unit or an element in population.

A "sample" is a miniature representation of and selected from a larger group or aggregate. In other words, the sample provides a specimen picture of a larger whole. This larger whole is termed as the "population" or "universe". In research, this term is used in a broader sense; it is a well-defined group that may consist of individuals, objects, characteristics of human beings, or even the behaviour of inanimate objects, such as, the throw of a dice or the tossing of a coin.

Suppose there are 60 Community Development Blocks (here in after referred as Blocks) in a State and we include all the Blocks in our study, it would not only be expensive but also cumbersome and time consuming. So, we select a few Blocks. The selected Blocks are termed as sample. The total number of Blocks is called 'population' or 'universe'. This process of relative few blocks is known as sampling.

Representativeness and Adequacy

Basically there are two requirement of a sample: it has to be 'representative' and adequate. If the nature of the population has to be interpreted from a sample, it is necessary for the sample to be truly representative of the population. Moreover, it calls for a drawing a representative 'proportion' of the population. The population may contain a finite number of members or units. Sometimes, the population may be 'infinite'. Therefore, a population has to be defined clearly so that there is no ambiguity as to whether a given unit belongs to the population or not. Otherwise, a researcher will not know what units to consider for selecting a sample.

The second issue related to the representation of a sample is to decide about the 'sampling frame', i.e., listing of all the units of the population in separate categories. In a study, there can be different sampling frames, such as male/female students, employed/unemployed students, etc. The sampling frame should be complete, accurate and up-to-date, and must be drawn before selecting the sample.

Thirdly, a sample should be unbiased and objective. Ideally, it should provide all information about the population from which it has been drawn. Such a sample based on the logic of induction, i.e., proceeding from the particular to the general, Methods of Sampling falls within the range of random sampling errors. This leads us to the results expressed in terms of "probability".

A sample should not only provide representativeness, but should also be adequate enough to render stability to its characteristics. What, then, is the ideal size of a sample? An adequate sample is the one that contains enough cases to ensure reliable results. If the population under study is homogenous, a small sample is sufficient. However, a much larger sample is necessary, if there is greater variability in the units of population. Thus the procedure of determining the sample size varies with the nature of the characteristics under study and their distribution in the population. Moreover, the adequacy of a sample will depend on our knowledge of the population as well as on the method used in drawing the sample.

Check Your Progress Exercise 12.1

1.1 Notes:
I. Space is given below for writing your answers.
II. Compare your answers with those given at the end of the unit.

Q.1 Define a sample and describe the conditions for sample survey briefly.
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Q.2 Define the following terms

i. Sampling: .....

ii. Sampling frame: .....

iii. Sample size……

CENSUS

In census, we study about each and every unit of the population. Population means total units of investigation area. In census, whole group related to investigation is investigated and the information are collected, i.e. Census of population of a country, Census of import and export, etc.

Census investigation is useful in following situations:

1. When a deep study to be performed;
2. When study area is limited;
3. When an adequate accuracy and reliability is desired;
4. When investigator have resources; and
5. When use of sampling method is tough and prohibited.

Merits and Demerits of Census

Merits

i) Useful in Heterogeneity

This method is very appropriate when the units are heterogeneous from each other and hard to be succeeded for sampling method.

ii) Deep Study is Possible

Through census, deep study of the subject is possible so that the investigator can get the total information of the variable of interest. He also knows the things or subjects which otherwise overlooked.

iii) High Level of Accuracy

High level of accuracy is expected by following this method. Because of that the personnel investigation is to be performed in investigation area therefore the results are accurate at higher degree.

iv) Necessary in Some Situation

If the nature of investigation is like that the involvement of all units is necessary than census is necessary i.e. census of population of a country.

Demerits

i) **Useless in Case of Destructive**: Units If the units are destructive type and been destroyed by examining, this method is useless. For example, to study about the hardness of a chawk or quality of crackers or life of bulbs or tube lights.

ii) **More Time and Energy**: This method is very time consuming and large number of persons required to complete the process. This method consumes much of energy and hard work to perform the study.

iii) **More Expensive**: Much of time and organization of big size is needed for a census investigation. A large number of field investigators to be involved in this work and arrangement of their training is also needed. In all, in this process large scale expenditure is needed.

iv) **Investigation Remains:** Incomplete In this method time, money, organization and large number of field investigators are required. Population is also large. Therefore, the investigation may remain incomplete due to weakness of investigating team or time or lack of availability of resources. In that situation, the effort or expenses which have already done that become useless.

v) **Inconvenient:** This method is very inconvenient because this needs a whole department to be established separately. Problems related to management arise.

vi) **Not Possible for all:** This method is not comfortable for all because this method can be used solely by powerful person or organizations.

vii) **Not Possible in Every Situation:** Census is not possible from many reasons in various situations, where the investigation area is large and wide. In such cases contact to each and every unit is not possible.

viii) **Statistical Error:** In this method we cannot have the knowledge of statistical error.

SAMPLE SURVEY

A finite subset of statistical individuals in a population is called a sample and the number of individuals in a sample is called the sample size. Sample is often used in our day to day practical life. For example, in a shop we assess the quality of rice, wheat or any other commodity by taking a handful of it from the bag and then decide to purchase it or not. A house wife normally tests the cooked food to find if they are properly cooked and contain the proper quantity of salt.

If the population is infinite, census is not possible. Also, if the units are destroyed in the course of inspection, 100% inspection though is not possible at all desirable. But even if the population is finite or the inspection is not destructive, 100% inspection is

not taken recourse too, because of the administrative, financial and time factor related problems. So we take the help of sampling.

Merits and Demerits of Sample Survey

Merits

i) Detailed Inspection As selected information is large so their detailed inspection can be done.
ii) Statistical Error The investigator can analyse the statistical error from only the size of the sample in their investigation.
iii) Good Representative If the proper selection is done than the result will be as same as after a census.
iv) Easy and Less Expensive This method is easy and less expensive. It saves time, money and energy.
v) Appropriate for Social and Economic Problem As this method takes less time, therefore, this method is very appropriate for fast changing social and economic problems.
vi) Scientific This method is more scientific because study may be done by other samples for available information.

Demerits

i) Possibility of Inaccurate Result If an investigator is biased at the time of selection of sample units then the result would be inaccurate.
ii) Inappropriate in Lack of Homogeneity Where the lack of homogeneity exists or every unit being different type and nature this method cannot be adopted.
iii) Inappropriate in High Level Accuracy This method is not appropriate in case where high level of accuracy is needed.
iv) Confused Result If a suitable sampling method is not adopted or the sample size is not sufficient then the results would be incorrect.

Conditions for Sample Survey

The investigations through sample survey are appropriate in the following conditions:

i) **Broad Area**: When the investigation area is broad, for example, testing of the effect of a drug for disease by a drug company, then they have to adopt the sample survey method.

ii) **Implication of Rules:** When implications of rules are to be done in a broad way, use of this method is advisable because conformation of rules can be done by various samples.

iii) **When the Population is Infinite**: When the number of elements in the population is infinite then this method is suitable i.e. counting of leaves in a tree is a tough job.

iv) **Insufficient Resources:** Where the money, time and employee/workers are in insufficient numbers, then this method can be adopted.

v) **No Need of High Level of Accuracy:** Where a very high level of accuracy is not necessary, then this method can be used.

vi) **When Units are of Destructive Nature**: In some situations, if the units of the population are of destructive nature and if the census method is used then all the population would be destroyed. In this situation, the sample survey is advisable, for example, testing of sound of crackers.

vii) **Use of Census is not advisable as well as not Possible**: Some investigation situations, where census is not only inappropriate but impossible also the sample survey is appropriate. For example if it has to know that in India's coal mine, how much and which type of coal existed so for that the sample survey is appropriate.

viii) **Homogeneity**: If the elements of a population are homogeneous than sample units would be of same characteristics as of the population. In short a sample should be a true representative of population.

ADVANTAGES OF SAMPLING OVER CENSUS

The advantages of sampling over complete census may be outlined as follows: i) Sampling requires less time and labour than census because only a part of the population has to be examined. The sampling results also can be analysed much faster;

ii) Sampling usually results in reduction in cost in terms of money and man powers. The total cost of the sample survey is expected to be much smaller than a complete census;

iii) There is generally a greater scope in a sample survey than in census. Some inquiries may require highly trained personnel or specialized equipment for collection of data, then the census may be inconceivable;

iv) In some cases a complete census is ruled out by the nature of the population. If there is a population which is infinite and/or hypothetical, then sampling is the only option;

v) A sample survey gives data of better quality than a complete census, because in a sample survey it may be possible to use better resources than complete census;

vi) If the population is too large, as for example, trees in a jungle, leaves in a tree i.e. we are left with no option but to resort to sampling; and

vii) If testing is destructive, then complete enumeration is impracticable and sampling design is the only method to be used in such cases. For example, testing the breaking strength of a chalk, testing of lifetime of an electrical bulb, etc.

SAMPLING FRAME

A Sampling frame: is a list of all the units of the population. The preparation of a sampling frame is sometimes a major practical problem. The frame should always be made up to date and be free from errors of omission and duplication of sampling units.

A perfect frame: identifies each element once and only once. Perfect frames are seldom available in real life. A frame is subject to several types of defect which may be broadly classified on the following lines.

Incomplete Frame: When some legitimate sampling units of the population are omitted the frame is said to be incomplete. If we want to collect information regarding the political opinion of a group of voters on a sample basis, a complete list of voters is necessary to select a sample. But instances are known when such a list is incomplete.

Inaccurate Frame: When some of the sampling units of the population are listed inaccurately or some units which do not actually exist are included, the frame is said to be inaccurate. If you use the list of ration cards as a frame to select persons obviously such a frame will be inaccurate as the details about the persons such as, age is never updated.

Inadequate Frame: A frame which does not include all units of the population by its structure is an inadequate frame. If you use the list of names included in the telephone directory of a city as the frame for selecting a sample to collect information about a consumer product, obviously it will be an inadequate frame. It will include the names of only those persons who have a telephone omitting the majority of the residents of the city.

Out of Date Frame: A frame is out of date when it has not been updated although it was accurate, complete and adequate at the time of preparation. The use of census blocks as a frame to select a sample of households is a fairly accurate frame immediately after the decennial census. But thereafter, its reliability as a frame deteriorates in a rapidly growing or rapidly declining area.

CHARACTERISTICS OF A GOOD SAMPLE

A good sample should have the characteristics of (i) Representativeness and (ii) Adequacy, as already described earlier in the unit.

It is essential that the sample should be 'representative' of the population if the information from the sample is to be generalized for that population. The term representative sample means an ideal 'miniature' or 'replica' of the population from which it has been drawn.

A good sample should also be 'adequate' or of sufficient size to allow confidence in the stability of its characteristics. An adequate sample is considered to be one that contains enough cases to ensure reliable results. Hence, planning the size of the sample in advance is very important. It varies with the nature of the characteristics under study and its distribution.

It may be mentioned that representativeness and adequacy do not automatically ensure accuracy of results. The sampling and data collection techniques need to be selected and employed carefully to obtain higher degrees of precision in results and generalizations about the population.

Check Your Progress Exercise 12.2

Notes:
I. Space is given below for writing your answers.
II. Compare your answers with those given at the end of the unit.

Discuss the characteristics of a good sample.

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Describe the census and situation where it is essential.

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PROBLEMS OF SAMPLING METHODS

Some problems arise regarding the sampling on which pre discussion is necessary:

1. Determination of Base of Sampling

Sample should neither be too small nor too big. This is to be noted that a sample is surely would not be a representative only by size. Sample size depends on the following points:

Homogeneity or heterogeneity of population;

i. Nature of investigation;

ii. Practical things like money, time, hard work by trained supervisors, etc.;
iii. Level of purity; and
iv. Sampling method.

2. Discussion on Effect of Biasedness in Sampling

Partiality, predefined and unknowingly happenings make impure the sample. So it is necessary to beware of that.

3. Reliability in Sampling

This can be done in following ways:

i. Comparison of sample after dividing in two equal parts;
ii. Selection of another sample of same size from the same population and comparison; and
iii. Comparison of the result of a sub-sample to the result of the sample itself.

SUMMARY

In this unit, we have discussed about sample and population. A population is a welldefined group of units: individuals, objects, attributes, qualities, characteristics, traits of human beings, etc. A sample is a small representation of a population. It is a miniature picture of the entire group from which it has been selected. To obtain a representative sample, you must select the unit in a specified way. This process is called sampling. It usually involves the following four steps: (i) Defining the population; (ii) Listing the population; (iii) Selecting a representative sample; and (iv) Obtaining an adequate sample. The choice of an appropriate sampling method by a researcher depends upon many factors. These include (i) defining the population, (ii) availability of information about the structure of population, (iii) the parameters to be estimated, (iv) the objectives of the analysis including degree of precision required, and (v) the availability of financial and other resources. Representativeness and adequacy are the major characteristics of a good sample.

GLOSSARY

Population: a population is any group of individuals or units that have one or more characteristics in common and are of interest to the researcher. It may consist of all the units or individuals of a particular type or a more restricted part of that group.

Sample: a sample is a small proportion of a population selected for analysis. By observing the sample, certain inferences may be drawn about the population. Samples are not selected haphazardly, but deliberately, so that the influence of chance or probability can be estimated.

Sampling Frame: a complete, accurate, and up-to-date list of all the units in a population is called a sampling frame.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: A finite subset of statistical individuals in a population is called a sample and the number of individuals in a sample is called the sample size. Sample is often used in our day to day practical life. For example, in a shop we assess the quality of rice, wheat or any other commodity by taking a handful of it from the bag and then decide to purchase it or not.

Answer to Q.2: i) Sampling is the process of selecting a sample which is a small representation of a large whole or group. A sample should represent truly and adequately the larger whole. A sampling frame should be complete, accurate, up-to date, unbiased and objective.

ii) List of all sampling units in the target population is called a sampling frame.

iii) The number of units or subjects sampled for inclusion in the study in called sample size.

Answer to Q. 3: A good sample must be

- representative of the population chosen
- adequate and
- accurate

Answer to Q.4: In census we study about each and every unit of the population, that means whole group related to investigation is investigated and the information are to be collected. Population means total units of investigation area i.e. census of population, census of import and exports, etc.

Census investigation is useful in following situation:

1. When a deep study to be performed;

2. When study area is limited;

3. When an adequate accuracy and reliability is desired;

4. When investigator have resources; and

5. When use of sampling method is tough and prohibited.

EXERCISE

1. What is sampling?
2. What is the relevance of sampling in the research?
3. What are the principle steps of sample survey?
4. Discuss the characteristics of good sample.

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UNIT 18 TYPES OF SAMPLING-PROBABILITY AND NON-PROBABILITY

Structure

INTRODUCTION

The primary purpose of research is to discover principles that have universal application. But to study a whole population in order to arrive at generalizations would be impracticable if not impossible. Some populations are so that their characteristics cannot be measured, because before the measurement could be completed, the populations would have changed. Imagine the difficulty of conducting an experiment with all fifth-grade Indian children [as subjects] on numerical ability. The study of this population would require the services of thousands of researchers, the expenditure of millions of rupees and thousands of class hours. In view of this it

becomes imperative to collect the data from a smaller group of the population instead of collecting from the whole population. There are various ways to achieve this. We will discuss these in this unit

LEARNING OBJECTIVES

After completing the study of this unit, you will be to:

- explain the meaning of probability sampling;
- describe various probability sampling methods;
- explain the meaning of non-probability sampling;
- describe various non-probability sampling methods

TYPES OF SAMPLING

In the earlier unit, we studied the concept of sampling. Now we shall study different sampling methods. The sampling method was used in social sciences research as early as in 1754 by A.L. Bowley. Since then the method is increasingly used. The sampling methods are broadly classified into two types: (i) Probability sampling and (ii) Non-probability sampling.

Probability Sampling

Probability Sampling is based on some statistical concepts such as the 'Law of Large Numbers', 'Central Limit Theorem and the Normal Distribution' etc. In this type of sampling, the units of the population are not selected at the discretion of the researcher, but by means of certain procedures which ensure that every unit of population has one fixed probability of being included in the sample. It is also called random sampling.

- The Law of Large Number states that as the sample size becomes large, probability that the estimate differs from the parameter to a greater extent, becomes small. Or in other words a larger number provides a more precise measure of the parameter under consideration. However, one precaution must be taken. While increasing the size of the sample care should be taken to maintain the representiveness of the sample, because a large sample does not automatically guarantee representiveness.
- As per the second concept, sampling distribution approaches normal distribution provided- more the irregular distribution in the population, larger is the sample and sample is selected to avoid biases.

Non-Probability Sampling

The non-probability methods are based on the judgements of the investigator as the most important element of control. The guiding principles in non-probability methods are - availability of the subjects, the personal judgement of the investigator, and convenience in carrying out the research.

Criteria for Selecting Sampling

i. Because there are various sampling methods it becomes crucial to select appropriate sampling method. Young has suggested three criteria to be considered while selecting a sampling method-

- A measurable or known probability sampling technique should be used to control the risk of errors in the sample estimate.
- Simple, straight forward and workable methods, adapted to available facilities and personnel, should be used.
- Achieving optimum balance between expenditure incurred and maximum of reliable information should be the guiding principle.

ii. The decision whether a probability sampling or a non -probability sampling is to be applied rests on the constraints which are not very different from those stated earlier. These are- objectives of the study, type of study and availability of the resources for the study.

If the objective of the research is to apply the results of the study to a small local group then sampling may not be given as much consideration as in a study the results of which are to be applied to a larger group. In experimental research internal validity is of more concern than the external validity.

- Action research generally does not require sampling from a larger group. Most of the times sampling is not very essential in historical research also. Whereas survey studies generally have a more rigorous sampling.
- The availability of time, funds, manpower and equipment required is another important consideration in deciding about the size and technique of sampling.

iii. If one is interested in obtaining an estimate of the sampling error, one may resort to probability sampling rather than to a non-probability one.

Check Your Progress Exercise 13.1

Notes:

I. Space is given below for writing your answers.

II. II. Compare your answers with those given at the end of the unit.

Q.1 State the meaning of the following terms:

Population, Sample,
Probability Sampling,
Nonprobability sampling

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PROBABILITY SAMPLING

We know the meaning of and requirement for probability sampling. Now we will take a brief account of different methods of probability sampling.

Simple Random Sampling

Theoretically, this is a method of selecting 'n' units from N units in such a way that everyone in the population of N units has an equal chance of being selected. This can be done through the following steps

- Defining population by specifying its various limits.
- preparing the sampling frame
- Incorporating sampling the names or serial numbers of individual units in the sampling frame (every unit is to be listed, order does not make any difference).

It is important to note that random sample is not necessarily as identical representation of the population. After this, to get the required 'n' units different techniques are available. Let us get acquainted with these techniques one by one.

i) Lottery Method

After naming or numbering every unit in the population, they are well mixed. The required numbers of units are then drawn from all these well-mixed chits. The individuals/objects with these identification name/numbers are then picked up for inclusion in the sample.

However this technique has some objections. When the population is very large and includes such individuals/objects, which are of such nature that could not be mixed and further if 'well mixing' is not attained despite all efforts, the principle of randomness in the population may be violated.

ii) Random Table Method

In view of the mentioned objections, it is advised to use the random number tables instead of lottery method. The use of random numbers or manual lot drawing will be too cumbersome to recommend in case of large population. In such situation, computer generated random selection should be resorted to, in order to save time and labour.

Tables of random numbers have been generated by computers producing a random sequence of digits e.g. random digit table by Rand Corporation and prepared by Kendall & Smith, by Fisher & Yates and by Tippett are frequently used.

The required numbers of units are selected from such a table in any convenient and systematic way. Now suppose we have select to 20 distance learners for interview from 80-distance learners registered at a study centre. We may start with any column

and any row. Because we want 20 numbers i.e. two digit numbers, we have to select only the first two digits from each number. If we select the first column and start from first row then we will get following twenty two digit numbers-23,05, 14,38,97, 11, 43,.....61. You will notice that numbers greater than 80 will have to be deleted from this list and for the remaining numbers selecting any other column and the row the procedure will have to be repeated, till we get required number i.e. 20. If any number is repeated in this list, it is to be substituted by selecting the next number. Until a sample of desired size is obtained, the selection procedure is to be continued.

Row → / Column ↓	1	2	3	4	5	...	N
1	2315	7548	5901	8372	5993	...	6744
2	0554	5550	4310	5374	3508	...	1343
3	1487	1603	5032	4043	6223	...	0834
4	3897	6749	5094	0517	5853	...	1695
5	9731	2617	1899	7553	0870	...	0510
6	1174	2693	8144	3393	0862	...	6850
7	4336	1288	5911	0164	5623	...	4036
8	9380	6204	7833	2680	4491	...	2571
9	4954	0131	8108	4298	4187	...	9527
10	3676	8726	3337	9482	1569	...	3880
11	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...
N	3914	5218	3587	4855	4881	...	5042

Advantages

1. This method calls for no special expertise and training or even insight. It can be used mechanically by anybody.

However, best results are achieved by adopting simple random sampling method. Still, it is not free from criticism.

Limitations

Practically listing of all the units in the population may not be possible.

1. In case of population with infinite numbers, listing is out of the question.

2. It is difficult though not impossible, but it involves high cost.

3. In case of heterogeneous population the selected random sample may not truly represent the characteristics of the population.

Systematic Sampling

A variation of the random process of sampling is the systematic sampling. It is the selection of the required number of elements of the population to include in the sample. It involves the following steps:

- Listing the population elements in some order, say alphabetically, merit wise etc.
- Determining the desired number to be selected from the population e.g. 10% of 1000 means 100 out of 1000.
- Starting with any number from among the numbers 1 to 10 (i.e. 1 to k, both inclusive), to select every 10th (or kth) element from the list. If the number chosen from 1to 10 is 4, then the selected numbers will be the 4th, 14th, 24th... 994th elements making the sample with 100 elements.

As the elements are chosen from regular intervals, this technique is also known as sampling by regular intervals, this technique is also known as sampling by regular intervals, sampling by fixed intervals or sampling by every kth unit.

Advantages

1. It is more practical in that it involves less labour.

2. Because it is simpler to perform, it may reduce errors.

3. The procedure is speedy in comparison with simple random sampling.

4. The systematic sample is spread more evenly over the population which makes this method more precise than stratified random sampling.

Limitations

1. Selection of every element other than the first selected randomly is linked with the first element. This makes the process different from the simple random method where selection of every element is independent of other one.

2. When the list of elements has a periodic arrangement, there is a risk that the sample interval may coincide with the periodic interval in the list. Suppose, A, B, C, D and E are the 5 schools selected and from each school 100 students are selected. The students from school A are placed starting from 1, from school B starting from 2, from school C starting from 3, from school D starting from4 and from school E starting from 5 with an interval of 5. Thus the school A students will hold the numbers 1,6,11,16,21,.....496. The school B students will hold the numbers2,7,12,17,22,.....497.Now in systematic sampling procedure suppose we decide to select 5 % of the total and randomly choose any number from 1 to 5 say '3' then starting from 3 we will have to select every 5" number. These numbers will be 3,8,13,18. 498. Have you noticed that all these numbers belong to school C? Why has it happened so?

The answer is Because every school is repeated in the list with an interval of '5' and elements are selected with an interval of '5'.

3. Another limitation of the systematic sampling method is the trend of the listed population. This is explained below -

Suppose 100 students are listed in the decreasing order of academic merit. We want to draw a sample of 20 students from this using systematic sampling method. 20 out of 100 means the size of interval is '5'. We can draw many samples from this listed population. If we randomly pick up a number from amongst 1 to 5, say 3 then the, sample will comprise the elements 3rd, 8th, 13th, 18th 98th instead, if we randomly pick '5' then the sample will comprise the 5th, l0th,15th, ... 100th elements. Is it not obvious that the two samples will not be comparable in terms of merit? The mean average of these two samples would be significantly different with respect to merit and other associated variables. Calculations made from such samples cannot pinpoint the sources of variability.

Stratified sampling

One question may arise in your mind is that: How to increase the precision of the sample?

By increasing the size of the sample, its precision can be increased. But this is not the only way. Let us see which the other one is. It is the 'stratified sampling'. The term 'stratified' is very much self-explanatory. It involves dividing the population into such sub-population (strata) that each one of them is homogeneous within itself.

The steps to be followed within itself in this method are as under-

- Deciding upon one or more characteristics on the basis of which strata will be formed e.g. location of schools-rural, urban, suburban, urban-slums, metropolitan etc.
- Dividing the population under consideration into strata on the basis of stratification characteristics/criteria.
- Listing the units in each stratum separately.
- Selecting requisite number of elements from each stratum using appropriate random selection technique.

Thus all the elements selected from all the strata compose the required sample. Important points to be noted-

i. The criteria for dividing the population into strata should be correlated with the variable being studied.
ii. The criteria should be practical. It should not yield an unwieldy number of strata.
iii. A good measure of the stratification criteria should be available; e.g. if reliable and valid tool of determining socio-economic status is not

available, stratification on this basis would lead to confounding of the results.

iv. Selection of the elements at random from each stratum in the same proportion as that of the actual size of the stratum in the population improves the representativeness of the sample and helps in achieving higher efficiency at a reduced cost.

v. In some studies (like census) stratification is not possible before the data have been collected. After collecting the data stratification as per sex, age, educational level is affected. Or a simple random sample of the required size is selected and the classification into strata is observed.

Advantages

1. Stratified random sampling is very useful when a list of the elements in the population is not available.

2. It is the most applicable method of sampling when the population is heterogeneous.

Cluster Sampling

When listing of population or at least the total strength of the population is possible and available or in other words when the population is finite we saw that the sampling methods applicable were-simple random, systematic or stratified random sampling.

But what to do when the population is infinite?

In such a case, the method applicable is called as 'cluster sampling'.

Cluster sampling is used when the population under study is relatively infinite, where the list of the elements is not available, the elements/units are geographically scattered or when sampling of individual elements is not required or is not convenient.

A cluster is an intact group as available in the field. It is not formed by the researcher for the purpose of data collection. For example a school complex (a group of schools) is a cluster. Some such clusters are selected to make a sample. Here a sampling element/unit is a group/cluster.

In social survey, the cluster sampling is described as 'area sampling'.

This method involves following steps-

- Deciding the nature of the cluster required.
- Identifying/locating such clusters to make the population.
- Selecting the clusters in required number at random.

Advantages

This method of sampling is economic, especially when the cost of measuring a unit is relatively small.

Limitations

When the sampling unit is to be an individual element/unit or number in the population, this method is not applicable.

Multi-Stage and Multi-Phase Sampling

In the multi-stage sampling selection of different types of sampling units such as some Districts in a State, some Taluka places in those Districts and then some schools, is involved at different sampling stages. Whereas in the multi-phase sampling, the researcher is concerned with the same type of sampling unit at each phase but some members are asked for more information than others, e.g. information regarding study habits of distance learners can be collected from 100 distance learners through a questionnaire and 20 out of them can be interviewed for more information. The main distinction between the multi-stage and the multi-phase sampling is the use of unit of sampling at different levels.

Advantages

1. In both the methods burden on respondents is reduced.

2. Relative cost also gets reduced.

3. Two-phase sampling is useful in studying rare cases.

4. In two-phase sampling resulting gain in precision is more due to possibility of getting more information in details.

Check Your Progress Exercise 13.2

Notes:
I. Space is given below for writing your answers.
II. Compare your answers with those given at the end of the unit.

Q.2. Match the Pairs.

I) **Sampling Method**	**Limitations**
i) Simple Random	a) Sampling unit is not an individual element
ii) Systematic	b) Not applicable to heterogeneous population
iii) Cluster	c) Listing the elements in sub-population necessary
iv) Stratified random	d) Periodic arrangement of elements

II) Sampling Method	Special Feature

i) Stratified random being selected	a) Every unit in the population has equal chance of
ii) Simple random	b) Spread more evenly over the population
iii) Systematic	c) Useful in case of heterogeneous population
iv) Cluster	d) Applicable in case of infinite population

Distinguish between multi-stage and multi-phase sampling methods.
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NON-PROBABILITY SAMPLING

We have understood the meaning of non-probability sampling. It is reiterated here. Where the selection of the units in the sample is based on the researcher's judgement and not on equal or known probability, it is the nonprobability sampling method. A non-probability sample is termed as 'non-random sample' due to the very fact that it is selected through non-random method. The main feature of such a sample is the lack of control of the sampling error on account of which this method of sampling is referred to as 'uncontrolled sampling' method. This description of the non-probability sampling should not be taken in negative sense. In spite of all this many a times it is the demand of the situation to go for nonprobability sampling method. Let us now study the different non-probability sampling methods one by one.

Incidental Sampling

Incidental Sampling is also known as accidental or convenience sampling. When a readily or easily available group is selected as a sample, it is termed as an 'incidental sample'. A teacher-educator e.g. may select the students from a school situated in the same campus which serves as a practicing school for the concerned college of education, to experimentally find the effectiveness of concept attainment model to teach a mathematical concept say, a quadrilateral.

Advantages

The administrative convenience of obtaining sample for the study, the ease of testing, saving in time, completeness of the data collected are some of the merits of this method.

Limitations

Since there is no well-defined population and no random sampling method is applied to select the sample, the standard error formulae apply with a high degree of

approximation. Hence no valid generalization can be drawn. Any attempt at generalization based on such data and conclusion thereof will be misleading.

Purposive Sampling

Another non-probability sampling method is 'purposive sampling'. In this method samples are expressly chosen because in the light of available information they resemble some larger group with respect to one or more characteristics. The controls/criteria for categorization in such samples are usually identified as representative areas such as a state, a district, a city etc. or representative characteristics of individuals such as age, sex, socio-economic status etc. or representative types of groups such as elementary school teachers, secondary school teachers, college teachers, university teachers etc. These controls/criteria may be further sub- divided e.g. the group of college teachers can be divided into male and female teachers or teachers in science/arts/commerce colleges etc.

Have you noticed that up to this stage the controls are somewhat similar to stratification criteria? After deciding upon the category required for the research, the researcher has to select the sample.

Actual selection of the units for inclusion in the sample is done purposively and not randomly; e.g. in order to tackle the problem of indiscipline only the undisciplined students are selected as the sample excluding others, on the basis of past experience.

Advantages

i) This method of sampling is useful where a small sample is required.
ii) It is focused on solving problems of particular groups.

Limitations

This method is applicable only for the selection of samples including typical/special cases such as 'best teacher award winners' from the population of teachers or 'meritorious past students of the school' from the population of the past students.

Quota Sampling

This is another method of non-probability sampling. It involves the selection of the sample units within each stratum, on the basis of the judgement of the researcher. What distinguishes it from probability sampling is that, once the strength of the sample (e.g. how many women teachers from among the college teachers) is decided which forms the ‘quota’; the choice of the actual units to fit into this framework is left to the researcher.

Quota Sampling is thus a method of stratification sampling in which selection of sample units within the stratum is non- random. These quotas are determined by the proportion of the groups, e.g. in order to study the attitude of school teachers towards environment education, first of all the school teachers will be stratified into men and

women teachers, quotas for these strata will be fixed and will be selected (not randomly).

SUMMARY

In this Unit you got acquainted with the concept of population and sample. We elaborated the two types of sampling, namely, the probability and non-probability sampling. We discussed in details various probability sampling methods including simple random sampling, stratified random sampling, systematic sampling, cluster sampling, and multi stage/ phase sampling. You also got an explanation of the nonprobability sampling methods including incidental sampling, purposive sampling and quota sampling.

GLOSSARY

Probability: Probability is the ratio of the number of ways in which a favoured way can occur to the total number of ways the event can occur. It may range from zero, when there is no chance whatever, of the favoured event, to 1.0, where there is absolute certainty that nothing else could happen.

Probability Sampling: in probability sampling, the units of a population are not selected at the discretion of the researcher but by means of certain procedures which ensure that every unit of the population has one fixed probability of being included in the sample. It is a procedure of drawing the units of a population in such a way that every unit has an equal and independent chance of being included in the sample.

Non-probability Sampling: in non-probability sampling, the units are selected at the discretion of the researcher. The researcher uses his/her judgement or experience while selecting the sample.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: Population-A group of individuals/ units having one or more characteristics in common which are of interest to the researcher for a particular research. Sample - A small representative proportion of a population selected for a particular research. Probability Sampling - Sampling based on some statistical concepts such as the 'Law of Large Numbers', 'Central Limit Theorem', and

the 'Normal Distribution' is known as probability sampling. Non-probability Sampling-Sampling based on the judgements of the researcher as the most important element of control is known as nonprobability sampling.

Answer to Q.2: I) i) - (b); ii) – (e); iii) - (a); iv) - (c) II) i) - (c); ii) – (a); iii) - (b); iv) - (d)

Answer to Q.3: The main distinction between multi-stage and multi-phase sampling is the use of unit of sampling at different levels. In multi-stage, sampling is done at various levels such as national, state, district level. In multi-phase, sampling units are of the same type at each phase only a few of them are asked for more information than others.

EXERCISE

1. What is probability sampling?
2. Discuss the various probability sampling methods.
3. What is non-probability sampling? Discuss with suitable example.
4. Explain various non-probability sampling methods.

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UNIT-19 DETERMINING SIZE OF THE SAMPLE PRACTICAL CONSIDERATIONS IN SAMPLING AND SAMPLE SIZE

Structure

INTRODUCTION

We collect data in order to make generalisation. For example, 'Are agricultural labourers today more progressive than they were in nineties?' Question of this kind calls generalisation. But only rarely does a study include observations of all respondents that are defined by the research problem. A familiar example is the elections. To predict the outcome of the elections, pollster interviews, a subset of the total electorate and predict the behaviour of the entire set (the electorate or population). Similarly, suppose that, as a researcher, you want to study the effects of Integrated Rural Development Programme in your District. For this, you need not have to select all the beneficiaries in the district. Instead you may select a few representatives from the Villages / Blocks from your District and assess the effects of the programme. The process of selection demands thorough knowledge of various sampling methods. In this Unit, we shall familiarize you with the concept of sample size and how to determine the sample size.

LEARNING OBJECTIVES

After studying this Unit, you should be able to:

- Discuss the meaning of sample size
- Explain the process of determination of sampling size
- Recognise the factors which affect the sample size decision

SAMPLE SIZE

How large a sample should be taken in a study? At this stage, we will only mention some factors affect the sample size decision and in later units some of these ideas will be gone into in more depth.

One of the most important factors that affect the sample size is the extent of variability in the population. Taking an extreme case, if there is no variability, i.e. if all the members of the population are exactly identical, a sample of size 1 is as good as a sample of 100 or any other number. Therefore, the larger the variability, the larger is the sample size required.

A second consideration is the confidence in the inference made-the larger the sample size, the higher is the confidence. In many situations, the confidence level is used as the basis to decide sample size as we shall see in the next unit.

In many real life situations, the factor of overriding importance is the cost of the study and the problem then becomes one of designing a sampling scheme to achieve the highest statistical efficacy subject to the budget for the study. It is here that cluster sampling and convenience sampling score over other more statistically efficient methods of sampling, since the unit cost of data collection is lower.

DETERMINATION OF SAMPLE SIZE

The sample size can be determined by:

i) Using a formula
ii) Using a table

Determining Sample Size Using a Formula

$$n = \frac{Z^2pq}{d^2} \quad \text{(when population is greater than 10,000)}$$

$$nf = \frac{n}{1+(n/N)} \quad \text{(when population is less than 10,000)}$$

n, nf = desired sample size

Z = the standard normal deviate

p= the portion in the target population estimated to have a particular characteristic. If there is no reasonable estimate, then use 50 percent (.50).

q= 1-p

d= degree of accuracy desired, usually set at 0.05 or occasionally at 0.02.

n= the estimate of the population size

Z at 99% confidence level i.e. at 1% level of significance = 2.58

Z at 95% confidence level i.e. at 5% level of significance = 1.96

Z at 90% confidence level i.e. at 10% level of significance = 1.65

Example: (when population is more than 10,000)

If the proportion of target population with a certain characteristic is .50, the Z statistic 1.96 and we desire accuracy at the 0.05 level, then the sample size is

$$n = \frac{(1.96)^2 \ (.50*.50)}{(0.05)^2}$$

$$= \frac{3.84*0.25}{(.0025)}$$

$$= \frac{0.96}{0.0025}$$

$$= 384$$

If we use the more convenient 2.0 for the Z statistic, then the sample size will be smaller.

$$nf = \frac{400}{1 + \frac{(400)}{1000}}$$

$$= \frac{400}{1.4}$$

$$= 286$$

Determining Sample Size by Using a Table

Another way to determine sample size is to rely on published tables which provide the sample size for a given set of criteria. Table 3.1 presents sample size values that will be appropriate for many common sampling problems. The table includes sample sizes for both continuous and categorical data assuming alpha levels of 0.10, .05, or .01.

Table 3.1: Table for Determining Minimum Returned Sample Size for a Given Population Size for Continuous and Categorical Data

Population size	Sample size					
	Continuous data (margin of error= .03)			Categorical data (margin of error= .05)		
	alpha= .10 t=1.65	alpha= .05 t=1.96	alpha= .01 t=2.58	p=.50 t=1.65	p=.50 t=1.96	p=.50 t=2.58
100	46	55	68	74	80	87
200	59	75	102	116	132	154
300	65	85	123	143	169	207
400	69	92	137	162	196	250
500	72	96	147	176	218	286
600	73	100	155	187	235	316
700	75	102	161	196	249	341
800	76	104	166	203	260	363
900	76	105	170	209	270	382
1,000	77	106	173	213	278	399
1,500	79	110	183	230	306	461
2,000	83	112	189	239	323	499
4,000	83	119	198	254	351	570
6,000	83	119	209	259	362	598
8,000	83	119	209	262	367	613
10,000	83	119	209	264	370	623

ERRORS IN SAMPLING

Many mistakes and errors in social science research happen because of misleading and biased sample. According to Yule and Kendal, "Bias may be due to imperfect instruments, the personal qualities of the observer, defective techniques and other cases. Like experimental error, it is difficult to eliminate entirely, but usually may be reduced to relatively small dimensions by taking proper care'. There are two types of errors such as sampling errors and non-sampling errors. These are discussed below:

Sampling Error

By definition, when you have collected a sample from a population, you have less than complete information about the population. This, in turn, means that there is a chance that the sample statistics you calculate, (for example, the mean of a variable, a frequency distribution etc.) may not be an unbiased estimate of the population parameter.

The error in the sample estimate is not an intrinsic impediment to analysis. For probability samples, sampling theory allows you to calculate the expected amount of error given a particular sample size, sampling method, and the specific statistic of interest. In general terms, the sampling error for a statistic can be defined as:

$$\text{Standard error} = \sqrt{\frac{Variance}{n}} = \frac{sd}{\sqrt{n}}$$

Where n refers to the number of respondents (sample size)

As the sample size increases, the standard error of a statistic decreases; as the variance, or dispersion, of a statistic increases, so does its sampling error. Sampling error decreases rapidly as the sample size increases from a few hundred to about 1000 respondents. However, there is rarely any reason to select larger samples while comparing the increased cost of survey with reduction in sampling error. The formula for the standard error of a proportion is simple and easy to apply:

$$\text{Standard error} = \sqrt{\frac{p \times (1-p)}{n}}$$

Here, p represents the proportion of successes (favourable response, those who received the benefits), {q = (I-p)} represents the proportion of failures (those who did not receive the benefits), and n is the total number of respondents. The standard error of a statistic is greatest when p and (l-p) are equal, which occurs when each is 0.50, or 50%, of the sample.

Non-Sampling Error

Before discussing how to determine sample size, we will briefly review other sources of error in surveys. When you read a news article that reports the results of a national poll, the error in the estimates is always listed, derived, generally speaking, from Equation 6.2. However, experienced survey researchers know that errors due to other sources are typically greater than the error due to sampling alone. Following are some other types of errors.

- Measurement errors, caused by poorly written questions, poorly designed questionnaires, respondent errors in completing questionnaires, and so on.
- Non-response errors, caused because the respondents are not a representative subset of the population.
- Data coding errors, caused, by errors in coding and entering the data.

Of these error sources, the first two are typically more severe. In mail surveys, nonresponse error is often the most serious problem.

There are two critical characteristics of these non-sampling errors. First, as mentioned above, their sum is often greater than the sampling error. Second, and more insidious,

these errors are often impossible to estimate for any one survey, especially measurement and non-response errors. Consequently, using Equation 6.1 and Equation 6.2 to estimate the error in a statistics often provides a false sense of security. Experienced survey researchers take this fact into account by being more cautions in discussing survey results than the sampling error alone would indicate, and you should do the same. Ideally, the other sources of error would balance themselves out so that errors in one direction negate errors in the other directions, but you cannot assume that this is the case.

Check Your Progress Exercise 14.1

Notes: I. Write your answer in about 50 words.
II. Check your answer with possible answers given at the end of the unit

What is sampling error?

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How is the sample size determined using the formula?

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SUMMARY

In this unit, we have discussed the concept of sample size and the determination of sample size and errors in sampling. Sample size determination is the mathematical estimation of the number of subjects/units to be included in a study. When a representative sample is taken from a population, the findings are generalized to the population. If the sample is too small, it may fail to detect important effect or associations. It may associate this effect or association imprecisely.

EXERCISE

1. What is the meaning of sample size?
2. Explain the process of determination of sampling size.
3. What is sample error?

GLOSSARY

Standard Error: This is the expected amount of error while estimating the specific statistic of interest, using a particular sample size and sampling method with respect to actual population value.

Sampling Error: While collecting information from a sample, there is a chance that the sampling statistics may not be equal to the same values in the population. The error is that the sample does not contain complete information about the population.

Sample Size: The number of elementary units in a sample is called a sample size.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: By definition, when you have collected a sample from a population, you have less than complete information about the population. This, in turn, means that there is a chance that the sample statistics you calculate, (for example, the mean of a variable, a frequency distribution, etc.) may not be unbiased estimate of the population parameter. This error is called sampling error.

Answer to Q.2: The calculation of the sample size is concerned with the number of respondents required. To determine the number to select for the sample drawn from the sampling frame, you must estimate the non-response rate. The actual sample size to be drawn is:

$$Sample\ size = \frac{Number\ of\ respodents}{Response\ rate}$$

So, if any survey organization decides that they need 700 respondents, and the expected response rate from the population is 50%, then 700/0.50, or 1400, customers must be drawn from the sampling frame.

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UNIT- 20 PLAGIARISM CHECKING

Structure

INTRODUCTION

In the course-1 'Introduction to Research', we have discussed about the selection of a research problem and formulation of research design. A research design is a blue print which directs the plan of action to complete the research work. As we have mentioned earlier, the collection of data is an important part in the process of research work. The quality and credibility of the results derived from the application of research methodology depends upon the relevant, accurate and adequate data. In this unit, we shall study about the various sources of data and methods of collecting primary and secondary data with their merits and limitations and also the choice of suitable method for data collection.

LEARNING OBJECTIVES

On the completion of this unit, you should be able to:

- Discuss the necessity and usefulness of data collection,
- Explain and distinguish between primary data and secondary data,
- Explain the sources of secondary data and its merits and demerits,
- Describe different methods of collecting primary data and their merits and demerits,
- Examine the choice of a suitable method, and
- Examine the reliability, suitability and adequacy of secondary data.

MEANING AND NEED FOR DATA

Data is required to make a decision in any business situation. The researcher is faced with one of the most difficult problems of obtaining suitable, accurate and adequate data. Utmost care must be exercised while collecting data because the quality of the research results depends upon the reliability of the data. Suppose, you are the Director of your company. Your Board of Directors has asked you to find out why the profit of the company has decreased since the last two years. Your Board wants you to present facts and figures. What are you going to do?

The first and foremost task is to collect the relevant information to make an analysis for the above mentioned problem. It is, therefore, the information collected from various sources, which can be expressed in quantitative form, for a specific purpose, which is called data. The rational decision maker seeks to evaluate information in order to select the course of action that maximizes objectives. For decision making, the input data must be appropriate. This depends on the appropriateness of the method chosen for data collection. The application of a statistical technique is possible when the questions are answerable in quantitative nature, for instance; the cost of production and profit of the company measured in rupees, age of the workers in the company measured in years. Therefore, the first step in statistical activities is to gather data. The data may be classified as primary and secondary data. Let us now discuss these two kinds of data in detail.

PRIMARY AND SECONDARY DATA

The Primary data are original data which are collected for the first time for a specific purpose. Such data are published by authorities who themselves are responsible for their collection. The Secondary data on the other hand, are those which have already been collected by some other agency and which have already been processed. Secondary data may be available in the form of published or unpublished sources. For instance, population census data collected by the Government in a country is primary data for that Government. But the same data becomes secondary for those researchers who use it later. In case you have decided to collect primary data for your

investigation, you have to identify the sources from where you can collect that data. For example, if you wish to study the problems of the workers of X Company Ltd., then the workers who are working in that company are the source. On the other hand, if you have decided to use secondary data, you have to identify the secondary sources that have already collected the related data for their study purpose.

With the above discussion, we can understand that the difference between primary and secondary data is only in terms of degree. That is that the data which is primary in the hands of one becomes secondary in the hands of another.

Check Your Progress Exercise 15.1

Notes: I. Space is given below for writing your answers.
II. Compare your answers with those given at the end of the unit.

What do you mean by data? Why it is needed for research?

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Distinguish between primary and secondary data. Illustrate your answer with examples.

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SOURCES OF SECONDARY DATA

We have discussed above the meaning of primary and secondary data. Sometimes, it is not possible to collect primary data due to time, cost and human resource constraints. Therefore, researchers have to take the help of secondary data. Now let us discuss, (a) various sources from where, one can get secondary data, (b) precautions while using secondary data, its merits and demerits and some documentary and electronic sources of data in India.

Documentary Sources of Data

This category of secondary data source may also be termed as Paper Source. The main sources of documentary data can be broadly classified into two categories:

a) Published sources, and

b) Unpublished sources.

Let us discuss these two categories in detail.

a) Published Sources

There are various national and international institutions, semi-official reports of various committees and commissions and private publications which collect and publish statistical data relating to industry, trade, commerce, health etc. These publications of various organizations are useful sources of secondary data.

These are as follows:

1) **Government Publications**: Central and State Governments publish current information along with statistical data on various subjects, quarterly and annually. For example, Monthly Statistical Abstract, National Income Statistics, Economic Survey, Reports of National Council of Applied Economic Research (NCEAR), Federation of Indian Chambers of Commerce and Industry (FICCI), Indian Council of Agricultural Research (ICAR), Central Statistical Organisation (CSO), etc.

2) **International Publications**: The United Nations Organisation (UNO), International Labour Organisation (ILO), International Monetary Fund (IMF), World Bank, Asian Development Bank (ADB) etc., also publish relevant data and reports.

3) **Semi-official Publications**: Semi-official organizations like Corporations, District Boards, Panchayat etc. publish reports.

4) **Committees and Commissions**: Several committees and commissions appointed by State and Central Governments provide useful secondary data. For example, the report of the 10th Financial Commission or Fifth Pay Commissions etc.

5) **Private Publications**: Newspapers and journals publish the data on different fields of Economics, Commerce and Trade. For example, Economic Times, Financial Express etc. and Journals like Economist, Economic and Political Weekly, Indian Journal of Commerce, Journal of Industry and Trade, Business Today etc. Some of the research and financial institutions also publish their reports annually like Indian Institute of Finance. In addition to this, reports prepared by research scholars, universities etc. also provide secondary source of information.

b) Unpublished Sources

It is not necessary that all the information/data maintained by the institutions or individuals are available in published form. Certain research institutions, trade associations, universities, research scholars, private firms, business institutions etc.,

do collect data but they normally do not publish it. We can get this information from their registers, files etc.

Electronic Sources

The secondary data is also available through electronic media (through Internet). You can download data from such sources by entering web sites like google.com; yahoo.com; msn.com; etc., and typing your subject for which the information is needed.

You can also find secondary data on electronic sources like CDs, and the following online journals:

Electronic Journal
http://businessstandard.com

Electronic Journal
http://www.businessworldindia.com

Electronic Journal

http://www.business-today.com

Electronic Journal
http://www.indiainvest.com

Census of India
http://www.censusindia.net

Union Budget and Economic Survey
http://www.indianbudget.nic.in

Directory of Government of India
http://goidirectory.nic.in

Indian Council of Agricultural Research
http://www.icar.org.in

Ministry of Commerce and Industry

http://www.commin.nic.in

Indian Institute of Foreign Trade

http://www.iift.edu

Department of Industrial Policy and

http://www.dipp.nic.in Promotion,

Ministry of Commerce and Industry

Ministry of Consumer Affairs, Food &
http://www.fccimin.in

Public Distribution Khadi and Village Industries

http://www.kvic.org.in

Board for Industrial & Financial
http://www.bifr.nic.in

Reconstruction Building Material & Technology

http://www.bmtpc.org

Promotion Council Central Food Technological Research
http://www.cftri.com Institute

Now you have learnt that the secondary data are available in documents, either published or unpublished, and electronic sources. However, you have to take precautions while using secondary data in research. Let us discuss them in detail.

Precautions in Using Secondary Data

With the above discussion, we can understand that there is a lot of published and unpublished sources where researcher can gets secondary data. However, the researcher must be cautious in using this type of data. The reason is that such type of data may be full of errors because of bias, inadequate size of the sample, errors of definitions etc. Bowley expressed that it is never safe to take published or unpublished statistics at their face value without knowing their meaning and limitations. Hence, before using secondary data, you must examine the following points.

Suitability of Secondary Data

Before using secondary data, you must ensure that the data are suitable for the purpose of your enquiry. For this, you should compare the objectives, nature and scope of the given enquiry with the original investigation. For example, if the objective of our enquiry is to study the salary pattern of a firm including perks and allowances of employees. But, secondary data is available only on basic pay. Such type of data is not suitable for the purpose of the study.

Reliability of Secondary Data

For the reliability of secondary data, these can be tested: i) un-biasedness of the collecting person, ii) proper check on the accuracy of field work, iii) the editing, tabulating and analysis done carefully, iv) the reliability of the source of information,

v) the methods used for the collection and analysis of the data. If the data collecting organizations are government, semi-government and international, the secondary data are more reliable corresponding to data collected by individual and private organizations.

Adequacy of Secondary Data

Adequacy of secondary data is to be judged in the light of the objectives of the research. For example, our objective is to study the growth of industrial production in India. But the published report provides information on only few states, and then the data would not serve the purpose. Adequacy of the data may also be considered in the light of duration of time for which the data is available. For example, for studying the trends of per capita income of a country, we need data for the last 10 years, but the information available for the last 5 years only, which would not serve our objective. Hence, we should use secondary data if it is reliable, suitable and adequate.

Merits and Limitations of Secondary Data

Merits

1) Secondary data is much more economical and quicker to collect than primary data, as we need not spend time and money on designing and printing data collection forms (questionnaire/schedule), appointing enumerators, editing and tabulating data etc.

2) It is impossible to individual or small institutions to collect primary data with regard to some subjects such as population census, imports and exports of different countries, national income data etc. but can obtain from secondary data.

Limitations

1) Secondary data is very risky because it may not be suitable, reliable, adequate and also difficult to find which exactly fit the need of the present investigation.

2) It is difficult to judge whether the secondary data is sufficiently accurate or not for our investigation.

3) Secondary data may not be available for some investigations. For example, bargaining strategies in live products marketing, impact of T.V. advertisements on viewers, opinion polls on a specific subject, etc. In such situations we have to collect primary data.

Check Your Progress Exercise 15.2

Notes:
I. Space is given below for writing your answers.
II. Compare your answers with those given at the end of the unit.

Q.3 Write names of five web sources of secondary data which have not been included in the above table.

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Explain the merits and limitations of using secondary data.

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What precautions must a researcher take before using the secondary data?

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In the following situations indicate whether data from a census should be taken?

i) A TV manufacturer wants to obtain data on customer preference with respect to size of TV.

ii) IGNOU wants to determine the acceptability of its employees for subscribing to a new employee insurance programme.

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METHODS OF COLLECTING PRIMARY DATA

If the available secondary data does not meet the requirements of the present study, the researcher has to collect primary data. As mentioned earlier, the data which is collected for the first time by the researcher for his/her own purpose is called primary data. There are several methods of collecting primary data, such as observation, interview through reporters, questionnaires and schedules. Let us study about them in detail

Observation Method

The Concise Oxford Dictionary defines observation as, 'accurate watching and noting of phenomena as they occur in nature with regard to cause and effect or mutual relations'. Thus observation is not only a systematic watching but it also involves

listening and reading, coupled with consideration of the seen phenomena. It involves three processes. They are: sensation, attention or concentration and perception.

Under this method, the researcher collects information directly through observation rather than through the reports of others. It is a process of recording relevant information without asking anyone specific questions and in some cases, even without the knowledge of the respondents. This method of collection is highly effective in behavioural surveys. For instance, a study on behaviour of visitors in trade fairs, observing the attitude of workers on the job, bargaining strategies of customers etc. Observation can be participant observation or non-participant observation. In Participant Observation Method, the researcher joins in the daily life of informants or organizations, and observes how they behave. In the Nonparticipant Observation Method, the researcher will not join the informants or organizations but will watch from outside.

Interview Method

Interview is one of the most powerful tools and most widely used method for primary data collection in research. In our daily routine we see interviews on T.V. channels on various topics related to social, business, sports, budget etc. In the words of C. William Emory, 'personal interviewing is a two way purposeful conversation initiated by an interviewer to obtain information that is relevant to some research purpose'. Thus an interview is basically, a meeting between two persons to obtain the information related to the proposed study. The person who is interviewing is named as interviewer and the person who is being interviewed is named as informant. It is to be noted that, the research data/information collect through this method is not a simple conversation between the investigator and the informant, but also the glances, gestures, facial expressions, level of speech etc., are all part of the process. Through this method, the researcher can collect varied types of data intensively and extensively.

Interviews can be classified as direct personal interviews and indirect personal interviews. Under the techniques of direct personal interview, the investigator meets the informants (who come under the study) personally, asks them questions pertaining to enquiry and collects the desired information. Thus if a researcher intends to collect the data on spending habits of Delhi University (DU) students, he/ she would go to the DU, contact the students, interview them and collect the required information.

Indirect personal interview is another technique of interview method where it is not possible to collect data directly from the informants who come under the study. Under this method, the investigator contacts third parties or witnesses, who are closely associated with the persons/situations under study and are capable of providing necessary information. For example, an investigation regarding bribery pattern in an office. In such a case it is inevitable to get the desired information indirectly from other people who may know them. Similarly, clues about the crimes are gathered by

the CBI. Utmost care must be exercised that these persons who are being questioned are fully aware of the facts of the problem under study, and are not motivated to give a twist to the facts.

Another technique for data collection through this method can be structured and unstructured interviewing. In the Structured interview set questions are asked and the responses are recorded in a standardized form. This is useful in large scale interviews where a number of investigators are assigned the job of interviewing. The researcher can minimize the bias of the interviewer. This technique is also named as formal interview. In Un-structured interview, the investigator may not have a set of questions but have only a number of key points around which to build the interview. Normally, such types of interviews are conducted in the case of an explorative survey where the researcher is not completely sure about the type of data he/ she collects. It is also named as informal interview. Generally, this method is used as a supplementary method of data collection in conducting research in business areas.

Now-a-days, telephone or cellphone interviews are widely used to obtain the desired information for small surveys. For instance, interviewing credit card holders by banks about the level of services they are receiving. This technique is used in industrial surveys especially in developed regions.

Check Your Progress Exercise 15.3

Notes:
I. Space is given below for writing your answers.
II. Compare your answers with those given at the end of the unit.

How can data be collected through the Observation method?

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Distinguish between the observation and the interview method of data collection.

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Through Local Reporters and Correspondents

Under this method, local investigators/agents or correspondents are appointed in different parts of the area under investigation. This method is generally adopted by government departments in those cases where regular information is to be collected. This method is also useful for newspapers, magazines, radio and TV news channels. This method has been used when regular information is required and a high degree of accuracy is not of much importance.

Questionnaire and Schedule Methods

Questionnaire and schedule methods are the popular and common methods for collecting primary data in research. Both the methods comprise a list of questions arranged in a sequence pertaining to the investigation. Let us study these methods in detail one after another.

i) Questionnaire Method

Under this method, questionnaires are sent personally or by post to various informants with a request to answer the questions and return the questionnaire. If the questionnaire is posted to informants, it is called a Mail Questionnaire. Sometimes questionnaires may also sent through E-mail depending upon the nature of study and availability of time and resources. After receiving the questionnaires the informants read the questions and record their responses in the space meant for the purpose on the questionnaire. It is desirable to send the questionnaire with self-addressed envelopes for quick and high rate of response.

ii) Schedule Method

As discussed above, a Schedule is also a list of questions, which is used to collect the data from the field. This is generally filled in by the researcher or the enumerators. If the scope of the study is wide, then the researcher appoints people who are called enumerators for the purpose of collecting the data. The enumerators go to the informants, ask them the questions from the schedule in the order they are listed and record the responses in the space meant for the answers in the schedule itself. For example, the population census all over the world is conducted through this method. The difference between questionnaire and schedule is that the former is filled in by the informants; the latter is filled in by the researcher or enumerator.

CHOICE OF SUITABLE METHOD

You have noticed that there are various methods and techniques for the collection of primary data. You should be careful while selecting the method which should be appropriate and effective. The selection of the methods depends upon various factors like scope and objectives of the inquiry, time, availability of funds, subject matter of the research, the kind of information required, degree of accuracy etc. As appraised,

every method has its own merits and demerits. For example, the observation method is suitable for field surveys when the incident is really happening; the interview method is suitable where direct observation is not possible. Local reporter/correspondent method is suitable when information is required at regular intervals. The questionnaire method is appropriate in extensive enquiries where sample is large and scattered over large geographical areas and the respondents are able to express their responses in writing. The Schedule method is suitable in case respondents are illiterate.

Check Your Progress Exercise 15.4

Notes:
I. Space is given below for writing your answers.
II. Compare your answers with those given at the end of the unit.

List out the methods of collecting primary data

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Point out the major problems in constructing questionnaires .

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Distinguish between direct personal interview and indirect interview. Givesuitable examples.

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Distinguish between schedule and Questionnaire?

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Are the following statement True or False?

a) Interview method introduces more bias than the use of questionnaire.

b) 'Yes' or 'No' type questions should not be used in questionnaires unless only one of the two answer is possible.

c) Open questions are more difficult than most other types to tabulate.

SUMMARY

In this unit we elaborated on the meaning of data, methods of data collection, merits and limitations of data collection, precautions which are needed for the collection of data. The information collected from various processes for a specific purpose is called data. Statistical data may be either primary data or secondary data. Data which is collected originally for a specific purpose is called primary data. The data which is already collected and processed by someone else and is being used now in the present study is called secondary data. Secondary data can be obtained either from published sources or unpublished sources. It should be used if it is reliable, suitable and adequate, otherwise it may result in misleading conclusions. It has its own merits and demerits. There are several problems in the collection of primary data. These are: tools and techniques of data collection, degree of accuracy, designing the questionnaire, selection and training of enumerators, problem of tackling nonresponses and other administrative aspects.

Several methods are used for collection of primary data. These are: observation, interview, questionnaire and schedule methods. Every method has its own merits and demerits. Hence, no method is suitable in all situations. The suitable method can be selected as per the needs of the investigator which depends on objective nature and scope of the enquiry, availability of funds and time.

GLOSSARY

Data: Quantitative or/ and qualitative information, collected for study and analysis. Interview: A method of collecting primary data by meeting the informants and asking the questions. Observation: The process of observing individuals in controlled situations.

Primary Data: Data that is collected originally for the first time.

Published Sources: Sources which consist of published statistical information.

Questionnaire: is a device for collection of primary data containing a list of questions pertaining to enquiry, sent to the informants, and the informant himself writes the answers. Schedule: is a device for collection of primary data containing a list of questions to be filled in by the enumerators who are specially appointed for that purpose.

Secondary Data: Data which were collected and processed by someone else but are being used in the present study.

CHECK YOUR PROGRESS: ANSWER KEYS

Answer to Q.1: In many business companies, some of the data required for statistical analysis are obtained from internal sources like computer files of accounting data. Together with internal data, business often uses data from external sources. For example, aggregate data on national economic activity are readily available from CSO, annual report of Ministry of Labour, Government of India.

Answer to Q.2: Data which is collected originally is called primary data and the same collected by others are called secondary data. For example, a researcher interested in knowing what consumer's choice about the brand of toothpaste, he or she must make a survey and collect data on the opinions of the consumer. This is called primary data. The data obtained from published and unpublished sources is called secondary data.

Answer to Q.3 http://www.bis.org.in http://www.business-today.com http://www.businessonlineindia.com http://www.indiacofee.org http://www.dgft.nic.in

EXERCISE

What precautions would you take while using the data from secondary sources?

Explain what precautions must be taken while designing a questionnaire in orderthat it may be really useful. Illustrate your answer giving suitable examples.

Construct a suitable questionnaire containing not more than twenty five questions pertaining to the sales promotion of your company's product.

Distinguish between the following:

a) Primary and Secondary Data

b) Internal and External Data

c) A Schedule and Questionnaire

Explain the various methods of collecting primary data pointing out their meritsand demerits?

What is the need for pre-testing the drafted questionnaire?

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