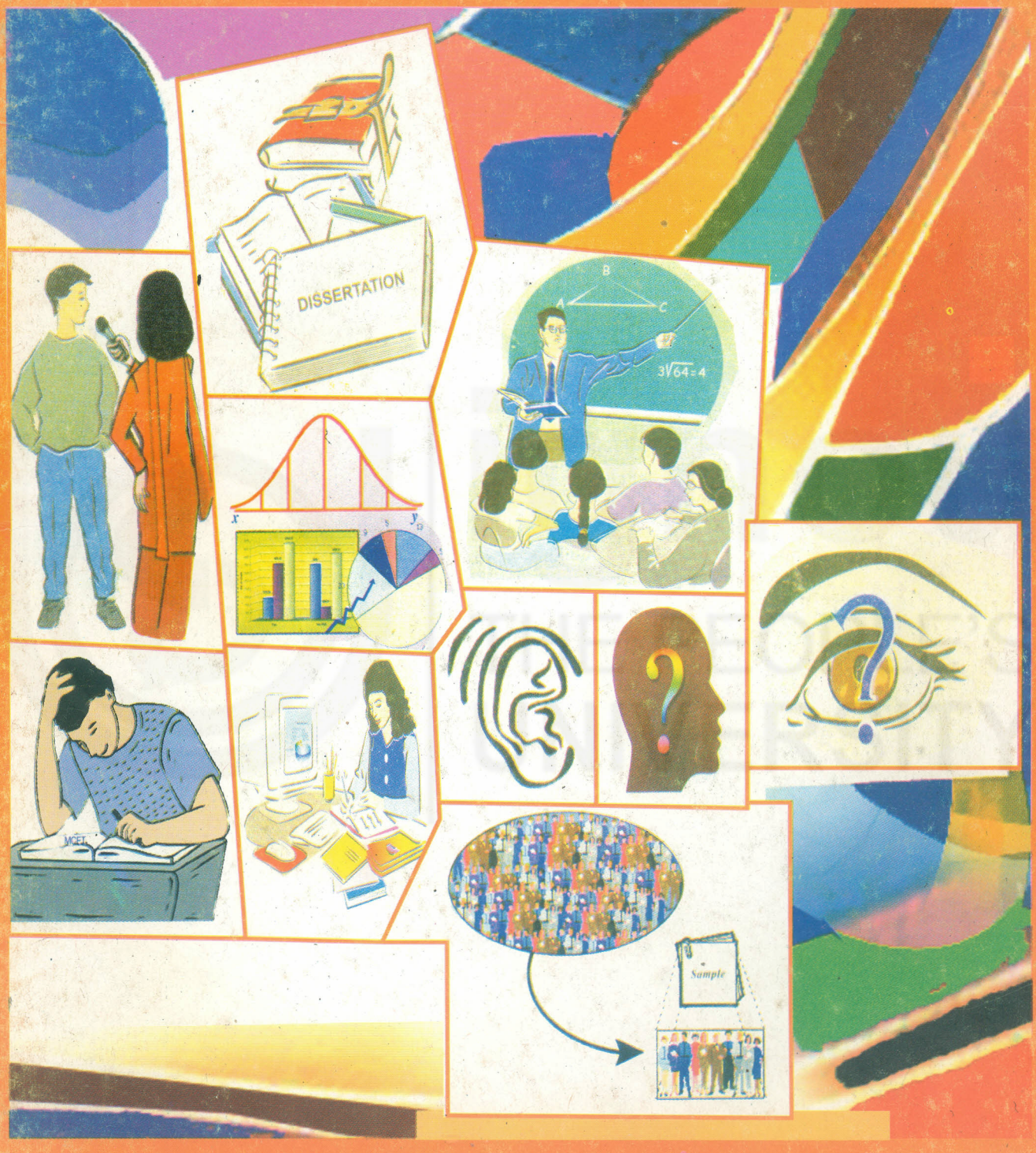
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MCFT-005

Counselling and Family Therapy: Research Methods and Statistics



FUNDAMENTALS OF RESEARCH

1

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

- इन्दिरा गांधी

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

- Indira Gandhi

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MCFT-005
Counselling and Family Therapy: Research Methods and Statistics

Block

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COURSE INTRODUCTION

Knowledge generation in Counselling and Family Therapy like any other field of study, is inevitable not only for expanding the knowledge base in Counselling and Family Therapy but also for providing solutions to myriad problems in the field. Knowledge generation in Counselling and Family Therapy takes place through the conduct of systematic and scientific research in the field. Therefore, as a student of M.Sc. (CFT) you need to acquire a thorough knowledge of research methodology so that you not only become an effective researcher but also contribute to the growth of Counselling and Family Therapy as an area of scientific study. With this basic premise, the course "Counselling and Family Therapy: Research Methods and Statistics" is designed to equip you with the required competencies to conduct research in the field. The Course provides you with a comprehensive understanding of various aspects covering the understanding of research in Counselling and Family Therapy, its utility both in theorisation and practical applications at the ground level.

The course (MCFT-005) comprises of four theory Blocks, and the Manual for Supervised Practicum Course (MCFTL-005) is based on the theoretical aspects of MCFT-005.

Block 1 is on "Fundamentals of Research". The Block introduces the objectives and importance of research in Counselling and Family Therapy and outlines the various research paradigms. Knowledge generally means what a person knows or believes to be true. There are various types and sources of knowledge. Counselling and family therapy research helps us generate new knowledge in this field, as well as focus on the applications of the same. It refers to the use of scientific method for systematic study of problems. Two major paradigms of knowledge have influenced knowledge generation. Positivistic paradigm of knowledge emphasizes observation and reason as the means of understanding human behaviour. On the contrary, non-positivistic paradigm of knowledge stresses the study of phenomena through human senses. In the Block, we discuss research designs as well as aspects such as, validity and reliability.

Block 2 of the course is on "Methods and Techniques of Data Collection". It is devoted to different types tools and techniques used in research; that may be qualitative or quantitative in nature. Some of the research methods are used in both qualitative and quantitative methods. At the outset, the Block acquaints us with the sampling process. Thereafter, it explains the methods of data collection – including observation, interview, questionnaire, documents etc. that are typically used in qualitative and quantitative research studies.

Block 3 of the course is entitled "Data Analysis and Interpretation". After collection of data with the help of relevant tools and techniques, the next logical step a researcher is required to follow, is to analyze and interpret data with a view to arriving at empirical solution to the problem. Research data are of two types – quantitative and qualitative. Quantitative data are analysed with three types of statistical measures. These are descriptive statistics, inferential statistics based on parametric tests and inferential statistics based on non-parametric tests. Each statistical measure consists of several statistical techniques which are used in data analysis. Qualitative data are detailed descriptions of events, people, interactions and observed behaviours, etc. There are various

qualitative data analysis techniques through which data are analysed. Although researchers often analyse research data manually, these days one tends to take the help of computer software. The popular software for quantitative data analysis are SPSS and SAS package. Similarly, NUDIST, a software package, is used for analyzing qualitative data.

Block 4, "Report Writing and Evaluation" is the last theory block of the course. It deals with how to write a research proposal, how to carry out literature search/review, how to chapterise and how to prepare research reports. Prior to carrying out the research work, a researcher is required to prepare a research plan or proposal. It is like a blueprint which the architect designs before the construction of a house and contains a brief account of the work to be carried out by the researcher. A good research proposal is developed if the researcher carries out extensive and judicious literature review/ search. Literature search is done to develop a theoretical framework of the study, to find out the gaps in the existing research works and to build up rationale for the present study. When the research work is completed, the researcher is supposed to communicate research results in the form of a research report to the general public including other reseachers and practioners for their perusal and use. A research report comprises certain chapters, namely, introduction, review of literature, design of the study, analysis and interpretation, summary and conclusions, references and appendices.

The Manual for Supervised Practicum MCFTL-005 for this course describes the practical activities that you need to carry out under the supervision of the Academic Counsellor at the Study Centre you have been assigned to.

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BLOCK 1 FUNDAMENTALS OF RESEARCH

Introduction to the Block

As we have already mentioned in the course introduction, the main focus of this Block is to familiarise you with the foundational aspects and concepts needed to conduct research in the field of Counselling and Family Therapy.

In *Unit 1* ''Introduction to Counselling and Family Therapy Research'' the importance of research and the objectives of research are elaborated upon. counselling and family therapy research is defined as the use of scientific method for systematic study of family and social situations. The unit elaborates on the nature of research which includes characteristics of research relevant to the field.

Unit 2 is on "Research Paradigms". It examines research paradigms in counselling and family therapy; in particular, empiricist paradigm, interpretive paradigm; critical paradigm, phenomenography and second order perspective. Further, the unit explains the different approaches to research like qualitative and quantitative approaches, triangulation approaches, component analysis approach and model building.

Unit 3 "Scientific Method and Knowlege Generation" deals with the generation of knowledge. The Unit covers knowledge generation from the early period of human civilization upto the development and application of scientific method in research. The Unit begins with various sources of knowledge that human beings have historically drawn upon to solve their problems. These sources are based on her or his experiences, teachings from the authority figures, influences from customs, traditions and socializing agents. With the development of deductive reasoning based on Aristotle's syllogism and introduction of inductive reasoning based on Bacon's induction, generating knowledge was made more scientific and later on, these two approaches gave rise to scientific method.

Unit 4 entitled "Formulation of Research Problems", starts with positivistic paradigm of knowledge which is based on "observation and reason as means of understanding human behaviour. It delineates the assumptions and limitations of positivistic paradigm. Although positivistic paradigm gave rise to the emergence of scientific method, alternative approaches were developed to view reality and visualize appropriate models of enquiry. The Unit provides you with a critical overview of these approaches.

Unit 5 is on "Research Design". It acquaints you with the meaning, purpose and need for research design; features of a good research design; and principles that one needs to follow to formulate a good research design. Further, it provides an orientation to the various types of research design.

Unit 6 is entitled "Characteristics of a Good Research Tool". It focusses on what is a test, types of tests; and features of a good research tool. It also highlights the use of different scales in research.

UNIT 1 INTRODUCTION TO COUNSELLING AND FAMILY THERAPY RESEARCH

Structure

1.1 Introduction

1.2 Definition of Research

1.3 Objectives of Research

1.4 Importance of Research

1.5 Research in Counselling and Family Therapy

1.6 Conceptual Framework

1.7 Nature of Research

- 1.7.1 Characteristics of Research
- 1.7.2 Types of Research

1.8 Research Design

- 1.8.1 Types of Research Design
- 1.8.2 Need for Research Design
- 1.8.3 Features of a Good Research Design

1.9 Let Us Sum Up

1.10 Glossary

1.11 Answers to Check Your Progress Exercises

1.12 Unit End Questions

1.13 Further Readings and References

1.1 INTRODUCTION

Research simply refers to a search for knowledge. Everyone in this world right from the primitive man to the modern man, has a quest for knowledge and puts in efforts to understand the environment and have control over it through various efforts. Initially the primitive man depended on his power to observe, experience, and learn by trial and error etc. But with advancement in science and technology, the increased capacity to work and conduct research, and getting positive results and applying them in day-to-day problem solving situations; the field of research has progressed and has advanced.

It was in the 15th century that new dimensions and methods of research became a medium of acquiring knowledge through scientific methods. With the advancement in educational system i.e. opening of new institutions, institutions of higher education; research became an important area besides teaching, training and publication function. Since the research has advanced a lot, there has been plenty of literature related to various aspects of research.

Objectives

After studing this Unit, you will be able to:

- Define research and its objectives;
- Get an insight into the importance of conducting research in counselling and family therapy;
- Grasp the conceptual framework of research; and
- Perceive research design as an important step in whole research process.

1.2 DEFINITION OF RESEARCH

The Advanced Learners' 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".

Redman and Mory define research as a "systematized effort to gain new knowledge".

Slesinger and Stephenson in the Encyclopedia of Social Sciences define research as "the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art".

Best and Kahn define research as the "systematic and objective analysis and recording of controlled observation that may lead to the development of generalization, principles or theories, resulting in prediction and possibly ultimate control of events".

1.3 OBJECTIVES OF RESEARCH

The purpose of research is to discover the answers to questions through the application of scientific procedures. The main aim of research is to find out the indepth and hidden truth which is not yet discovered. Though each research study has its own specific purpose, we may group them into broad categories. These are:

1. To gain familiarity with a phenomenon or to achieve new insight into it. Studies with this purpose are termed as exploratory or formulation research studies.
2. To describe the characteristics of a particular individual, situation or a group accurately. Studies with this purpose are known as descriptive research studies.
3. To determine the frequency with which some phenomenon occurs or the frequency with which it is associated with others. These research studies are known as diagnostic research studies.
4. Research studies that find out the causal relationship between variables and test the hypothesis are known as hypothesis testing research studies.

Check Your Progress Exercise 1

Note: a) Read the following question carefully and answer in the space provided below.

b) Check your answer with that provided at the end of this Unit.

I) Fill in the blanks:

1. Research is a systematized effort to gain ..... .

2. The ..... of research is to discover the answers to questions through the application of scientific procedure.

1.4 IMPORTANCE OF RESEARCH

Research inculcates scientific and inductive thinking and it promotes the development of logical habits of thinking and organization. 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. The role of research in various fields; be it economics, health or mental health, has greatly increased in modern times.

Research provides the basis for nearly all government policies in our economic system e.g. government plans the budget based on the research analysis of the needs and desires of the people whether it is related to provisions of health– physical or mental, education, women, children old age homes, etc., and plans accordingly to meet these needs. Through research we can devise alternative policies and can also examine the consequences of each of these alternatives.

Research has its special importance in solving various operational and planning problems in counselling and family therapy. Research is important for social scientists in studying social relationships and in seeking answers to various social problems. For effective counselling and family therapy interventions, various research domains include impact of counsellor qualities on the counselling session role of family members in effective psychoeducation; role of family therapy in therapeutic process, use of cognitive behaviour family therapy in quitting smoking etc. Research provides the intellectual satisfaction to the scientist by providing knowledge and practical utility.

In addition, the significance of research can also be understood keeping in view the following points:

a) For students who are pursuing their master's or Ph.D research and for other young research scholars, understanding of meaning, context and application of research is vital.

b) For professionals and policy makers in the counselling and family therapy field, research output is of particular significance.

c) To philosophers and thinkers, research may mean the outlet for new ideas and insights.

d) To literary men and women, research may mean the development of new styles and creative work.

e) For intellectuals, research may mean the generalization of new theories.

1.5 RESEARCH IN COUNSELLING AND FAMILY THERAPY

The team 'counselling' is used in a number of ways, for instance, counselling may be viewed as a special kind of helping relationship or as a set of activities and methods or as defining an area in which services are provided. Although counselling is a major intervention focusing on the needs of the less disturbed, recently there has been emphasis on developmental and preventive counselling as contrasted with remedial work. Counselling involves the skills of listening, understanding and being sensitive to the developmental status, needs and feelings of pupils or clients.

Research in counselling and family therapy can broadly be stated as any systematic striving for understanding actuated by a need or some difficulty directed towards some complex phenomenon of more than immediate personal concern stated in a problematic form. It is any investigation, survey or study tending to correct, verify or add to knowledge in general or in specific areas of these fields. Keeping this in view, the ultimate aim of such a science is to provide knowledge that will permit the counsellor to achieve the goal by the most effective method.

An ecological perspective is emerging in family therapy. Ecology deals with the relationship between organisms and their environment, the interaction between the two and their interdependence. In the multifamily counselling approach, cultural differences are brought together when five or six families with different backgrounds meet. It is being increasingly recognized that there should be a close liaison between school and home, parents and teachers. For this purpose parent teacher associations have been formed. It is firmly believed that there is a genuine need for research in counselling and dealing with parents. The increasing scope and need for counselling and family therapy interventions, and for research with respect to the same, is being idenfitied day-by-day.

Check Your Progress Exercise 2

Note: a) Read the following question carefully and answer in the space provided below.

b) Check your answer with that provided at the end of this Unit.

1) State 'True' or 'False':

i) Research indicates scientific and inductive thinking. .....

ii) Research is not important in formation of new policies. .....

iii) An ecological perspective is emerging in social sciences .....

1.6 CONCEPTUAL FRAMEWORK

Concept is an abstraction of observed things, events or phenomena. Every science develops its own concept for communicating its findings. So the theoretical system of a science can be referred to as a conceptual system. We have already discussed the definitions of research in Section 1.2. In this section, we shall go into the details of different concepts from the point of view of performing various functions of research.

At the very outset the researcher must single out the problem he/she wants to study i.e. he/she must decide the general area of interest or aspect of a subject matter that he/she would like to inquire into. Essentially two steps are involved in formulating the research problem, *viz.* understanding the problem thoroughly and rephrasing the same in meaningful terms from an analytical point of view. Once the problem is formulated, a brief summary of it should be written down. For this the researcher should undertake extensive literature survey connected with the problem. After extensive literature survey, researcher should state in clear terms the hypothesis and identify variables to test the hypothesis. The next step is to find evidences by collecting appropriate data or facts by a suitable method, analyzing the collected data, interpreting the results to derive the conclusions and generalizing the findings, to be applied to an appropriate or a typical situation, and finally including the present findings into the existing body of knowledge.

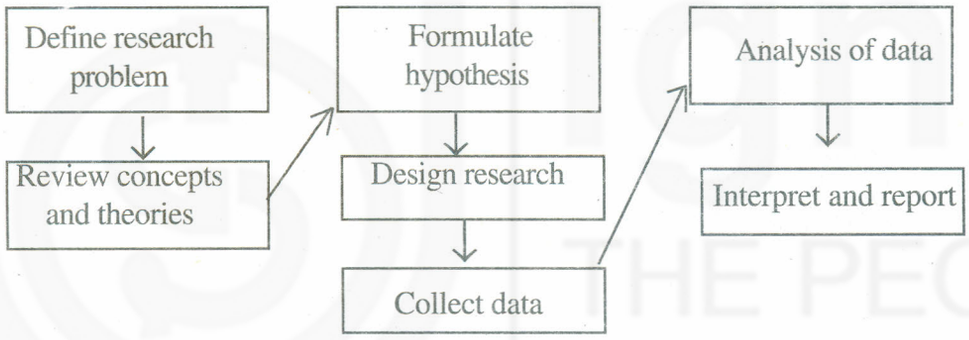


Fig 1.1: Research process in flow chart

1.7 NATURE OF RESEARCH

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 horizons of knowledge.

1.7.1 Characteristics of Research

The major characteristics of any research are: objectivity, generality, verifiability and predictability. Let us examine each in detail.

1. **Objectivity:** Objectivity is characterized by emphasis upon the views, events, phenomena, ideas etc. as external and without being affected by researcher's own views. Hence, objective studies are those of a detached, impersonal, unbiased, or unprejudicial nature.

2. **Generality:** Generality means the ability to generalize from a particular phenomenon under study. Conclusions or generalizations drawn should be of universal application. Of course, as far as social sciences are concerned complete universality is rarely achieved.

3. **Verifiability:** Generalization thus drawn has in turn certain effects on the established body of knowledge. But this gained knowledge must be verifiable. Verifiability is a characteristic which indicates that observed phenomena or facts must be verifiable.

4. **Predictability:** This means that the results of the study can predict the future events with sufficient accuracy. While an accurate prediction is perhaps possible only in the field of the exact sciences, it is rather difficult to achieve the same in social situations.

The essentials of scientific method

Certain essential principles and procedures are implied in scientific method. These are as follows:

1. Logical analysis of the problem, isolating it from other problems;
2. Operational definition of terms and concepts and statistical units and measures so that others will understand it exactly and be able to repeat the analysis and test the generalization;
3. Collection of data related to the study;
4. Classification of data;
5. Relationship of factors;
6. Use of statistical procedures in summarizing the data and in isolating the attributes or variables and measuring their relationships and inter-effects;
7. Sound logical reasoning as to the implications of these conclusions on the trial hypothesis and in the formulation of generalization;
8. Statement of conclusions or generalization definitely and clearly so that others will be able to check them;
9. Complete elimination of personal equation; and
10. Complete and careful reporting of the data and methods of analysis, so that any other can check the analysis or test the generalizations with the new sets of data.

1.7.2 Types of Research

i) **Pure or basic research:** Pure or basic research is intended to contribute to the development of scientific discipline or scientific body of knowledge. It is designed either for verification of some old theory or establishment of a new one. Need for such research arises with the emergence of new problems and new situations; the questions which the old theories fail to answer satisfactorily. The dynamic character of life requires that old theories should constantly be tested in the light of new situations and necessary modifications be made in them in order to make them more perfect.

ii) **Applied research:** Applied research deals with the possibilities of application of the results of pure research to social problems. The major difference between applied and pure research is that while the latter deals with the fundamental principles leading to the development of the concerned science, the former pertains to immediate problems.

1.8 RESEARCH DESIGN

The formidable problem that follows the task of defining the research problem is the preparation of the design of the research project, popularly known as the "research design". Decisions regarding what, where, when, how much, by what means concerning a research study constitute a research design. "A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure". 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. As such the design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data.

1.8.1 Types of Research Design

Keeping in view the above discussion one may split the overall research design into the following parts:

a) The sampling design which deals with the method of selecting items to be observed for the given study;

b) The observational design which relates to the conditions under which the observations are to be made;

c) The statistical design which concerns with the question of how many items are to be observed and how the information and data gathered are to be analyzed; and

d) The operational design which deals with the techniques by which the procedures specified in the sampling, statistical and observational designs can be carried out.

From what has been stated above, we can state the important features of a research design as follows:

(i) It is a plan that specifies the sources and types of information relevant to the research problem.

(ii) It is a strategy specifying which approach will be used for gathering and analyzing the data.

(iii) It also includes the time and cost budgets since most studies are done under these two constraints.

In brief, research must, at least, contain – (a) a clear statement of the research problem; (b) procedures and techniques to be used for gathering information; (c) the population to be studied; and (d) methods to be used in processing and analyzing data.

1.8.2 Need for Research Design

Research design is needed because it facilitates the smooth sailing of various research operations, thereby making research as efficient as possible, yielding maximal information with minimal expenditure of effort, time and money. Just as for better economical and attractive construction of a house, we need a blueprint (or what is commonly called the map of the house) well thought out and prepared by an expert architect, similarly we need a research design or a plan in advance of data collection and analysis for our research project. Research design stands for advance planning of the methods to be adopted for collecting the relevant data and techniques to be used in their analysis, keeping in view the objective of the research and the availability of staff, time and money. Preparation of the research design should be done with great care as any error in it may upset the entire project.

Thoughtlessness in designing the research project may result in rendering the research exercise futile. It is, therefore, imperative that an efficient and appropriate design must be prepared before starting research operations. The design helps the researcher to organize his ideas in a form whereby it will be possible for him to look for flaws and inadequacies. Such a design can even be given to others for their comments and critical evaluation. In the absence of such a course of action, it will be difficult for the critic to provide a comprehensive review of the proposed study.

1.8.3 Features of a Good Research Design

A good design is often characterized by adjectives like flexible, appropriate, efficient, economical and so on. Generally, the design which minimizes bias and maximizes the reliability of the data collected and analyzed 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.

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

(i) The means of obtaining information;

(ii) The availability and skills of the researcher and the staff, if any;

(iii) The objective of the problem to be studied;

(iv) The nature of the problem to be studied; and

(v) The availability of time and money for the research work.

If the research study happens to be an exploratory or a formulative one, wherein the major emphasis is on discovery of ideas and insights like counselling the parents of children with exceptional needs, the research design must be flexible enough to permit the consideration of many different aspects of a phenomenon. But when the purpose of a study is accurate description of a situation or of an association between variables (in what are called the 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.

Check Your Progress Exercise 3

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. What are the characteristics of good research?

.....

.....

.....

.....

2. What are the types of research?

.....

.....

.....

.....

1.9 LET US SUM UP

All progress is born out of inquiry. Doubt often leads to inquiry and inquiry leads to invention. Research is unfolding of the hidden layers of particular phenomenon; a description which holds for the field of counselling and family therapy as well. The significance of research has been well recognized in the present day of science and technology. Today's world is fast changing and so are the values and beliefs. In the present scenario to keep pace with the fast moving world one has to keep oneself physically, mentally and socially healthy. In this context it becomes important to remain stress free and maintain healthy and friendly relations within the family. Research in the field of counselling and family therapy to facilitate necessary and affective intervertions is vital.

1.10 GLOSSARY

Concept	:	Abstraction of observed things, events or phenomena.
Hypothesis	:	A proposition or set of propositions set forth as an explanation for the occurrence of some specified group of phenomena.
Research	:	Systematic effort to gain new knowledge.
Research design	:	Arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance and purpose.
Scientific methods	:	Pursuit of truth as determined by logical methods.

1.11 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

i) new knowledge

ii) purpose

Check Your Progress Exercise 2

i) True

ii) False

iii) True

Check Your Progress Exercise 3

1. Following are the charateristics of good research:
   i) Objectivity,
   ii) Generality,
   iii) Verifiability, and
   iv) Predictability.
2. Two types of research are:
   i) Pure or basic research, and
   ii) Applied research.

1.12 UNIT END QUESTIONS

1. Define research and purpose of conducting research.
2. Why it is important to conduct research in the field of family therapy?
3. What are concepts that form the research process?

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UNIT 2 RESEARCH PARADIGMS

Structure

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2.1 INTRODUCTION

The development of the doamin of counselling and family therapy is being shaped by technological and demographic factors as well as experiences of the individuals. These components bring in changes rapidly and radically. In other words, you can say that research is essential to know the effect of changes on the family patterns, parental authority, mental well-being, etc. so that future intervertions in the field of counselling and family therapy can be shaped according to the results of the present study and previous developments. It will later help to provide a base for decision making and policy formation. This would also lead to development of useful innovative techniques in area of counselling and family therapy.

There is always a concern for directing research activities in counselling and family therapy to the real needs of the participants and society. As a student of counselling and family therapy we hope that this Unit will familiarise you with the developing traditions of research activities in counselling and family therapy, and help you to understand why research is directed towards certain problems or phenomena and to design and conduct basic as well as applied research. The Unit deals with the models, patterns or ways in which you can go about conducting research in counselling and family therapy. We will inform the possibilities, approaches and limitations of various tools and techniques, models etc. This will enable you to analyse, theorise and pose questions which deal with a large number of counselling and family therapy issues, macro perspectives involving social effects, impact of counselling and family therapy, and communication issues.

This Unit will serve as a guide for the beginners for doing research in counselling and family therapy. It is assumed that the field of counselling and family therapy has produced and will continue to yield growing bodies of knowledge. But, knowledge does not grow naturally or inexorably. It is produced through the critical inquiries of practitioners or scholars, and is, therefore, a function of the kinds of questions asked, problems posed and issues framed by those who conduct researches. To understand the methods and findings of research carried out in the field of counselling and family therapy, one should appreciate and utilise the varieties of ways in which research questions are formulated. The framing of research questions, like that of an advocate asking questions in a court of law, limits the range of permissible responses and prefigures the character of possible outcomes. In other words, it is essential that a researcher understands the questions that have been asked and the manner in which those questions have been framed, both conceptually and methodologically. As a researcher, you should know why research is formulated in a specific fashion, what the alternative approaches to inquiry are, how to work on a research project, how to select a tool and how to prepare a design for research. The paradigms of research will provide you a solid background in each of the research discourses and allow you to explore the trends of research from a global perspective. In a way, these paradigms inform us about problems and procedures which are consistent with researching within a specific social, cultural, economic and political framework. Keeping in view the above facts, this Unit provides you a detailed discussion pertaining to paradigms of research.

Objectives

After studying this Unit, you will be able to:

- Describe the concept of 'paradigm';
- Distinguish between the three paradigms of research;
- Explain the approaches to research in counselling and family therapy; and
- List the different areas of research in counselling and family therapy.

2.2 RESEARCH PARADIGMS IN COUNSELLING AND FAMILY THERAPY

There are a number of issues pertaining to the nature of research in counselling and family therapy, for example, whether the proposed research topic is as per the need of the situation; how shall the topic be viewed by the wider community of professionals in counselling and family therapy engaged in research activities; what sort of theoretical interpretation might lie behind the research questions; what is the status of research in counselling and family therapy and how to theorise and generate knowledge in counselling and family therapy. To answer these questions it would be useful to introduce the idea of various models and approaches to research. Many researchers have talked about the way scientists use models known as maps or *paradigms* to develop *framework* for counselling and family therapy research.

The paradigm approach provides for a solid background in each research exercise and helps us to follow up, in depth, specific areas. This background is an essential part of the development of models in counselling and family therapy research.

There is always a concern for directing research activity in counselling and family therapy to the real needs of the participants. It is also essential to connect research in counselling and family therapy and social sciences. For example, there are some commonalties between much of what occurs in counselling and family therapy and the work done with individualised instruction, independent study, and technology. The research should deal with micro perspectives such as use of cognitive behavioural therapy to control drug abuse and macro perspectives involving social and political influences on individual, family and therapeutic process.

The Concept and Genesis of Research Paradigms

The concept of paradigm has turned out to be useful in inspiring critical thinking about "normal science" and the way shifts in basic scientific thinking occur. A paradigm determines the criteria according to which one selects and defines problems for inquiring and how one approaches them theoretically and methodologically. A paradigm could also be regarded as a cultural artifact, reflecting the dominant notions about scientific behaviour in a particular scientific community, be it national or international and at a particular point in time. In other words, we can say that paradigms determine scientific approaches and procedures which stand out as exemplary to the new generation of scientists – as long as they do not oppose them. A 'revolution' in the world of scientific paradigm occurs when one or several researchers at a given time encounter anomalies; for example, they may conduct experimental studies, make observations, which in a remarkable way do not fit the prevailing paradigm. Such anomalies can give rise to a crisis after which the universe of research under study is perceived in an entirely new light. Previous theories and facts become subject to thorough rethinking and re-evaluation. It is relatively easy to point out changes in paradigms in natural sciences. For example, in physics paradigm shift occurred from Aristotle via Galileo and Newton to Einstein. But when research activities in social sciences emerged in the nineteenth century, a conflict was observed in the field of research concerning both the purpose and method of inquiry. Alternative perspectives have been proposed and accepted by many. The value of alternative approaches was not denied, since scholarly debates and the exploratory use of these alternative approaches, add vitality to the field. During the 1960s and 1970s, scholars from different social science disciplines studied educational problems with many disciplinary affiliations. Most of them have a background in psychology or other behavioural sciences, but quite a few of them have humanities background in philosophy and literature. Thus, there cannot be a single paradigm prevailing like in the normal science in the multi-faceted field of research in counselling and family therapy. So, the scholars contributed new methods and new perspectives.

Some scholars argue that there are two main paradigms – (i) the scientific and (ii) the humanistic, which are not exclusive, but complementary to each other. Nevertheless, it can be argued that the drawing of a distinction between these two approaches cannot be sustained to the extent that they are regarded as two different paradigms. The twentieth century has seen the conflict between these two as employed in researching aspects and issues pertaining to counselling and family therapy. The one which is modeled on the natural sciences shows emphasis on empirical quantifiable observations and analyses data with mathematical tools.

The other paradigm is derived from the humanities with an emphasis on holistic and qualitative information for interpreting data.

A review of relevant literature indicates four major paradigms:

i) empirical- analytic (roughly equivalent to quantitative science)

ii) interpretive - symbolic (qualitative or hermeneutical inquiry)

iii) critical (where criteria relating to human betterment are applied in research)

iv) phenomenography

Let us now examine each of these in detail.

2.2.1 Empiricist Paradigm

This paradigm emphasises careful and controlled observation as the basis for knowledge. The observer is dispassionate and independent of the object of observation. Knowledge is objective, generalisable and can be used to *predict* and *control* future events (Smith et.al. 1990). In other words, within an empiricist research paradigm, the activities or processes proceed in a hypothetico-deductive way. Here, we have a theory behind the particular problem we wish to investigate. The theory provides the concepts which pose the research problem. The hypotheses arise from the theoretical framework made up from the concepts and variables interacting with each other. Holmberg (1990: 159) emphasised that scholarly work that tests propositions and modifies theoretical approaches has to be inter subjectively rational, exact, and of non-partisan character.

Since research processes, according to this view, should proceed by the hypothetico - deductive problem method, you need to have some kind of theory for a particular problem you wish to investigate. This theory or model will provide the language and concepts which pose the problem. Your hypotheses will arise from the theoretical framework made up from the way the concepts or variables interact with each other.

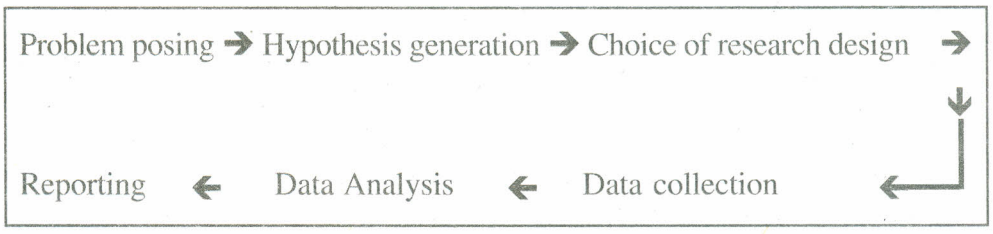
For example, suppose you want to *explore the relationship between school dropouts and socio-economic status.* For this problem the following hypotheses can be formulated with the eventual aim of operationalising the statements and finding ways of empirically testing them. These hypotheses are:

1. Socio economic status of the family influences school dropouts.

2. Emotional involvement in the study promotes deep learning and goal attainment.

You can notice that if we are to move to an empirical approach for testing the above hypotheses, we face a problem of deciding what we might measure, how to go about measuring emotional involvement, deep learning and goal attainment. So within empiricist research, a hypothesis must focus on a meaningful problem, have clearly defined concepts. After this, to verify our assertion that there exists a relationship between emotional involvement and deep learning, we have to construct and conduct the test. We also have to design the research activity, whether to select the experimental approach or any other method. If we decide to be experimental in our approach, we have to manipulate the extent of emotional involvement to see whether there is any effect on deep learning. Who will be our

subjects? Also, we have to take into account the practical and ethical considerations in attempting this empiricist approach. You can see that you have to prepare a typical pattern for empiricist approach. The steps involved are:



Deriving a theory is a deductive principle, but a theory which is based on evidence can be proved only by the induction approach. For example, a researcher observes again and again that friendly communication (feelings of belonging and personal relations between learner and teacher) influences not only motivation but also achievement favourably. General opinion among educators supports the researcher in assuming that what he/she has *induced* from the cases is based on the theory or a law. A theory to this effect is developed and various hypotheses derived from it – and – in fact, agreeing with – what has been noticed in practice, and tried empirically. In other words, assumptions are then deduced from theory.

2.2.2 Interpretive Paradigm – Phenomenology

This paradigm emphasises social interaction as the basis of knowledge. The researchers use their skills as 'social actors' to understand the subjective worlds of others. Here knowledge is subjective, constructed through mutual negotiation and is specific to the situation under investigation. The difference between empiricist and interpretive paradigms is that the empiricist approach focuses on prediction and control, but the interpretive approach is concerned with the understanding of a particular situation by the researcher.

The interpretive approach focuses on the intentions behind human actions, seeks to uncover, and interpret the meanings of all that is happening, being done or being understood by those who are involved in the activity under investigation (Nunan 1990: 26). This type of research includes *qualitative* methods of study. Here the focus is on the observed present, but the findings are contextualised within a social, cultural and historical framework.

The dominant influence within the interpretive paradigm can be seen in research on students' approach to learning. The research study focusing on students learning, particularly following the phenomenography of Marton and Saljo (1976) explained the deep and the surface approaches. The idea of approaches to learning, though apparently simple, is very useful in understanding why students learn differently under the same circumstances. It is not a learning style inherent in students which they manifest in all situations, but a characteristic of interaction between an individual and learning task. So, it is the interpretation of an intention and an action. It only has meaning with reference to a situation with certain types of content. From phenomenography approach, Marton and Saljo (1976) came to this important point about distinguishing deep from surface learning and explained that students would adopt the means of processing academic tasks according to their intentions or perception of their future. If learners merely wished to display symptoms of having learned, they would adopt a surface level approach. If they wanted to grow in understanding, they would adopt a deep level strategy. From the above

discussion you must have realized the impact of interpretive paradigm on deep and surface levels of learning. But what is the phenomenological approach? Let us discuss in brief about two phenomenological approaches before we proceed to the strengths and limitations of interpretive paradigm.

Phenomenology - It is concerned with an interpretive understanding of human action. As a philosophical movement, phenomenology was founded by Edmund Husserl. Its main concern is to provide philosophy with a foundation that will enable it to be a pure and autonomous discipline free from all presuppositions. Its method is essentially descriptive, and its aims are to uncover the fundamental structures of intention, consciousness and the life-world. The idea of the life-world of 'lived-experience' which is always taken for granted even by empirical sciences, is one of the two main concepts of phenomenology, which has interested many social scientists including psychologists. Nevertheless, critics have argued that when phenomenological concepts are transferred from their original domain to the context of social science, their meaning is radically transformed. In a wider context, we can say that phenomenology has influenced the researchers' analysis of the constructs and the interpretation in reality. For example, an important point about students learning approaches is that one depends upon the student's perception of the course, the teaching and the learning environment. A range of constructs such as heavy workload, didactic teaching, content oriented assessment and a fact-filled syllabus have been consistently met with a surface approach. The constructs made by the researcher, through phenomenological analysis, in a learning environment help to study the behaviour of the learner as the researcher tries to explain in accordance with the constructs whether the learner has deep or surface level learning. The phenomenological analysis of learning approaches has provided the researchers with interpretable tools which are sensitive to the context of the department or the individual learner or teacher; so it helps in designing courses and planning curriculum more conducive to students employing a deep approach.

Phenomenological and interpretive researches derive their responses for the subject and blur the distinction between subjects and objects. Phenomenological concern attends to how subjects make sense of the world. How do learners, or teachers or whoever interpret social practice and situations in which they find themselves? Phenomenologists look to the 'object' of study for descriptive first order constructs. What were formerly objects, for example, students, teachers or educational administrators are now subjects.

Phenomenologists adopt an attitude of epochs, where past beliefs, opinions, attitudes, experiences, ideologies, and frames of references propose that the discourse of research emanate from the subjects. Subjects expose first-order constants by which they organize and make sense of their daily lives. Researchers then develop second-order scientific and explanatory constructs that account for first-order constructs.

Some issues such as defining the perceived social situation, collecting data through unstructured and informal approaches should be handled properly to collect relevant information. In any interpretive study, the researcher may sometimes receive information which is not intended for public disclosure. Being a participant and an observer, the researcher carries a number of responsibilities to deal with a particular situation with moral considerations because the construction of meaning from an observational account and informal interviews is a key activity in interpretive paradigm. The limitation of the interpretive paradigm is that there is no inherent

mechanism for moving beyond interpretation. If this paradigm is followed, the researcher depends on the level of interpretation and there is no mechanism for moving on towards remediating the identified problems.

2.2.3 Critical Paradigm

The critical paradigm emphasises that knowledge is problematic and capable of systematic distortion. It represents the interests of some groups within society and has the potential to be either oppressive or emancipating. This approach shares the assumptions of the interpretive approach but adds the above element. One of the concerns of the critical paradigm is to understand the theory as well as practices.

Now, to re-conceptualise this research activity, let us take the example of learning styles of a distance learner. In this case, our first concern will be to try and understand the practices of distance learners as they engage in learning. As a participant in this research, the researcher will be setting up strategies which involve learners in critical reflections about their actions as learners at a distance. The researcher has to listen to their language and conceptual understanding of the way in which the learners are emotionally involved in influencing their abilities to learn and attain their goals. The researcher may anticipate the introduction of social and political contexts in this approach.

Sometimes the researcher may change the situation in order to provide a greater degree of control to the learner. For example, warmth in human relations, and rapport with teachers at a distance could be collectively redefined in ways which change the practices of those attempting to facilitate learning at a distance. The use of collective redefined actions by previously isolated and independent students to achieve changes in their involvement within the educational enterprise may also be explored. This is because the critical paradigm sees knowledge developing as participants are actively involved in construction and reconstruction of theory and practice. The approaches involved in this paradigm are emancipatory praxis and critical pragmatism. For example, emancipatory praxis identifies a 'guidance' role for expert researchers in facilitating involvement of participants; critical ethnography supports emancipatory action; and critical pragmatism extends beyond the typical critical approach and helps for post-structural analysis.

In the critical paradigm, the researcher has to identify the social group of the participants/subjects through dialogue and analysis of the intentions of the participants. She or he has to study the historical development of the social conditions and the current social structure to understand the group. The researcher has to collect data with the help of participant observation and in depth interview. She or he has to involve herself or himself to visualise the social situation. The key feature of this paradigm is its concern for finding the truth or facts without distortion or bias. It focuses on sociological and political issues as a research problem.

One mode of research associated with the critical paradigm is *action research* which is a form of participatory and collaborative research. Action research aims to help practitioners investigate the connections between their own theories and the day-to-day practices. It aims to integrate the research act into the educational setting so that research can play a direct and immediate role in the improvement of practice.

Check Your Progress Exercise 1

Note: a) Read the following question carefully and answer in the space provided below.

b) Check your answer with that provided at the end of this Unit.

1. Explain the importance of paradigms in counselling and family therapy research.

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2.2.4 Phenomenography and Second Order Perspective

Phenomenography has been extensively dealt with by Marton (1997). According to him, "Phenomenography is the empirical study of the limited number of qualitatively different ways in which various phenomena in and aspects of the world around are experienced, conceptualized, understood, perceived, and apprehended". Phenomenographers call it a 'second order perspective' (Marton 1981).

This point can be explained with the help of an example taken from a piece of phenomenographic research. One of the ways in which children experience numbers is as "fingers-numbers" which is stated by Numan (1987) and quoted by Marton (1997). Children frequently lay the numbers 1 to 10 in their *fingers* present in two hands, calling one of the little fingers '1' (one), the ring finger '2' and so on. Numbers larger than 5 are then understood as 5+ some fingers. In carrying out simple arithmetical tasks, children try to keep the undivided '5' together. Hence, when solving problems like 2+7= 9, they reverse the addends and transform the problem to 7+2=? where 7 is "undivided" as 5+2 and the problem as a whole becomes (5+2)+2=?

From the above example, you can understand a concept of something or a way of experiencing something. The two expressions are being used interchangeably. It is a way of being aware of a phenomenon. One might be aware of 7, when one perceives it as 5+2, when one looks at one's hand or as 6+1 or 4+3, it might be all immediate experience of the number 7; it might be the result of reflection or some other possibilities. So, here the perceptions differ in a qualitative way.

Phenomenography is a research specialization. The researches were carried out at the University of Gutenberg, Sweden, in the early 1970s. The point of departure for these studies was one of the simplest observations that can be made about learning, namely, that some people do better at learning than others. These

observations led to the first question which was to be investigated empirically, (a) what does it mean to say that some people are better at learning than others? This in turn led to the second question, (b) why are some people better at learning than others?

This phenomenographical study was carried out with individual tasks provided to the learners under comparatively natural conditions and learners were allowed to read the text provided to them. Thus, after completing their reading, the students were interviewed about what they understood the text to have been about. The interview also pertained to their experience of the situation and they were specifically asked how they had gone about learning the text. All the interviews were recorded and subsequently transcribed verbatim. On examining the transcripts of the students' accounts of how they had understood and remembered the text as a whole, it was found that there were different ways of understanding the text; thus, a hierarchically ordered set of categories were devised and termed the "outcome space". By referring to this outcome space, the categories of description could be compared with one another to judge how appropriate, in relation to specified criteria, the understanding they represented was. Thus a way was found for answering the second question as to why are some people better at learning than others. Further research for answering the second question demonstrated the relationship between approaches to learning, that is, surface and deep on the one hand and the quality of the outcomes on the other. This phenomenographic study developed the notion of two approaches to learning. The idea of approaches to learning is very useful in understanding why individuals react differently in the same circumstance.

Thus, two key issues regarding phenomenographic study are:

1. Different ways of understanding a specific content which learners developed in a certain situation; sense was made of these in terms of differences in the approaches the learners adopted to the specific learning task, that is, in terms of differences in their ways of experiencing the specific situation.

2. The second issue is that in developing the phenomenographic research, the focus of interest was to shift away from that which emerges in a specific situation and toward the learner's preconceived ideas about the phenomena dealt with in the specific situation. For example, the way in which children understand numbers, is of vital importance to the way in which they deal with problems in arithmetic. Can you envisage a similar example pertaining to some other aspect of human cognition, affect and behaviour?

The above discussion points out that, phenomenography is the empirical study of the limited number of qualitatively different ways in which various phenomena can be experienced, understood, perceived and conceptualized. This may be considered as a way of finding out how the development of knowledge and skills within the domains can be facilitated.

In this Section, we discussed the research paradigms in the doamin of counselling and family therapy which have significant potential for research studies.

Having presented to you the four research paradigms, we shall now examine a few methodological issues and approaches.

2.3 APPROACHES TO COUNSELLING AND FAMILY THERAPY RESEARCH

In the above discussion we saw how a research method is a particular way of studying a problem. With the increasing number of research studies in counselling and family therapy, much emphasis is laid on methodological issues and *approaches* to research in this field. In this section, we will present to you a few issues and approaches of research.

These approaches will provide you with guidelines by which you can design a research problem, develop field techniques to collect data, interpret data and arrive at generalisations.

2.3.1 Qualitative and Quantitative Approaches

Qualitative methods help us to examine the nature of human behaviour and experience and social conditions. But quantitative methods focus on objective and standardised means of inquiry and application of statistical analysis for attainment of objectivity and generalisations.

Qualitative methods permit the researcher to study selected issues, cases or events in depth. Qualitative data are collected through direct observation, participant observation, in-depth interviewing, case studies, recorded documents, open-ended questionnaires and journals. Quantitative methods use standardised 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 of questions, thus facilitating comparison and analysis of the data with the help of close-ended questionnaires, attitude scales, rating scales and postal surveys.

The qualitative-quantitative debate has persisted in the field of 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 underlie qualitative methods include phenomenology, naturalistic behaviourism, and psychology. The philosophical roots of qualitative methods emphasise the importance of understanding the meanings of human behaviour 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.

A large number of works on qualititative methods offer the use of this method in the context of counselling and family therapy. Various qualitative research methods like ethnography, case study, grounded theory (Minnis, 1985, Marland 1989; Coldeway 1990) and the methodology of critical reflection put forward by Evans and Nation (1989) are considered to be more promising in this context.

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 study.

2.3.2 Triangulation Approach

As a reaction to the debate between the qualitative and quantitative approaches, significant researches have highlighted many flexible and eclectic approaches. One

of the eclectic approaches in counselling and family therapy research is *triangulation.* The choice of research methods follows not from research doctrine, but from decisions in each case as to the best available technique. The problem defines the method used not vice versa. Equally, no method (with its own built-in limitations) is used exclusively or in isolation; different techniques are combined to throw light on a common problem. Besides viewing the research problem from a number of angles, the 'triangulation' approach facilitates the cross-checking of otherwise 'tentative findings'.

As you know, qualitative approach puts more emphasis on participant observation, open-ended questionnaires, in-depth interviewing and analysis of documents. On the other hand, quantitative approach uses close-ended questionnaires and survey methods for collection of data. As a precaution against subjectivity in both the approaches, the *triangulation* method insists on cross-checking the important findings through the use of different techniques, coding and appropriate checking of open-ended questions, and independent interpretation of data by different members of the research team. While using this approach, theoretical principles and methodological ground rules can be discussed and made explicit, criteria for selecting or rejecting areas of investigation can be spelt out and evidence can be presented in such a manner that others can judge its quality.

This method attempts to eliminate bias or error and as a result increase the probability of a truthful explanation. There are three major goals of triangulation, namely: convergence, inconsistency and contradiction.

Convergence is the first goal of triangulation approach. Here, the result of data collected from different sources, methods and investigations are combined to provide evidence about a single phenomenon.

Inconsistency refers to the inconsistency among the data. Often multiple measures produce conflicting evidence that do not confirm a single proposition.

Contradiction refers to the data collected from various sources being not only inconsistent, but also contradictory.

In the context of distance education, some of the research problems are complicated, often confounded with a variety of interlocking variables. Sometimes, it may even be difficult to carry out the research. A triangulation method may prove effective in dealing with a variety of variables. For example, a researcher wants to study the development of the distance education system during the nineties. He/she has to consider a variety of interlocking variables pertaining to instruction, management and logistics. The variables associated with the instructional system are learning strategies, instructional materials, feedback and support system, etc. In management system, the components are organisastional structures, policies and procedures of an institution, leadership and use of researchers. Finally, logistics include technical quality, programme delivery and instructional environment.

The researcher uses the triangular approach for increasing the validity of research findings. He/she uses multiple methods and multiple data sources. The approach helps the researcher to eliminate bias. or error and as a result, increases the probability of a truthful explanation.

2.3.3 Component Analysis Approach

The term 'component' refers to one of the features or parts of a system. For example, in distance education system the components are learners, instructional

materials, support services, etc. Here, the components that directly affect learners are of particular interest for research. It begins with an analytical phase to identify the nature of each component and how they possibly interact. Once the components are identified, it is possible to determine the contribution each component has towards the overall effect.

For example, a distance education programme has the following components:

i) a printed course package,

ii) a set of audio and video-cassettes,

iii) access to counselling sessions, and

iv) a set of policies related to admission and evaluation processes.

The above components work together to produce a particular effect i. e., achievement, rates of course completion, etc. Suppose a researcher wants to determine which of these components are most important in producing a particular effect, say, completing a programme. The first stage in component analysis research would be to analyse each component in the course to determine whether it exists at a level of quality. For example, to determine the instructional components in the printed package, one has to analyse the well-written objectives, clear presentation and self check questions that match the objectives of the components. It may be useful to begin research work with formative evaluation than to determine the overall effect of a programme. Component analysis approach is a good way to combine the benefits of evaluation with a potential programme of more generalisable research (Coldeway 1990: 394).

2.3.4 Model Building

Model building approach provides ways of addressing important research questions that are ignored while designing the framework of research. It serves to integrate various knowledge bases together. Information outside counselling and family therapy can also be used to guide decision making. Calvert (1989) proposed a conceptual framework indicating relationships between various input, process and outcome variables. The framework helps to construct a model of a distance educational research programme. Model building for distance educational research is useful to begin with a research problem and to predict the difficulties in conducting the research and to estimate the reliability, and external validity.

Check Your Progress Exercise 2

Note: a) Read the following question carefully and answer in the space provided below.

b) Check your answer with that provided at the end of this Unit.

1. List the four approaches to counselling and family therapy research.

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2.4 LET US SUM UP

In this Unit, we have discussed the need for research, and have focused on the four paradigms of research. They are: empiricist, interpretive and critical paradigms and phenomenography. The major apporaches to research in the feild of counselling and family therapy; namely the qualitative and quantitative approaches, the triangulation approach, the component analysis approach, and model building were also elaborated upon, and their advantages outlined.

2.5 GLOSSARY

Phenomenology : Interpretive understanding of human action.

2.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1. A paradigm determines the criteria according to which we select and define the problem. It also acts as cultural artifact, which reflects the scientific behaviour in any community. In counselling and family therapy it provides a background for the research exercise and helps to go into depth.

Check Your Progress Exercise 2

1. Following are the four approaches to counselling and family therapy research.
   a) Qualitative and quantitative approach,
   b) Triangulation,
   c) Component analysis, and
   d) Model building.

2.7 UNIT END QUESTIONS

1. What do you mean by research paradigms?
2. Explain phemenography and the second order pecspective.
3. What are the different approaches to counselling and family therapy research?

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UNIT 3 SCIENTIFIC METHOD AND KNOWLEDGE GENERATION

Structure

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3.1 INTRODUCTION

It has been estimated that knowledge almost doubles after every eight years. You may wonder why it is so and how it happens. In fact, human curiosity is the main reason for increase in knowledge. This knowledge is what may be called 'human commonwealth'. It knows no boundaries. People from all countries use this commonwealth and contribute to it. The present age has rightly been called the age of knowledge; knowledge generation is today as important as communicating it and helping others construct it for themselves.

Research in social sciences in general and in counselling and family therapy in particular, is a scientific process of generating knowledge. Human beings have

been generating knowledge from the dawn of civilization on the basis of their life experiences, teachings from authority, influences from customs, traditions and socializing agents like educational institutions. Generating knowledge or discovering truth has also been largely possible by the use of deductive and inductive reasoning. Looking into the limitations of these two processes of reasoning, scholars integrated the most important aspects of deductive and inductive methods, shaping out scientific method or approach to knowledge generation. This has been the fundamental approach to research and hence to generation of knowledge.

In this Unit, we shall look into the sources of the knowledge generation, and scientific method.

Objectives

After studying this Unit, you will be able to:

- Discuss various sources of knowledge;
- Differentiate between knowledge generation through inductive and deductive modes of reasoning;
- Explain the meaning of scientific method;
- Justify the scientific method as a more scientific mode of knowledge than other modes; and
- Understand positive paradigm and emergence of field methods.

3.2 KNOWLEDGE: NATURE AND TYPES

3.2.1 What is Knowledge?

It is not easy to define knowledge. Most dictionary definitions of knowledge do not do justice to the concept of knowledge. The word 'knowledge' has been derived from the verb 'to know'. Loosely defined, knowledge consists of all that a person knows and believes to be true. This would be called 'personal knowledge'.

Personal knowledge differs from one person to another. This is because much of one's personal knowledge may be unexamined, untested and therefore subjective. In the context of research, when we use the word 'knowledge', we refer to scientific knowledge. Scientific knowledge is well tried out, examined and tested (i.e. validated) knowledge. It is scientific knowledge, which is considered and accepted by experts to be true. Knowledge, in this sense, represents the entire content of our intellectual heritage.

In spite of what has been said above, we should remember that the concept of knowledge expresses our standards, ideals, and tastes about the rightful exercise of cognitive skills because collectively they express our conceptions of truth and evidence. Knowledge is, therefore, concerned with how we come to know, what are our approved standards of competence – in performance, in inquiry and in criticism.

The concept of knowledge has been associated with what are called philosophical traditions; these are primarily three: the rationalistic, the empirical, and the pragmatic. *Rationalistic Tradition* according to the rationalistic tradition, knowledge is derived through deductive reasoning based on self-evident basic truths. Knowledge,

according to rationalists, does not strictly depend upon experience; it depends instead on reasoning. Rationalists consider mathematics to be the ideal science. Mathematicians do not conduct experiments and surveys. Yet through reasoning, they arrive at truth that does not depend on experience for its confirmation.

Empirical Tradition

According to the empirical tradition, all natural phenomena can be known only through experience and not through deductive reasoning or intuition. Empiricists assume that our mind has the power to compare, combine, analyze and generalize upon whatever is provided to it by experience. They also believe that the mind possesses the ability to perform logical operations upon concepts. The empirical tradition emphasizes learning from experience, through accurate observation, reason-based generalization, and willingness to revise laws that are not supported by events related to a particular phenomenon.

Pragmatic Tradition

The pragmatic tradition emphasizes the experimental character of the process of acquiring knowledge. The pragmatic tradition stresses that merely carrying out logical operations on basic truths is not enough; one needs to go beyond the generalization about observed phenomena. Pragmatists are in favour of experimentation based on controlled observation of environment and events. The process of generating and testing knowledge is, according to Dewey, the process of 'trying and undergoing'– trying an idea in practice and learning from observation of the consequences of the trial. Pragmatists are of the view that the mind has the capacity for active generation of ideas so that the problem faced by the individual can be resolved. Pragmatists are in favour of active and imaginative theorizing provided it leads to experimentation. The outcomes of the experimentation should give direction to imaginative theorizing.

3.2.2 Types of Knowledge

Declarative Knowledge

According to Biggs (1999), knowledge is of many kinds. Chief among these is declarative or propositional knowledge. This knowledge refers to knowing about things or knowing 'what'. Declarative knowledge is generated by research; it is not solely based on one's personal experience. Our knowledge about the solar system, about how different seasons are formed, how children learn, how humans process information – all these and much more are part of declarative knowledge. It is also known as *public knowledge* because it is tested through rules of evidence that make it verifiable, replicable, and logically consistent.

Functional Knowledge

Functioning knowledge is concerned with 'how to do things' and it involves performance based on understanding. Functioning knowledge is strongly rooted in declarative knowledge. Unless one is strong in declarative knowledge and understands what action(s) can be performed through it, it cannot become functioning knowledge. In other words, declarative knowledge when put to use for problem solving or for performing theory-based tasks, becomes functioning knowledge.

Procedural knowledge

Then comes procedural knowledge, which is essentially skill-based; it however, does not have the high rigour of declarative knowledge. Procedural knowledge goes hand in hand with appropriate competencies in a particular area. Procedural knowledge is largely based on performance of right action in the correct sequence.

Conditional knowledge

There is yet another type of knowledge, *viz*, conditional knowledge, which is a combination of both procedural and higher level declarative knowledge. It informs us of what one should do under given circumstances, why and under what conditions one should do this and not that.

3.3 SOURCES OF KNOWLEDGE

A person needs knowledge and generates it for the purpose of her or his life activities. Without going into the theory of knowledge (epistemology), it may be considered what we call "Knowledge" is the product of knowing, perceiving, thinking, guessing, being mistaken, remembering, finding out, inferring, proving, reflecting, imagining and so on. Knowledge may be in the form of fact, belief or judgement. A fact is anything that exists or can be conceived of; what we claim to know is belief or judgement. Human knowledge takes the form of belief or judgement about a particular phenomenon. Some beliefs may be supported by evidence, others may be based on our perceptions and experiences. The beliefs, which are supported by evidence, are called justified beliefs. Only justified beliefs are knowledge. Knowledge includes what we know about matters of fact as well as the principles and processes of inference. It has three elements:

(i) there is a system of ideas;

(ii) the ideas correspond to things actually existing; and

(iii) there is belief in such correspondence.

If we look at the historical perspective it will be evident that efforts of centuries were required by human beings to improve their capacity and readiness to obtain reliable knowledge. To gain some insight into the tortuous pathway traversed for the purpose, the following discussion briefly examines the various sources of knowledge that persons draw upon to solve problems. These are

(i) Life experiences,

(ii) Authority,

(iii) Customs and traditions,

(iv) Deductive reasoning,

(v) Inductive reasoning, and

(vi) Scientific Method.

3.3.1 Life Experiences

In order to conduct the life activities satisfactorily and successfully, a person has to understand her or his environment and the nature of phenomena it presents to

her or his senses, otherwise she or he can hardly hope to solve problems she or he faces constantly. One of the means by which we seek the answers to our problems is our life experiences. Perhaps the most primitive, and yet the most fundamental source of the solution to a problem lies in personal experiences. Thus, confronted with a sudden flow of water down a ravine, prehistoric person could have solved her or his problem and saved her or his life if she or he had only remembered that water does not generally stay on hills. On an elementary level she or he had the knowledge of a basic scientific fact that water runs downhill. In ancient times, nomads and various tribes from their personal experience probably remembered that certain wild fruits always made them ill, that grains ripen at particular times of the year, and that sudden floods in the rivers during rainy season were due to the fact that water does not generally stay on hills. A young man can repair a puncture in a bicycle inner tube because he has done it several times previously. People may thus draw upon their own individually accumulated body of knowledge and skills derived from encounters and acquaintance with facts and events in their environment. However, one has to keep in mind the limitations of personal experiences as a source of knowledge. Although experience is a familiar and well-used source of knowledge, it still may be inappropriate for new problems. Also, an uncritical use of personal experience may lead to erroneous conclusions. People may make errors when observing or reporting what they have seen or done. They may:

- Omit evidence that does not agree with their opinion;
- Use measuring instruments that entail many subjective estimates;
- Establish a belief on insufficient evidence;
- Fail to observe significant factors relating to a specific situation; or
- Draw improper conclusions or inferences owing to personal prejudices.

In general, it may be observed that how one is affected by an event depends upon who the one is. Two persons will have very different experiences in the same situations. For instance, two supervisors observing the same classroom at the same time could truthfully compile very different reports if one focused on and reported the things that went right and the other focused on and recounted the things that went wrong. Similarly, inferences drawn by different members of a family are different depending upon their individual emperiences, attachments, perceptions, etc.

3.3.2 Authority

Seeking and accepting the explanation of authorities is a well-established method of getting knowledge and solving problems encountered in the environment. When one has not had personal experience with a phenomenon, the obvious recourse is to consult their parents, their teachers, or even their older siblings for answers to problems with which they are not familiar. Rather than attempting to determine truth independently, people often seek the advice of experts who, because of their intellect, training, experience, or aptitudes, are better informed than other people. Experts are necessary in a complicated culture such as ours where knowledge is expanding so rapidly that no one can be an expert at everything. And obviously certain individuals have such a wide experience and deep insight that their advice

can be of immense benefit. But it should never be forgotten that as sources of knowledge, authorities have limitations. Authorities cannot be infallible. They may at times be in disagreement among themselves on issues. This shows that their authoritative statements are nothing but personal opinions, and not facts. We should, therefore, check their agreements and evidence upon which they base their claims to knowledge. Accepting experts' opinions unconditionally, thus, may at times lead us to untruth rather than knowledge. In some familial issues advice of the elders helps to resolve disputes.

3.3.3 Customs and Traditions

It goes without saying that customs and traditions serve as source of knowledge for the members of a particular society and culture. They depend on customs and traditions for answers to many questions related to their professional and everyday problems. People usually and readily accept customary modes of dress, speech, food, worship and etiquette. In practical life this automatic acceptance of approved patterns of behaviour is often necessary, because one cannot question all things. But the limitations of customs and traditions as sources of knowledge should not be lost sight of. One should not make the mistake of assuming that everything that has customarily been done is right or that an appeal to the accumulated knowledge and wisdom of ages will always lead to the truth.

3.3.4 Deductive Reasoning

Reasoning is inherently a thinking process. Human beings have recourse to reasoning in order to obtain reliable knowledge. They attempt to comprehend the world around them by applying the faculty of reasoning. There are two types of reasoning; deductive and inductive. Deductive reasoning can be considered as a thinking process in which one proceeds from general to specific statements through logical arguments.

Aristotle's syllogism

Deductive reasoning is based on the syllogism, which was the great contribution of the Greek philosopher, Aristotle, to formal logic. In its simplest form, the syllogism consists of a major premise based on a priori or self-evident proposition, a minor premise providing a particular instance, and a conclusion. To use a simple example, consider the following proposition:

All planets orbit the sun (Major premise)

The earth is a planet (Minor premise)

Therefore, the earth orbits the sun (Conclusion).

The assumption underlying the syllogism is that through a sequence of formal steps of logic, from the general to the particular, a valid conclusion can be deduced from a valid premise.

In personal and professional life we very often use deductive logic in solving problems. Lawyers, doctors, soldiers, detectives often resort to deductive argument in their professional work. Research workers have been invariably using deductive reasoning to carry out certain tasks of their research work. Without deduction, facts obtained through observation and experiment would be fruitless since one could not fit them into deductive systems called sciences.

Limitations of deductive reasoning

Deductive reasoning has obviously its own limitation. Deductive conclusion depends upon pre-existing knowledge; it does not enable scholars to gain new knowledge or to make new discoveries. Deductive reasoning stresses on the forms of argument and not on the truth or falsity of the statements. According to the deductive mode of reasoning if the form of argument is sound, then even a false premise will not matter. Of course, this does not mean that deductive reasoning has no role in the knowledge generation process. Rather it has its own use in formulating and proposing hypotheses from the general truth (theory), this helps knowledge generation through enquiry by the use of hypothesizing. Deductive reasoning can systematize what is already known and can identify new relationships as one proceeds from known to unknown, but it cannot be relied upon as a self sufficient method for securing reliable knowledge.

Deductive *Versus* Inductive Reasoning

In deductive reasoning, we start with a generalization and apply it to a specific case and deduce an inference.

In inductive reasoning, we start with a specific event and make many more observations and on the basis of the commonality in a given set of observations, we formulate a generalization. Thus while in deductive reasoning we start with a generalization and apply it to a specific instance, in inductive reasoning we proceed in the reverse order; we start with a particular event or instance and conclude with a generalization.

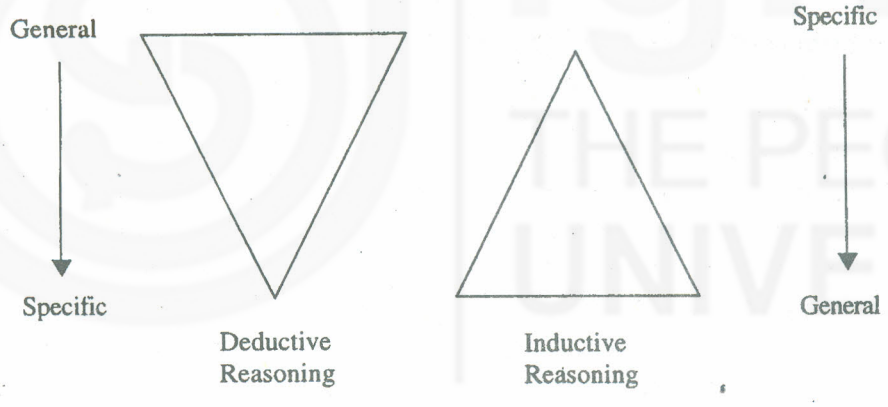


Fig. 3.1 : Deductive and inductive reasoning

Let us now understand inductive reasoning as a source of knowledge in greater detail.

3.3.5 Inductive Reasoning

We know that the conclusions reached by deductive reasoning are true only if they are derived from true premises. But the question is how to determine whether the premises are true. Inductive reasoning has been devised to complement deductive reasoning as a means of searching for knowledge. Particular instances (concrete facts) are observed in inductive reasoning and by examining these particular instances, a general conclusion is established about the whole class to which these particular instances belong. These general conclusions, arrived at through induction, may be used as a major premise for deductive inferences.

Baconian Induction

In the early 1600's, Francis Bacon introduced the mode of inductive reasoning. He felt strongly that deductive mode of reasoning could never suffice for discovery of truth because it started with a preconceived notion and, therefore, biased the results obtained. He declared that if one collected enough data without any preconceived idea about their significance and orientation, one could maintain complete objectivity about the process. Then, Bacon held, it was most likely that an inherent relationship would emerge.

There may be two forms of induction – *perfect* and *imperfect.* Perfect induction establishes a conclusion by an exhaustive enumeration of all instances that are subsumable under a given class. All India Census operation is an example. Imperfect induction arrives at a generalization by observing only some instances, an adequate and representative sample from the entire class. The researchers in social sciences utilize imperfect induction more often than perfect induction, for in most investigations it may not be possible to examine all the instances to which a conclusion refers.

Bacon's contribution to scientific progress is significant. He realized that advancement of knowledge was not possible only through deductive method. Increasing stress was to be laid on the observational basis of science. Bacon directed the attention of scientists to nature for solutions to people's problems, demanding empirical evidence for verification. Logic and authority in themselves were no longer regarded as conclusive means of proof and instead became sources of hypotheses about the world and its phenomena.

Limitations of inductive reasoning

Inductive reasoning has inherent limitations. Just as in the case of deductive reasoning, inductive reasoning also, only by itself, does not lead to much advancement of knowledge. Its basic limitation is that it can be applied to only as many events as can be observed, and hence the conclusions arrived at cannot really be infallible. The conclusions reached by imperfect inductive reasoning do contain information that is not present, even implicitly, in one of the premises (the observed instances). If all the premises (observed instances) are true, the probability of conclusions arrived at may be of varying degrees.

Check Your Progress Exercise 1

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. List the sources of knowledge.

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2. What is syllogism?

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3.4 SCIENTIFIC METHOD

Francis Bacon planted the seeds of the modern scientific method of acquiring knowledge. He recommended that investigators reach conclusions on the basis of observed facts. In order to construct a more practical method of attaining reliable knowledge, scholars like Newton, Galileo, and their successors eventually combined the deductive and inductive thought processes. This synthesis of reason and observation gave rise to the modern scientific method of generating knowledge.

3.4.1 Defining Scientific Method

The most distinctive feature of science is its empirical nature, the next most important characteristic is its set of procedures which show not only how findings have been arrived at, but are sufficiently clear for others who are interested to repeat them, that is to check them out with the same or other materials and thereby test the result. A scientific approach necessarily involves standards and procedures for demonstrating the empirical warrant of its findings, showing the match or fit between its statements and what is happening or has happened in the world. These standards and procedures, taken together, form the scientific method. Thus, the scientific method is the way in which one can test opinions, impressions or guesses by examining the available evidence both for and against. It is simply the pursuit of truth, which is determined by logical considerations. We see that the scientific method aims at discovering facts. But facts cannot be discovered without some reflective thinking and enquiry. When using the scientific method, we engage in a thinking process called 'reflective thinking'. Every fact is initially nothing but some proposition or problem. John Dewey in 'How We Think' analyzed the stages of the activity involved in the process of reflective thinking in the following five steps:

1. A felt difficulty — When one encounters a puzzling experience or problem.
2. Location and definition of the difficulty — When one makes observations, gathers facts, to specify the difficulty more concretely and precisely.
3. Suggested solutions of the problem or hypothesizing — When one, after a preliminary study of the facts about the problem, makes intelligent guesses about the possible solutions of the problem, which are called hypotheses.
4. Deductive reasoning — One formulates the consequences of the suggested solutions (hypotheses).
5. Testing the hypotheses — When one makes observations or collects evidences to confirm or disconfirm the hypotheses.

Here is how Kerlinger gives a graphic description of the above stages of the scientific method:

First, there is a doubt, a barrier, an indeterminate situation crying out so to speak, to be made determinate. The scientist experiences vague doubts, emotional

disturbances, incoherent ideas. He struggles to formulate the problem, even if inadequately. He studies the literature, scans his own experience and the experience of others. Often he simply has to wait for an inventive leap of mind. May be it will occur; may be not. With the problem formulated, with the basic question or questions properly asked, the rest is much easier. Then the hypothesis is constructed, after which its implications are deduced. In this process the original problem, and of course the original hypothesis, may be changed. It may be broadened or narrowed. It may even be abandoned. Last, but not final, the relation expressed by the hypothesis is tested by observation and experimentation. On the basis of the research evidence, the hypothesis is accepted or rejected. This information is then fed back to the original problem and it is kept or altered as dictated by the evidence. What is important to note is the overall fundamental idea of the scientific method as a controlled rational process of reflective enquiry, the interdependent nature of the parts of the process, and the paramount importance of the problem and its statement.

3.4.2 Scientific Method Combines Induction and Deduction

The steps in the act of reflective thinking as delineated in the previous section, reveal how induction and deduction serve as opposing processes of the total problem solving act. Induction provides the ground work for hypotheses, and deduction explores the logical consequences of the hypotheses, in order to eliminate those that are inconsistent with facts, while induction again contributes to the verification of the remaining hypotheses. Thus, in an investigation, one continually shifts between collecting facts, making generalization (hypotheses) to explain facts, deducing the consequences of one's hypotheses, and seeking additional facts to test the hypotheses. By combining both induction and deduction, one is able to arrive at reliable knowledge.

It must be borne in mind that these steps of scientific method do not provide a rigid pattern into which scientists must mould their thinking, for thinking cannot simply be scheduled. Investigators rarely follow a prescribed sequence of procedure. Knowledge generation is often a confused, floundering process rather than a well-shaped logical, orderly one. In an investigation, one does not tackle one step at a time, completes that process, and then moves on to the next step. One may tackle the steps out of order, shuffle back and forth between steps, or work on two steps more or less simultaneously. Some steps may require little effort; other steps may take a disproportionate amount of time and effort.

What is most important to remember is that the scientific method is characterized by an inherent logic of its steps and procedures, which enables an investigator to pin his faith on it as a reliable tool for attaining truth and generating knowledge.

Scientific Method

The scientific method was formulated in order to avoid the defects of deductive reasoning as well as inductive reasoning. The scientific method is the method of research. In spite of the variety, research has a typical set of procedures based on the scientific method, which is also known as the hypothetico-deductive paradigm. According to researchers, the scientific method consists of the following sequence of steps (See Fig 4.2):

Step 1: A theory exists about the phenomenon.

Step 2: The researcher identifies and researches questions in the context of the problem.

Step 3: The researcher formulates a research hypothesis based on the theory. The research hypothesis is a statement of the possible relationship between two or more variables and it is testable.

Step 4: The researcher describes the specific procedures i.e. operations by which the variables are defined and action performed on them. The researcher formulates a null hypothesis on the research hypothesis, which can be tested statistically. He develops an appropriate research design that is plan of action for testing the null hypothesis.

Step 5: The researcher conducts the study according to the research design and collects the data.

Step 6: The null hypothesis is tested by the researcher using the data collected through the study.

Step 7: The null hypothesis may be rejected or accepted on the basis of statistical testing. If the null hypothesis is accepted, the theory is confirmed. If the null hypothesis is rejected, then the research hypothesis may have to be reformulated and tested again in order to solve the research problem. For this, steps 2 to 7 are repeated.

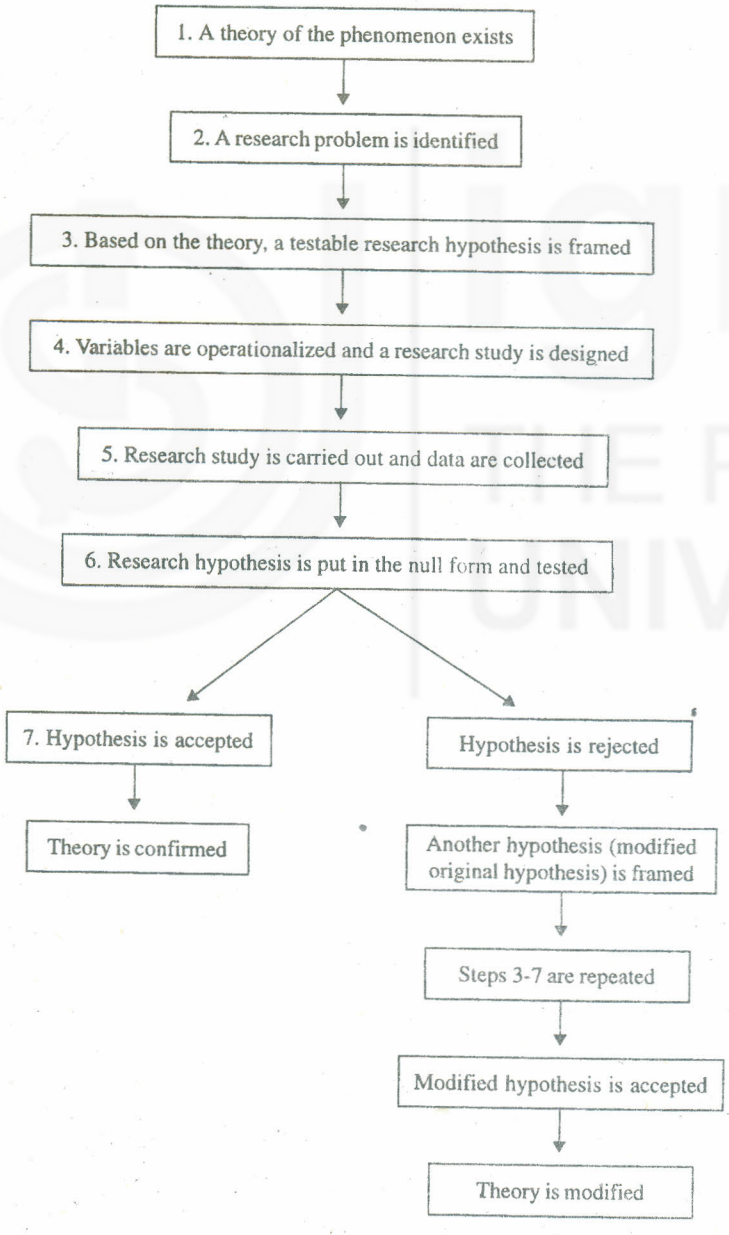


Fig. 4.2 : Flow Chart on using Scientific Method

Limitations of Scientific Method

- It has to be appreciated that the scientific method does not consist merely of the application of the steps such as problem definition, hypothesizing, collection of evidence, inferring and testing or verifying, but certain other factors like intuition, imagination, and chance have an undeniable role to play in any process of enquiry. In the history of scientific enquiry there is no dearth of examples to support this view.

- In respect of methodology for explorations of fields yet unknown, the limitation of the scientific method becomes obvious if one recognizes that it represents only a reconstructed logic and not logic-in-use as far as scientific explorations are concerned. According to Kaplan, a reconstructed logic is not a description but rather an idealization of scientific practice. Not even the greatest of scientists has a cognitive style, which is wholly and perfectly logical, and the most brilliant piece of research still betrays its all-too-human nature. The logic-in-use is embedded in a matrix of a logic-in-use, and even an illogic-in-use. The reconstruction idealises the logic of science.

- Another argument made in adopting the scientific method is that it is only the outcome of applying the scientific method that can be considered as valid knowledge regarding the educational phenomenon. This methodological orthodoxy obviously raises more fundamental epistemological questions as to the role of empirical facts and experiences as tools of acquiring knowledge. Perhaps, an educational researcher needs to examine the underlying assumptions before wedding himself to the method he adopts. This is because the interpretation that a researcher would provide, even for his empirical findings, depends finally upon the philosophical and ideological position he takes.

- One cannot but observe that the situation presents a misconstrued notion that the law of scientific method has already been formulated and it remains for the researcher only to pick out a problem and apply it. This tendency puts a serious methodological limitation to educational research.

It encourages a view in which new methods or new ways of doing research would invariably be looked at with suspicion and hostility; eventually, it blocks attempts to create and invent new methods and techniques which become necessary with the recognition of the fact that educational problems intrinsically vary from other fields of study such as physical and natural sciences.

Check Your Progress Exercise 2

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. Define the scientific method.

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2. List the steps of scientific method.

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3.5 POSITIVISTIC PARADIGM

In order to explicate positivistic paradigm we have first to understand what a paradigm is. This term was introduced in 1962 by Thomas Kuhn in his book, "The Structure of Scientific Revolution". The concept has turned out to be useful in inspiring critical thinking about "Sciences' and the way shifts in basic scientific thinking occur. A paradigm determines the criteria according to which one selects and defines problems for inquiry. A paradigm determines scientific approaches and procedures which stand out as exemplary to a new generation of scientists – as long as they do not oppose it. Kuhn characterizes a paradigm as: "An integrated cluster of substantive concepts, variables and problems attached with corresponding methodological approaches and tools…….A paradigm gathers into itself a community of investigators. By sharing information within itself, this community gives itself intellectual and social support. It tends not to communicate with investigators who follow different paradigms. Citation of other's work is frequent within a paradigm but much less frequent, perhaps nonexistent across paradigms. Hence, the followers of a paradigm tend to have their own journals, scientific societies, and meetings, because the paradigm has won their allegiance to an integrated set of concepts, variables, problems and methods."

A 'revolution' in the world of scientific paradigms occurs when one or several researchers at a given time encounter anomalies, for instance, make observation and reason as means of understanding behaviour. More simply, explanation proceeded by way of scientific description. It was Comte who consciously 'invented' the new science of society and gave it the name 'Sociology'. He thought that it would be possible to establish it on a 'positive' basis, just like the other sciences, which served as necessary preliminaries to it. For social phenomena were to be viewed in the light of physiological (or biological) laws and theories and investigated empirically, just like physical phenomena. Likewise, biological phenomena were to be viewed in the light of chemical laws and theories; and so on down the line. Comte's position was to lead to a general doctrine of positivism which held that all genuine knowledge is based on sense, experience and can only be advanced by means of observation and experiment. Following in the empiricist tradition, it limited enquiry and belief to what can be firmly established, thus abandoning metaphysical and speculative attempts to gain knowledge by reason alone. Positivist paradigm developed what has been described as a tough-minded orientation to facts and natural phenomena.

3.5.1 Aspects of Positivistic Paradigm

Positivistic paradigm has been defined in the last section. But its special features need to be explained. These are as follows.

Difficulty in Precise Meaning

Not only Comte but also many other scholars such as Bacon, Mill, Hume as well as the scholars of 'Vienna Circle' contributed to the development of the concept of positivistic paradigm. It is, therefore, difficult to assign it a very precise and consistent meaning. The term has also been applied to the doctrine of a School of philosophy known as 'logical positivism', originated by the scholars of Vienna Circle. Logical positivists hold that the meaning of a statement is, or is given by the method of its verification; unverifiable statements are, therefore, meaningless.

Assumption behind Positivistic Paradigm

Positivism derives its meaning from an acceptance of natural science as the paradigm of human knowledge. This has led to the development of the scientific method as a means of knowledge generation. Positive paradigm is, therefore, to be understood within the total framework of the principles and assumption of science.

First, there is the assumption of determinism, according to which events have causes and are determined by other circumstances; these causal links can eventually be uncovered and understood, and that the events are explicable in terms of their antecedents. The universe does not behave capriciously. It is the ultimate aim of the scientists to formulate laws to account for the happenings in the world around them, obtaining hereby a firm basis for prediction and control.

The second assumption is that of empiricism, which hold that certain kinds of reliable knowledge can only originate in experience which scientifically means that acceptance of a theory or hypothesis depends on the nature of empirical evidence for its support; 'empirical' here means that which is verifiable by observation. The viewpoint on empiricism may be summed up by saying that the best way to acquire reliable knowledge is the way of evidence obtained by direct experience. Thus, in an empirical science the scientist first gathers data on the basis of experience, then he classifies or if possible, quantifies data, tries to discover relationship in the classified and quantified data, and ultimately by gradual approximation he reaches the truth.

The third assumption underlying the work of the scientist is the principle of parsimony, the basic idea behind which is that phenomena should always be explained in the most economical way possible.

The fourth assumption is that of generality which forms the essential aspect of both the deductive and inductive methods of reasoning. Indeed, historically speaking, it was the problematic relationship between the 'concrete particular' and the 'abstract general' that results in two competing theories of knowledge — the rational and empirical. Beginning with observations of the particular, scientists set out to generalize their finds to the world at large. This is so because they are concerned ultimately with explanation. Of course, the concept of generality presents much less of a problem to natural scientists working chiefly with inanimate matter than to human scientists who, having to deal with samples of larger human populations, have to exercise great caution when generalizing their findings to the particular parent populations.

Having identified the basic assumptions of science, we come to the core question: What is Science? Science may be broadly defined as a way of comprehending the world, as a means of explanation and understanding, of prediction and control.

Science is based on certain beliefs and assumptions which are briefly stated as under:

(i) All events in nature are, at least to a degree, lawful and ordered, predictable and regular. This order, predictability and regularity of nature can be discovered through the activities of the scientific method.

(ii) Truth can ultimately be derived only from observation. Science does not depend upon authority as a source of truth but relies upon empirical observation. Thus the phenomena that can actually be observed to exist are within the domain of the scientific method.

(iii) The ultimate goal of science is to integrate and systematize findings into a meaningful pattern or theory which is regarded as tentative and not the ultimate truth. Theory is subject to revision or modification as new evidence is found.

Knowledge Generation Under Positivistic Paradigm

Positive paradigm has systematized the knowledge generation process, which proceeds as the development of a science. An area or a set of phenomena is brought under study or close scrutiny. Then the relevant factors and variables are identified. Research or study correlates the variables and parameters which may be found to be related to one another. Information about the phenomena under study is systematically integrated as theories begin to develop. If needed, the researcher may move from correlation to causality through systematic and controlled manipulation of variables (experimentation). This leads to establishment of a body of knowledge (theory) as the outcome of the study. Depending on the nature of the phenomena under scrutiny, laws may be formulated and systematized. Ultimately the established body of knowledge is used, according to necessity, in the resolution of problems or as a source of further enquiry.

3.5.2 Limitations of Positivistic Paradigm

Inspite of the scientific enterprise's proven success, especially in the field of natural sciences, its ontological (theory of being or of existence) and epistemological (theory of knowledge) bases have been the focus of sustained and sometimes vehement criticism. Beginning in the second half of the nineteenth century, the limitations of the positivistic paradigm were pointed out by the best intellectuals in Europe, that is, philosophers, scientists, social critics and creative artists; and even today opponents of positivism are made up of a similar cross-section, including many from within the ranks of the social scientists themselves. Essentially, it has been a reaction against the world picture projected by the positivistic paradigm which, it is contended, devalues life and mind. The fundamental limitation of the positivistic paradigm is that it reflects a mechanistic and reductionist view of nature which, by definition, excludes notions of choice, freedom, individuality, and moral responsibility. To quote a critique:

The positivistic paradigm or for that matter the mechanistic science eliminates the concept of life itself. All they can do is to define life in terms of biochemistry, biophysics, vibrations, wave lengths, and so on; they reduce 'life' to conceivable measurement, but such a conception of life does not embrace the most evident element of all; that life can only be known by a living being, by 'inner' experience. No matter how exact measurement may be, it can never give us an experience of life, for life cannot be weighed and measured on a physical scale.

The Danish philosopher, Soren Kierkegaard, the proponent of existentialism, also pointed out the limitations of the positivistic paradigm. Kierkegaard was concerned with individuals and their need to fulfill themselves to the highest level of development. This realization of a person's potential was for him the meaning of existence. But the characteristic features of the age, that is, democracy's trust in the crowd mentality, the ascendancy of reasons, scientific and technological progress – all militate against the achievement of this end and contribute to the dehumanization of the individual. Kierkegaard was convinced that people suffer from the illusion of objectivity which is one of the main masts of the positivistic paradigm. He wished to free people from this illusion. By 'objectivity' he meant the imposition of rules of behaviour and thought and the making of a person into an observer who is set on discovering general laws governing human behaviour. The capacity for subjectivity, he argued, should be regained. He regarded 'subjectivity' as the ability to consider one's own relationship to whatever constitutes the focus of enquiry.

The justification for any intellectual activity lies in the effect it has on increasing our awareness and degree of consciousness. This increase, come critics claim, has been retarded in our time by the excessive influence the positivistic paradigm has been allowed to exert on areas of our intellectual life. Thus, the positivistic paradigm demands that nothing must be regarded as real which cannot be founded by empirical science and rational methods by 'objectivity'. Since the whole problem belongs to 'psychic reality', to man's 'inner world', to his moral being, and to the subjective life, there can be no debate unless we are prepared to recognize the serious limitations of positivistic paradigm and the failure of strict adherence to 'objectivity' to give an adequate account of existence.

The theoretical perspective with which the positivistic paradigm has dominated the social science scene, seeks the facts or causes of social phenomena with little regard for the subjective states of individuals. The positivist considers social facts or social phenomena as things that exercise an external and coercive influence on human behaviour. The positivist searches for facts and causes through methods such as survey, questionnaires, inventories and demographic analysis which produce quantitative data, and which allow him to statistically prove relationships between operationally defined variables. The positivist is not interested in the subjective nature of human behaviour and therefore reduces people to statistical aggregates. And these are no less serious limitations.

Many critics of the positivistic paradigm question the perspective adopted by positivist social science because it presents a misleading picture of the human being. This biased and restricted image of humans comes about because the social scientists (wedded to positivism) concentrate on the repetitive, predictable and invariant aspects of the person, on 'visible externalities' to the exclusion of the subjective world. Another limitation of the positivistic paradigm is that it fails to take account of our unique ability, as human beings, to interpret our experiences and represent them to ourselves. We can, and do construct theories about ourselves and our world; moreover we act on these theories. In failing to recognize this, positivism is said to ignore the world in which the meanings are developed by active subjects through their life experiences.

The findings of positivistic social science are often said to be of little consequence to those for whom they are intended, namely, teachers, social workers, counsellors, personnel managers, and the like. The more effort, it seems, the researchers put

in to their scientific experimentation in the laboratory by restricting, simplifying and controlling variables, the more likely they are to end up with a 'pruned, synthetic and constructed version of the whole social reality.'

The limitations mentioned above are quite serious; but what alternatives have been shaped out to cope with these limitations? This is what is going to be outlined next.

3.4.3 Alternative Approaches to Development of Social Science Inquiry

The perspective of the researcher to view 'reality' and visualize appropriate modes of enquiry through which it can be observed, studied and understood, is heavily dependent on the ideological position one holds about these basic concepts and processes. This fact is at the root of the evolution of different methods of research and methodological emphases. The anti-positivist movement in different disciplines of the social sciences is represented by three schools of thought – phenomenology, ethnomethodology and symbolic interactionism. A common thread running through the three schools is a concern with phenomena, that is, the things we directly apprehend through our senses as we go about our daily lives, together with a consequent emphasis on qualitative as opposed to quantitative methodology.

Phenomenology

In its broadest meaning, phenomenology is a theoretical point of view that advocates the study of direct experience taken at face value. It sees behaviour as determined by the phenomena of experience rather than by external, objective and physically described reality. E. Husserl and A. Schutz are the main proponents of this school of thought. The distinguishing features of this view point are:

- A belief in the importance, and in the primacy of subjective consciousness,
- An understanding of consciousness as active, as meaning bestowing;
- A claim that there are certain essential structures to consciousness of which we gain direct knowledge by a certain kind of reflection. Exactly what these structures are is a point about which phenomenologists differ.

The phenomenologists believe that any phenomenon obtains because it is experienced. The experience provides meaningfulness to the phenomenon. The experience of individuals involved is, thus, an essential and integral part of the phenomenon. It is for this reason that the social phenomena, unlike natural phenomena, have an important component in human experience. The inclusion of this constituent of 'human experience' in the social phenomena makes them very different from natural phenomena.

The process of experiencing involves the interaction between social environment and the individual. During such interaction another significant process comes into play, namely, 'interpretation', through which meanings to different actions or ideas are attached and the experience constructed. It is this meaningfulness arrived at through defining and interpreting that makes the phenomenon a 'reality'. Getting to know the process of interpretation by individuals requires the researcher to develop empathic understanding. It is through this ability that the researcher can reproduce in his mind feelings, motives and thoughts that are behind the actions of others. This requires a researcher to view the other person's behaviour from the point of view of that reason.

To a phenomenologist, the situation under study is essentially unstructured, to which he has to give meanings through symbolic interaction and interpretation. In this process an individual's own consciousness plays an important role in comprehending the situation; relevant information, his perceptions of different elements in the situation, and a synthesized view of the situation, are utilized to arrive at perceiving symbolically meaningful objects which aid the process of understanding the situation. This demands taking into consideration the reaction of the individual, treating him as a person, and also knowing the perspective he holds, to view different elements of the situation for creating symbolically meaningful structures. Processing the situation data thus obtained leads to a gradual comprehension of it in the total context of the experience. In fact, this emphasis on experience and thus on experiencer's feelings and motives, makes objectification of data rather difficult and also unnecessary, since some relevant aspects of it are likely to be lost in the attempt of objectifying. It necessitates identifying and discerning the inner world of the individuals for understanding any phenomenon in the social environment. The essential structure of social phenomenon which involves social organization, social relationships, belief systems, value orientations, the resultant interactional patterns, refers to those elements which make the phenomenon. Individual's experience is an integral part of these elements. Also, the whole phenomenon is temporal and contextual. Any description of a social phenomenon made at a time, and in a given context of the larger social system, cannot be considered valid across varied conditions along the time dimension. Thus, the outcomes of pursuits of research with this perspective cannot be taken for generalizations in the form of context free or universal explanations. Moreover, it necessitates the need of reconstructing continuously what has been already studied, understood and described adequately. This feature of knowledge generation regarding social phenomena may throw light on the nature of knowledge and its structure in social sciences, and makes it distinct from the body of knowledge in natural sciences.

Ethnomethodology

Like phenomenology, it is concerned with the world of everyday life. According to its proponent, Harold Garfinkel, it sets out to treat practical activities, practical circumstances, and practical sociological reasoning as topics of empirical study and by paying to the most commonplace activities of daily life the attention usually accorded to extraordinary events, seeks to learn about them as phenomena in their own right. He maintains that the students of a social world must doubt the reality of that world; and that in failing to view human behaviour more skeptically, social scientists have created an ordered social reality that bears little relationship to the real thing. Ethnomethodology, thus, is concerned with how people make sense of their everyday world. More especially, it is directed at the mechanisms by which participants achieve and sustain interaction in a social encounter – the assumptions they make, the conventions they utilize, and the practices they adopt. Ethnomethodology, then, seeks to understand social accomplishments in their own terms; it is concerned to understand them from within. In identifying the 'taken-for-granted' assumptions characterizing any social situation and the ways in which the people involved make their activities rationally accountable, ethnomethodologists use notions like 'indexicality' and 'reflexivity'; the former refers to the ways in which actions and statements are related to the social contexts producing them, while the latter refers to the way in which all accounts of social settings – descriptions, analyses, criticisms, etc., and the social settings occasioning them are mutually interdependent.

Symbolic Interactionism

The notion of symbolic interactionism essentially derives from the work of G.H.Mead. The noted researchers such as Blumer, Hughes, Becker and Goffman were subsequently associated with this school of thought. It is possible to identify the following three postulates of this viewpoint.

First, human beings act towards things on the basis of the meanings they have for them. Humans inhabit two different worlds: the 'natural' world wherein they are organisms of drives and instincts and where the external world exists independently of them, and the social world where the existence of symbols, like language, enables them to give meaning to objects. This attribution of meanings, this interpreting, is what makes subjective meanings and the symbols by which they are produced and represented. This means not making any prior assumptions about what is going on in an institution, and taking seriously, indeed giving priority to, inmates' own accounts.

Second, this attribution of meaning to objects through symbols is a continuous process. Action is not simply a consequence of psychological attributes such as drives, attitudes, or personalities, or determined by external social facts such as social structure or roles, but results from a continuous process of meaning attribution which is always emerging in a state of flux and subject to change. The individual constructs, modifies, pieces together, and weighs up the pros and cons and bargains.

Third, this process takes place in a social context; individuals align their actions to those of others. They do this by 'taking the role of the other', by 'making indications to themselves about others' likely responses. They construct how others wish or might act in certain 'circumstances, and how they themselves might act. They might try to 'manage' the impressions others have of them, put on a 'performance', try to influence others' definition of the situation.

Instead of focusing on the individual, and his or her personality characteristics, or on how the social structure or social situation causes individual behaviour, symbolic interactionists direct their attention at the nature of interaction, the dynamic activities taking place between people. In focusing on the interaction itself as a unit of study, the symbolic interactionist creates a more active image of the human being and rejects the image of the passive, determined organism. Individuals interact; societies are made up of interacting individuals. People are constantly undergoing change in interaction and society is changing through interaction. Interaction implies human beings acting in relation to each other, taking each other into account, acting, perceiving, interpreting, acting in relation to each other, acting again. Hence, a more dynamic and active human being emerges rather than an action merely responding to others.

A Critical Overview of the Approaches

For the purpose of this overview, we term the phenomenological, ethnomethodological and symbolic interactionist perspectives commonly, as the phenomnological perspective or approach and make the following observations:

a. The way in which 'reality' is preceived in social situations with the phenomenological perspective is an artifact, a construction of all the participants of a social situation which, however permanent it may appear to be, may be redefined and, therefore, changed. It is assumed that the human mind has

an inherent capacity to define reality and interpret it and therefore, understand and describe it with related referents and contexts in which it operates. If it is further assumed, which many researchers do, that the whole process of defining 'reality' in its due context can be examined by another technical and willing person and assuming still further that the two could have identical or similar orientations in perceiving reality, they are likely to arrive at similar conclusions. The strength of the argument lies in that even if they do not arrive at similar conclusions, this suggests some way to judge the validity of the approach.

b. If the position of the phenomenological perspective and the contribution of the approach to the process of knowledge generation are examined, one notices some ambiguity as an alternative approach to what positivists have suggested. The emphasis on the involvement of the observer and his perceptions leaves the whole process of research and its outcomes transitory.

c. The process through which the individual observer may form his perceptions, and even define the reality and understand it, leaves scope for giving emphasis upto some degree, to certain views or feelings and ideas that may be dear to her/him. In fact, this is an essential feature of the phenomenological approaches. This may allow not only the scope for utilization of ideas and concepts in defining and understanding in a detached manner but may also get reflected in the very understanding and description of the reality. For instance, how equality of opportunity is defined and described in a social context cannot be free from one's view about certain matters which are of paramount importance socially and can lead to very varied conclusions depending upon how he utilizes his views for fixing the social parameters and develops the logical process to define it. At times, it may even run the risk of giving ventilation to the researcher's slanted views even if he is a man of integrity because the cognitive process in him is not free from what he holds about a social situation and what he thinks others do about the same situation.

d. The foregoing observations about phenomenological approaches in general highlight mainly two points. One, these approaches emerged mainly as a strong reaction to the positivist approach of using the paradigm of natural sciences in social sciences. There is a powerful appeal in their argumentation in discarding the positivists' scientific method as inadequate and inappropriate to understand social phenomenon. While phenomenologists can be legitimately credited with highlighting some very essential aspects regarding reality and the process of describing it, a very perceptive mind in a researcher may easily find the points at which they are ambiguous, vague and less convincing as far as the adequacy of the approach to contribute to the process of knowledge generation is concerned. Two, the approaches advocated by the positivists and phenomenologists are based on very conflicting premises and no doubt, each one holds some promise in the pursuit of knowledge generation. However, their inadequacies should suggest the scope for further thinking and continued search for new paradigms or modified ones to serve as more adequate tools of research.

Check Your Progress Exercise 3

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. What is positivistic paradigm?

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2. List the limitations of the positivistic paradigm.

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3.6 EMERGENCE OF FIELD METHODS

Earlier we have outlined two broad approaches to research. The first, based on the scientific (positivistic) paradigm, rests on the creation of theoretical frameworks that can be tested by experimentation, replication and refinement. Against this scientific, experimental approach, we have outlined an alternative perspective which has been described as interpretive and subjective, a focus we hasten to add that should be seen as complementing rather than competing with the experimental stance. In this section our presentation emphasizes the interpretive, subjective dimensions of counselling and family therapy practice and research that are best explored by case study method, projective technique and anecdotal records method.

Emergence of these methods which may be considered as field methods is, thus, a fall-out of the acceptance of interpretive approaches in social science research. Since the scope of controlled experiment is very limited in social sciences, the use of natural experimentation or field methods is the most reasonable way-out. Under these methods, the researcher has to make a field study or survey in order to collect research materials or data. The phenomenon is empirically studied and examined, and a conclusion is finally arrived at regarding the cause and effect of the phenomenon. Obviously all these methods are based on observation. Consequently, field method is a some what open-ended term that concerns not only techniques but also methodology and research procedure. The various elements involved might be defined as follows: 'general methodology' concerns the systematic and logical study of the general principles guiding an investigation. 'Research strategy or research procedure' refers to the way a particular investigation

is designed and carried out. 'Research technique' is a particular fact-finding manipulative operation that is used to yield social data. These three distinct aspects of 'field method' are brought together in the research process as they are intertwined with each other in the course of any social investigation. 'Field method' is not an exclusive method in the same sense, as say, experimentation is. Field methods are more like an umbrella of activities beneath which any technique of research may be used for gaining the desired information regarding the investigation.

3.6.1 Case Study Method

Case study can be defined as an in-depth study which is concerned with pertinent aspects of a particular unit or situation. The unit under study may be an individual, a social institution or an agency such as a family, a library, a school, a college, or a rural village etc. The case to be studied may be some phase of the life history of the unit of attention, or it may represent the entire life history or total functioning of the individual unit. Thus, the case study method involves the collection and recording of data about a case. The collection of data on site is termed as 'Field-work' and it involves:

(a) generally, participant or non-participant observation and interviewing;

(b) probably, the collection of documentary evidence and descriptive data, and even the administration of tests or questionnaires; and

(c) possibly, the use of photography, motion pictures or videotape recording.

Thus, whatever the problem or the approach at the heart of every case study lies a method of observation – participant or non-participant. In participant observation, observers engage in the very activities they set out to observe. Often their 'cover' is so complete that as far as the other participants are concerned, they are simply one of the group. To have better insight into the life of a gang of juvenile delinquents, going to live with them for an extended period of time, is a good example of participant observation. Non-participant observers, on the other hand, stand aloof from the group activities they are investigating. The best illustration of the non-participant observer role is perhaps the case of the researcher sitting at the back of a classroom coding up every three seconds the verbal exchanges between the teacher and the pupils by means of a structured set of observational categories.

The critics of participant observation as applied to case study or any other field method point out that observers may lose their perspective and become blind to the peculiarities that they are engaged to be investigating. These criticisms raise questions about two types of validity in observation-based research. In effect, comments about the subjective and idiosyncratic nature of the participant observation study are to do with its external validity. How do we know that the results of this one piece of research are applicable to other situations? Fears that observers' judgment will be affected by their close involvement in the group relate to the internal validity of the method. How do we know the results of this one piece of research represent the real thing, the genuine?

Many counselling and family therapy situations or problems involve such a complex interaction of variables that there seems to be an urgent need for analyses based on close observation. Case study method may be seen as a response to this need for a return to close natural observation, or as a reaction against the positivist epistemiology implied in the psychostatistical paradigm. Case study methods are often described as naturalistic, qualitative, descriptive, responsive, and interpretative

or idiographic by way of contrast to the abstracted, quantitative approach of psychostatistical methods that strip observation to indices.

3.6.2 Projective Techniques

Projective techniques are used to probe areas that cannot be reached easily by other means or areas in which direct questions are apt to elicit distorted data. Instead of asking a subject for specific information, an investigator has to interpret or respond freely to ambiguous stimuli, such as ink-blots, pictures, unfinished sentences, work associations or life like dramatic roles. Each of the above mentioned types of stimuli has given rise to a particular type of projective test or technique, such as Thematic Apperception Test, Rorschach Ink-blot Test, Word Association Test, etc. Through self-structured, spontaneous responses, the subject unconsciously reveals manifestation of his personality characteristics and organization. Only highly trained workers can interpret the implications of these responses, and scoring them is laborious. Projective tests are difficult to validate, and many of the tools have not been standardized. Some weaknesses in them are being overcome, but much work remains to be done.

3.6.3 Anecdotal Records

In order to have better insight into certain unusual aspects of emotional and social behaviour, anecdotal records may be kept in a cumulative way. For intance, anecdotal materials have come to be a significant part of evaluation and counselling activities in schools. A type of cumulative individual record which emphasizes episodes of behaviour important in the development of character or personality is known as *anecdotal-behaviour journal.* These anecdotes include not only maladjustment, but also positive and constructive episodes, the admirable behaviour of well-adjusted children and the outstanding accomplishments of the superior or talented. The anecdote as a revealing episode of conduct is in the form of a work picture or verbal snap-shots. To be most helpful, anecdotes should possess the characteristics of objectivity, factual emphasis, clarity and subjectivity (in the sense that an artistically composed photograph is subjective, with a centre of attention and with subordination of inconsequential details). Anecdotal records serve useful purposes by way of mutual understanding between teachers and pupils, counselling relationships, appraisal of learning outcomes and case instructions in professional programmes.

Check Your Progress Exercise 4

Note: a) Read the following question carefully and answer in the space provided below.

b) Check your answer with that provided at the end of this Unit.

1. Name at least three field methods.

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3.7 LET US SUM UP

In this Unit, we have understood that there are several means of generating and acquiring knowledge, *viz.*, experiences, authority, customs and traditions. We have noted that all these means have developed historically over time and each one has its own limitations as a source of generating knowledge. We have also seen that the scientific method combines inductive and deductive methods of reasoning, and hence its efficacy as a means of acquiring knowledge. The content of this Unit includes the impact of knowledge generation through scientific approach which ultimately opened up different newer fields of study. In reaction to positivistic paradigm, non-positivistic approaches gradually made their presence felt in social sciences.

3.8 GLOSSARY

Case-study method : An in-depth study which is concerned with pertinent aspects of a particular unit or situation.

Epistemology : Theory of knowledge.

Syllogism : A thinking process in which one proceeds from general to specific statements by deductive thinking.

3.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1. Various sources of knowledge are:
   - Life experiences,
   - Authority,
   - Customs and traditions,
   - Deductive reasoning, and
   - Inductive reasoning.
2. A syllogism can be described as a thinking process in which one proceeds from general to specific statements by deductive thinking. It provides a means of testing the validity of any given conclusion or idea by proceeding from known to unknown.

Check Your Progress Exercise 2

1. The scientific method is a back-and-forth movement of thought in which one first operates inductively from partially known or sometimes confused information learned from experience, previous knowledge, observation and so on towards a meaningful whole or hypothesis, and then deductively from suggested whole or hypothesis to the particular parts in order to connect

these with one another in a meaningful pattern to find relationships.

2. The five important steps of scientific method are:

   i) Identification and definition of the problem,

   ii) Formulation of a hypothesis,

   iii) Testing and implication of hypothesis through deductive reasoning,

   iv) Collection and analysis of evidence data, and

   v) Verification, rejection, or modification of hypothesis.

Check Your Progress Exercise 3

1. Positivistic paradigm of knowledge generation is based on the philosophical ideas of the French Philosopher, Auguste Comte, who considered observation and reason as the means of understanding human behaviour. In this approach all genuine knowledge is based on sense experience and can be only advanced by means of observation and experiment. It has been described as a 'tough - minded orientation to facts and natural phenomena'.

2. The following are the limitations of Positivistic Paradigm:

   (i) The theoretical perspective which has dominated the positivistic paradigm seeks the facts or causes of social phenomena with little regard for the subjective states of individuals,

   (ii) In positivistic paradigm social facts or social phenomena are considered to be the things that exercise an external and coercive influence on human behaviour,

   (iii) The positivist searches for facts and causes through methods such as survey, questionnaire, etc. which produce quantitative data. It allows him to statistically prove relationships between operationally defined variables, thus reducing human behaviour to statistical aggregates,

   (iv) Positivistic paradigm presents a misleading picture of the human being because it concentrates on the repetitive, predictable and invariants of the person (i.e. on his visible externalities) to the exclusion of the subjective world. It ignores the world in which the meanings are developed by active subjects through their life experiences, and

   (v) The positivist puts more effort in scientific experimentation which are likely to end up with a pruned, synthetic and constructed version of the whole social reality.

Check Your Progress Exercise 4

1. The three types of field methods are:

   (i) Case study method,

   (ii) Projective techniques, and

   (iii) Anecdotal records.

3.10 UNIT END QUESTIONS

1. Interview some senior students of a school and college to know from them what they learnt from following the customary and traditional practices like dressing, particular ways of behaving with children, peers and superiors. Analyze the content of the interview and bring out "Customs and Traditions' as a source of acquiring knowledge in life.

2. Talk to some researchers in counselling and family therapy and try to find out how they came upon their problems of research and how they attempted to systematically plan to study their problems. Analyze the content of your 'talk' and try to carve out the structure of the scientific method employed by the researchers in studying and solving their problems.

3. Group discussions with your peer group may be held on the following topics:

   a) Life experience is a better source of acquiring knowledge than inductive and deductive reasoning.

   b) Is the scientific method the best means of acquiring knowledge?

3.11 FURTHER READINGS AND REFERENCES

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UNIT 4 FORMULATION OF RESEARCH PROBLEMS

Structure

4.1 Introduction

4.2 Nature of a Problem

4.3 Identification of a Research Problem

4.4 Sources for Selecting a Research Problem

- 4.4.1 Theory
- 4.4.2 Experience
- 4.4.3 Discussion
- 4.4.4 Dissatisfaction
- 4.4.5 The Literature

4.5 Definition and Statement of the Problem

4.6 Research Questions

- 4.6.1 Formulation of Research Question
- 4.6.2 How to Specify the Delimitation
- 4.6.3 How to Frame Question Statement
- 4.6.4 Suggestions for Formulating Research Questions
- 4.6.5 Characteristics of Research Questions
- 4.6.6 Objectives of Research Questions

4.7 Meaning of the Hypothesis

4.8 Sources of Hypothesis

- 4.8.1 Experience and Creativity of the Researcher
- 4.8.2 Background Knowledge
- 4.8.3 Versatility of Intellect
- 4.8.4 Analogies
- 4.8.5 Scientific Theory
- 4.8.6 Authentic Knowledge

4.9 Types of Hypothesis

- 4.9.1 Directional and Non-directional
- 4.9.2 Research Hypothesis and Null Hypothesis

4.10 Testing of the Hypothesis

4.11 Characteristics of a Good Hypothesis

4.12 Significance and Importance of a Hypothesis

4.13 Let Us Sum Up

4.14 Glossary

4.15 Answers to Check Your Progress Exercises

4.16 Unit End Questions

4.17 Further Readings and References

4.1 INTRODUCTION

Research is an effort to seek answers to questions confronting the researcher. It seeks answers to questions, which have not yet been answered. Research helps in the development of generalizations, principles or theories, which open either new vistas of understanding in the relevant field of knowledge, or helps in verifying the existing knowledge. The research questions can be of quantitative or qualitative nature, and both require collecting the relevant data, their analysis and interpretation so as to arrive at some conclusion which provides the solution to a problem.

Research is a gateway to new knowledge that obviously depends on how meaningfully the problem has been identified and research questions have been answered. In the beginning, a researcher has problem blindedness and perceives a very diffused, vague and a general view of a problem. Hence, the identification of a problem is the most important and difficult step in the research process. It is a most thoughtful effort, even a little carelessness on the part of the researcher spoils the spirit of research. It is a systematic attempt to obtain answers to meaningful questions about a phenomenon through the application of scientific procedures. Problem identification and its formulation is inventive and individualistic rather than routine and mechanical. The identification of a research problem requires a great deal of patience and logical thinking on the part of the researcher. A beginning researcher finds the task of identifying a research problem a djfficult one. This may be due to his limited knowledge of the research process and his unpreparedness for identifying the problem. He may also be unfamiliar with the areas in which research is needed and the procedure he is to follow for selecting a suitable field for research.

In this unit you will study about the nature of the research problem and its identification by using various sources. You will also understand the criteria for selecting a suitable problem for research. The suggestions for formulating research questions will also be explained to you.

Objectives

After studying this Unit, you will be able to:

- Discuss the nature of research problem;
- Identify and select the problem of research;
- List the criteria of selecting a suitable problem of research;
- Discuss the nature of research questions; and
- Explain the meaning of hypothesis, what is its importance and types of hypotheses.

4.2 NATURE OF A PROBLEM

There are two types of research problems: viz. those which relate to the state of nature and those which relate to the relationship between variables. For example, a problem stated as "Epistemological Realities in the Panchtantra" is a problem, which discovers the sources of knowledge in Panchtantra; hence,

it is classified in first category of research. If the problem is stated as "the effect of television viewing on the values of children', the study explains the relationship between variables i.e. television viewing and values of children, hence, it is classified in the second category of research. Thus, the problem of research should be such which will help in theory building, making generalizations, formulating principles that will form the basis for future generation of knowledge besides making an original contribution to the respective field of knowledge.

It has to be further seen whether the nature of research is quantitative or qualitative, since the problem formulation varies as the nature of research varies. Under this classification various other types of researches fall. For example, experimental and survey type of researches fall under quantitative researches whereas historical, ethnic and philosophical fall under the qualitative research. The following examples will make the distinction between qualitative and quantitative research more clear.

Quantitative Research

'A comparative effect of inductive and deductive methods of teaching on the development of problem solving skills among 8lh grade students' (Experimental Research)

'A study of values of secondary school teachers in relation to their socio-economic status' (Survey Type Research)

Qualitative Research

'Development of Higher Education in Post-independent India' (Historical Research)

'Multicultural analysis of attitudes towards education' (Ethnographical Research)

'Metaphysical study of the literature of Swami Vivekanand' (Philosophical Research)

The essence of research, moreover, is to arrive at dependable solutions to the problem through a well thought out scientific procedure, This purpose is only served when the problem:

- Aims at arriving at dependable solutions to the problem,
- Makes useful generalizations and theory development,
- Provides insight into the hypothesis formulation,
- Provides the direction for the choice of research design,
- Helps in wiseful choice of statistical or other relevant methods of interpretations. Kerlinger (1993) states the following three criteria of a good problem:
  - ☞ It should express a relationship between two or more variables,
  - ☞ The problem should be stated clearly and unambiguously in question form, and
  - ☞ Statement of a problem must be such to imply possibilities of empirical testing.

Hence, a research problem which does not survive the above salient features can not be considered useful and worthwhile. A large part of the solution lies in knowing what one is trying to do. Another part lies in knowing what a problem is and especially what a scientific problem is.

Check Your Progress Exercise 1

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. What are the two types of researches?

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2. What are the characteristic features of a research problem?

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3. State the criteria for a good research problem.

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4.3 IDENTIFICATION OF A RESEARCH PROBLEM

Clear and concise identification of the problem is not an easy matter. Some research studies are pursued in such a way that it is difficult to determine what the researcher is trying to investigate. A most challenging situation for a researcher occurs when s/ he feels bewildered and suffers with diffused perceptions of the situations amenable to research. Identification of a research situation is an important phase of the entire research process. It demands a great deal of thinking, searching and speculating on the part of a researcher. It consumes a lot of energy, time and effort. A beginning researcher finds it very difficult as to how to locate the problem situation. This may happen because s/he has limited knowledge of the research process. S/he may be unfamiliar with the areas in which research is needed and the procedures that she/he has to follow to identify a suitable area of research. Novice investigators have an unrealistic,

glamorized conception of research problem. An investigator should follow the following major tasks in analyzing a problematic situation (VanDalen, 1973):

i) Accumulating the facts that might be related to the problem,

ii) Settling by observation whether the facts are relevant,

iii) Tracing any relationship between facts that might reveal the key difficulty,

iv) Proposing various explanations for the cause of the difficulty,

v) Ascertaining through observation and analysis whether these explanations are relevant to the problem,

vi) Tracing the relationship between explanations that may give an insight into the problem solution,

vii) Tracing the relationship between facts and explanations, and

viii) Questioning assumptions underlying the analysis of the problem.

The researcher, for instance, may face problems in classrooms, in administration of a college and in all *other* areas of education such as the teaching-learning process, guidance and counselling, curriculum, textbooks, physically and mentally challenged children, etc. A research problem must be firmly rooted in knowledge. The researcher should first identify a general area in which s/he wishes to do research and then immediately set about reviewing the knowledge available in that area.

The researcher must first decide the area of his/ her interest and the purpose of her or his research endeavours. It must be the area of research where the researcher is capable of demonstrating necessary initiative, insight, critical analysis and judgemental capacities.

The identification of a problem situation follows the following procedural efforts on the part of a researcher:

- The understanding of the known theories, facts and ideas in the field of researcher's interest structures his/ her problem searching domain. The research focus is sharpened by what he already knows, what researches in his field have been conducted and what needs to be discovered.
- A problem situation of research may emerge from the researcher's curiosity about something shared, seen, felt or wondered about or through the natural interest of a researcher.
- Life situations, relationships established by related researchers and implications advanced by technological advancements constitute the problem situation.
- New knowledge in the field of researcher's interest coming through the new arrivals of books, journal and researches extend a situation for research.
- A survey of suggestions for further research given at the end of research reports and reviews of research projects, the gaps which are there in a particular field of educational research are helpful in keeping the researcher informed about what researches are going on in the field in which he has the competence and deeper understanding.

Check Your Progress Exercise 2

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. What difficulties are faced by a beginning researcher?

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2. List the major tasks involved in identifying a problem situation.

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3. Give details of the efforts made by researchers to identify a problem situation.

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4.4 SOURCES FOR SELECTING A RESEARCH PROBLEM

After the broad area of research interest has been identified, the researcher will proceed towards narrowing it down o a highly specific and focused research problem. The problems do not germinate in barren brains but rather in minds enriched by varied experiences and fertile layers of knowledge. Reading educational publications extensively will help to prepare an intellectual soil in which problem ideas are likely to sprout. There are various sources which are available to researchers and which help them to identify and specify the meaningful problems of research. These are mainly:

- Theory
- Experience

- Discussion
- Dissatisfaction
- Literature

4.4.1 Theory

Scientific conceptions of the nature of things involve theories. The researcher should have some understanding of the nature of theory and should avoid trying to build theories that are too sophisticated. Theory is a set of generalizations arrived at by carefully analysed and studied phenomena. The inferences that are drawn from psychological and educational theories when known to a researcher help in identifying the research area.

The application of principles that are derived from theories extend an authentic ground to locate the problem. For example, theories of learning, personality and motivation etc. have provided research initiatives that were used to improve upon the classroom teaching-learning situations, curriculum designing and evaluation in the field of education. Therefore, the important source of the research problem lies in the inferences that can be drawn from various educational and psychological theories. The application of general principles involved in various theories to a specific classroom situation makes an excellent starting point for research and it will help to determine whether a particular theory can be translated into actual practice and also the validity, scope and practicability of various theories in educational situations. For example, if the 'Effect of Basic Teaching Model on a Teacher's Performance in Class' is to be studied, the theory on which this model is developed becomes an important reference. Moreover the theory:

- explains the phenomena under research proposed,
- permits the prediction of the occurrence/non-occurrence of the phenomena,
- enables the investigator to postulate and eventually to discover hitherto unknown and unobserved phenomena,
- explains the relationship among various components, facts and principles,
- pinpoints the crucial aspects to be investigated and crucial questions to be answered, and
- helps the researcher to structure and restructure the domain of understanding,

Research and theory go together. If research is conducted without consulting a theory, it means that many essential aspects of theory that could guide and control the researcher's efforts are ignored. If the researcher intends to work in the domain of teaching and learning, then learning theories by Pavlov and Skinner provide a frame of thinking as to how the researches in the area can be designed. Theory, of course, does not provide answer but it stimulates and controls research.

4.4.2 Experience

The best single way for a researcher to find a good research problem is to attach himself/herself to a dynamic research environment, which increases the opportunities for finding and solving problems. Spirited intellectual discourses, in which ideas are presented, explained, analysed and challenged is a rich source of inspiration.

Attending professional meetings particularly those in which papers are read and discussed, conferences with stimulating professors, lectures by eminent educationists, discussions with fellow research workers, part time job in research worthy of investigation provide clues needed for the solution of problems. Professors and research experts who have had experience in tackling a particular type of problem can help in telling the novice what can and what cannot be successfully accomplished.

Examining the everyday experiences gives and inspires an idea about a problem. Thus, as a result of participating in various academic activities and interacting with researchers, fellow teachers, a researcher may confront problems of various nature; they may be psychology based, sociological, behavioural, administrative etc. The personal experience which the researcher gains help him/her in the following ways:

- develops insight into sharpening the focus of research,
- experiences the relative usefulness of various issues that emerge in his/her mind for research,
- explores the context for innovative researches,
- formulate the research problem more meaningfully and practically,
- equips the researcher with such understandings that she or he is able to identify the problematic situations, behaviours and issues for which solutions are not available and which need to be researched, and
- becomes a wiser researcher.

Thus, the personal experience that the researcher gains is a potential source of research problems to be identified and formulated. Experience is a great teacher. You can formulate a research problem based on your own experience or experiences of persons associated with you. Thus, you may decide to focus on aspects such as the significance of the presence of the whole family in psychoeducation pertaining to a family member's physical illness; role of the father in counselling; impact of a couple's interpersonal relationship on their child; mass media influence on adolescents etc.

4.4.3 Discussion

Discussion works as a brainstorming exercise. It helps in settling a problem. While discussing with researchers, professors and other intellectual persons, the shrinkages of mind are opened and then there is a germination of a seed of a new problem.

These discussions give chances to the researcher to get into close contact with crucial problems and issues. The researcher finds a group of individuals working enthusiastically on some enterprise and some of their enthusiasm will rub off on him/her. Sometimes researchers have problems in their mind but they are not able to verbalise and give proper shape to the problem. It is discussions with his or her fellows and other senior professors that help him/her to evolve a manageable research problem from the one which was very vague and complex. Discussion is a very useful resource of research problem identification.

The following are some of the advantages which the researcher gets out of discussion:

- Contemporary research areas capture the mind of a researcher.
- Certain ambiguities that the researcher initially has get clarified.

- The researcher is helped with new academic inputs to reflect upon problem situations and to come out with suitable research problem identification.
- Many unknown hazards that the researcher may experience while identifying a problem situation become known to him / her.
- The meaningfulness of the research problem in the mind is further judged, e.g. whether this research problem will make a significant contribution to the existing knowledge or not.
- The researcher may be able to make a clear classification as to how to classify her or his problem–whether it will be fundamental, applied or action research.

4.4.4 Dissatisfaction

When a researcher attempts the identification of problem, she or he has to go through various situations–some satisfying and some dissatisfying. Research is a felt need of a researcher. Need itself leads to inadequacy and this inadequacy activates the researcher to design a course of action through which that need is fulfilled. The inadequacies and incompatibilities create dissatisfaction within the researcher for which she or he tries to identify the problem, which clearly shows the direction to the solution of a problem. After the researcher perceives the problem, for its proper identification and formulation she or he reviews the literature, discusses with people, consults recent books and journal and traces some flaws, gaps and inadequacies in his thinking. She or he may find it difficult to give a proper shape to her or his thinking and it becomes a gigantic task for her or him to formulate research questions. The dissatisfaction thus created, becomes a rich source of inspiration.

While working in the institutions, reading good books related to the problem area, the researcher is confronted with many dissatisfying situations that makes her or him problem sensitive, she or he then thinks about a problem, and comes out with a proper identification and formulation of the research problem. These days information and communication technology has revolutionized almost every aspect of human life, consequently posing new challenges and input for thinking. The researcher experiences dissatisfaction in herself or himself when she or he comes out with such problem situations as the impact of these technologies on human life.

4.4.5 The Literature

The review and the survey of literature may help the researcher to expand her or his knowledge background, examine new findings in her or his field, identify gaps in knowledge, and discover contradictions in findings and the need for fresh studies and their direction. Through her or his various readings she or he comes to know about various methods and techniques of research used by other researchers, learn about facts, phenomena, concepts, theories related to her or his field of research which may be useful to her or him in the formulation, description and conduct of her or his study. The source literature consists of surveys, periodicals and journals, foreign and Indian books, encyclopedias, dictionaries, handbooks and year books, bibliographical literature and other references.

Check Your Progress Exercise 3

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with that provided at the end of this Unit.

1. What are the variours sources of problem identification?

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2. Explain the contexts where experience helps the researcher.

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3. Mention any three important advantages of discussion as a source of research problem identification.

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4.5 DEFINITION AND STATEMENT OF THE PROBLEM

After the problem has been identified the next step is to state or define it in a form amenable to research. To define a problem means to put a fence around it, to separate it by careful distinctions from like questions found in related

literature and situations the researcher must be certain that he knows exactly what his problem is before he begins work on it. Specifying a problem explicitly and narrowing it down to a workable size are extremely important at the very start. In the formal definition of the problem, the researcher is required to describe the background of the study, its theoretical basis and underlying assumptions, and state the problem in concrete, specific and workable questions.

A good statement of a problem must clarify exactly what is to be determined or solved. In stating a problem, the researcher should see that it is neither stated in so general terms as to become vague, with no clear indications of the direction the study is to take, nor specified so narrowly as to become insignificant and trivial. The problem should be stated in such a way that it indicates a relationship between two or more variables. It should neither involve philosophical issue, nor values, or judgemental questions that cannot be answered by scientific investigation.

4.6 RESEARCH QUESTIONS

4.6.1 Formulation of Research Questions

A good statement of a problem must restrict the scope of the study to specific and workable research questions. These questions are the questions that the researcher would like to be answered or addressed. Research questions are the more specific situations from a general presentation of ideas. A researcher begins with a broad formulation of a problem, for example 'Information Technology'. From this he/she moves to a specific situation like 'Role of Information Technology' in developing teaching models. To study this problem, the researcher then reformulates the problem into a statement of intent or purpose 'how information technology contributes to developing teaching models'. After this, the investigator still requires to narrow the intent to a specific question, "Can information technology help in the development of teaching models?"

Thus after having studied a lot in the area of her or his interest, the researcher tries to ultimately decide what exactly should be her or his problem of research. It is not always possible for the researcher to formulate her or his problem simply, clearly and completely. She or he may often have only a rather general, diffused and even vague notion of the problem. This is in the nature of the complexity of scientific research. If the problem has been formulated in either in a broad manner or in a narrow way it gives results which are either very vague or very trivial. This is the stage when she or he finally chooses or states the problem. The formulation of a problem needs the choice of a format of the problem whether the researcher will state the problem in question form or in simple statement. For example, 'What is the effect of innovative methods of teaching on the academic achievement of children?' This problem is in question form. The other format may be 'A study of psycho-social factors leading to the deterioration of values among adolescents' in a statement form.

An important consideration underlying the final statement of research problem is that it must be feasible and tenable. For example 'The role of teacher in the cognitive development of children' is a problem that cannot be studied. In fact it is not an answerable problem. It can, however, be made researchable by restating it as 'A study of the relationship of teaching style and problem solving behaviour of children'. It is specific, precise and trimmed to manageable size.

4.6.2 How to Specify the Delimitation

Before the research problem is carried out, it should have boundaries, which give an ample opportunity to view it from varied vistas, and also suggest the most promising approach to it. The researcher must eventually formulate one or more precisely stated research questions about a particular problem not in a fuzzy state of understanding. However, the following procedure may be followed to delimit the research question from a broad area of research.

- A preliminary explanation of the facts and theories relating to the problem area should be conducted.
- Specification of the variables that have to be exactly studied and delimited e.g. intelligence and creativity. At the time of defining them, many problems come up such as: are all the indicators of intelligence related to creativity? What indicators of creativity should be taken in this investigation? Which indicators of intelligence are related to creativity? What precisely are the factors related to the investigation? etc.
- Indication of relationship between one or two variables.
- The selected problem should not be too broad or too narrow.
- Trimming of an investigation to a manageable size, to fewer variables, to a smaller geographical area, sample and segment of time. The researcher may break down the original problem into several sub-problems or sub-questions. Sometimes two or more sub-questions are incorporated in one study. Because of time, cost and other considerations the researcher may have to reduce the scope of his investigation. Therefore, the problem should be specified in following aspects:
  - Certain variables
  - Size of sample
  - Nature of sample
  - Method and design indicated
  - Tools and techniques
  - Geographical area

The following example will illustrate how delimitations are specified:

What is the effect of levels of socio-economic status on the academic achievement of 8th grade researchers?

In this research question variables have been specified that is socio-economic status and academic achievement are the variables, sample that is 8th grade students have been delimited and then what is to be done is also specified.

Thus, the delimitations are observed in terms of variables, sample, tool, statistical techniques, etc.

4.6.3 How to Frame a Question Statement

The purpose of statement of research is narrowed in the form of research question statement. Question statements are interrogative statements that narrow the purpose

statement to specific questions that researcher seeks to answer in her or his study. In both the types of research, quantitative and qualitative, question statements are framed. In quantitative research, the question statement explains the relationship among variables while in qualitative research, the question statement includes a central phenomenon to be explored. Research questions are typically framed at the end of the introduction of the statement of the problem section or immediately following the review of literature.

While formulating a research question, the following process is tenable:

- Pose a question
- Begin with how, what or why
- Specify the independent, dependent and control variables or specify a phenomenon.
- Use such words as describe, compare, relate or indicate the action or connection among the variables.
- Indicate the sample population.

Three popular forms are available to frame the question statement that is question, relationship and comparison. The following examples appropriately explain the three forms of question statement.

Question form

How can Computer Assisted Learning (CAL) foster better student learning?

Relationship form

What psycho-social factors relate to cognitive development of children?

Comparison

What is the comparative effect of inductive and deductive methods of students on the achievement of 8th grade students in mathematics?

4.6.4 Suggestions for Formulating Research Questions

Adequate formulation of research question statement is one of the most important parts of research. At a point of time when question statement is framed, the researcher must not have lost sight of the ultimate desirability and necessity of doing so nor should any difficulty be used as a rationalization to avoid stating the problem. The research questions differ greatly and there is no one right way to state them. Certain characteristics of problems and problem statements can be learned and used to good advantage. However, there are some suggestions, which if followed, result in good research question statements being framed:

- Research questions must explain the relationship among variables.
- Research questions should not be vague for example what is the issue of illiteracy?
- Specific problem to be solved must be indicated e.g. what is the effect of intelligence on achievement.

- Research questions should be researchable and feasible. These must be within the reach of a researcher and must contribute to the quantum of knowledge.
- It must specify the activities of the researcher. A good research question monitors the researcher's efforts.
- It must not involve any philosophical issue or value judgement.
- It should be observed that the problem's solution fills the gap in the existing knowledge or helps to fill the gap in the existing known facts or to resolve some of the inconsistencies or the interpretation.
- The scope of the investigation or the limits within which the problem is to be studied must be mentioned explicitly in stating a research problem.

4.6.5 Characteristics of Research Questions

The problem that is eventually isolated for a research purpose is stated preferably in terms of a question or statement form for which the proposed research is designed to obtain answer. Good research questions must have the following characteristics:

- Research questions must be amenable to research.
- Research questions must be based on a solid theoretical basis.
- A good research question must explain the relationship among variables.
- The research question should not be vaguely formulated.
- It should equip the researcher with insight into what can be done, what relevant data can be gathered to find the answer.
- It must serve as a guide for planning the study and choice of statistics for interpreting the results.
- The solution of the research question should be of a practical or theoretical value.
- The breadth of the application of the findings should be in terms of range of individuals and years of applicability should be wide.
- It must lead to the development of other investigations.
- The solution of research question should be well within the reach of a researcher in terms of his/her competency, accessibility to data, financial resources, time at her or his disposal, her/his determination and other related considerations.

The following few examples will illustrate all the above characteristics of research question:

- How does home work influence the problem solving behaviour of children?
- What is the effect of cooperative and competitive learning on the cognitive development of children?
- What is the relationship between the learning styles and learning types of gifted and creative children studying at secondary level?
- Is there any relationship between child rearing practices and cognitive development of children?

- How does the communication network influence the academic achievement of primary school children with regard to their intelligence and personality type?

- What classroom factors lead to the development of self-regulated learning?

4.6.6 Objectives of Research Questions

The main function of research is the creation of new knowledge and the verification of existing knowledge consistent with the scientific research today. It is viewed as a process. The process is cyclical. It typically begins with a problem or issue that needs to be studied and ends with a written report. Thus, the whole process has to emanate from the objectives of research questions, which are directed:-

- To make the research questions amenable to study and find the solution for.

- To result into the development of new theories, principles or laws by determining the relation between two or more variables. The research having this type of objectives contributes basic knowledge to the human knowledge.

- To explore the new facts and relationships.

- To eliminate the personal bias.

- To facilitate the scientific process of conducting the research

- To help in specify the design of the study, the method of analysis of data and interpretations considering a problem which the researcher may undertake for investigation, she or he is required to ask herself/himself a series of questions about it. The questions are: Is the problem researchable? Is the problem new? Is the problem significant? These questions are helpful in the evaluation of feasibility of the problem on the basis of personal suitability of the researcher and the social value of the problem. All these questions must be answered affirmatively before the study is undertaken.

Check Your Progress Exercise 4

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. What are the delimitations in research?

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2. What are the major forms of formulating research question?

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4.7 MEANING OF THE 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. Modern 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 lights 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 his/ 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 the 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 differ slightly 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.

4.8 SOURCES OF 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:

4.8.1 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 require 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.

4.8.2 Background Knowledge

A critical analysis of the background 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, informal talks with friends, socio-political speeches, etc. can be the potential sources in the generation of a hypothesis.

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.

4.8.3 Versatility of Intellect

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.

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.

4.8.4 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 Burn out Tendencies among College Students', the researcher insightfully thinks, "Why were burn 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.

4.8.5 Scientific Theory

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.

4.8.6 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 5

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. What is the meaning of hypothesis?

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2. List various sources of hypothesis.

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4.9 TYPES OF HYPOTHESIS

4.9.1 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 may be 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 stipulate that there is a difference in the academic achievement, the direction of the difference is not specified.

A hypothesis can take either 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.

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.

4.9.2 Research Hypothesis and 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.

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 are 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 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.

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 I) and the null hypothesis (HO) is that, if null hypothesis (HO) is rejected then research hypothesis (HI) 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.

After the hypotheses are stated the researcher moves towards testing them. Hypotheses are subjected to empirical as well as logical testing. The nature of a hypothesis may be simple or complex. A simple hypothesis is tested directly but a complex hypothesis cannot be tested directly. It may be tested in terms of its deduced consequences. In order to test the hypothesis in terms of deduced consequences, it is necessary to collect evidence by selecting or developing data collecting tools to analyse the data collection, and then to interpret results in the light of hypothesis and its deduced consequences. The necessary conditions for confirmation are:

i) all factual evidences collected through tests or other means (tools) should correspond with the deduced consequences;

ii) the data-collecting tools should take into account all factors and conditions that are suggested by the consequences;

iii) the consequences are logically deduced from the hypothesis.

Suppose the researcher wants to test the hypothesis: 'effective college principals will have higher level of job satisfaction'. This hypothesis cannot be tested directly by the researcher. He has to proceed indirectly by deducing the consequences that ineffective college principals will have low level of job satisfaction as compared to that of effective principals. In this way the researcher does not test the hypothesis, but tests the deduced consequences of the hypothesis. Once all the deduced consequences after testing come out to be true, the hypothesis is confirmed. If some of the consequences are true and some others are not, the hypothesis needs to be examined afresh (Koul, 1997, P.81).

The inference drawn as a result of testing the hypothesis is always tentative. The null hypothesis asserts that there is no difference between the means but some difference may always occur by chance. When the obtained difference is greater, the null hypothesis cannot be accepted. The question arises as to how much can be the difference due to chance, an estimate of which is provided by the values given in statistical tables. If the obtained difference is greater than the table value, the null hypothesis is rejected. It is accepted if the obtained difference is found to have sufficiently small probability of occurrence. In either rejection or acceptance of null hypothesis, two types of errors are always involved. These are type I and type II errors, they are also called alpha or beta errors respectively. These two errors are so related that if efforts are made to minimize one error then chances of other error increase.

4.11 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 8th 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 10th 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; unless it is operationally defined and a tool created to measure it.

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 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.

4.12 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 hypotheses 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 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 can not state facts clearly and detect relevant relationships between variables as there is no hypothesis to guide her or him.

Check Your Progress Exercise 6

Note: a) Read the following question carefully and answer in the space provided below.

b) Check your answer with that provided at the end of this Unit.

1. List the characteristics of a good (usable) hypothesis.

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4.13 LET US SUM UP

In this Unit, the attempt was made to illustrate how the research problem is identified and studied. The selection of suitable and relevant research problem is a systematic process. While identifying the problem the existing literature is to be reviewed and the various sources that is theory, experience, discussion, dissatisfaction and literature have to be relevantly used. How the research questions are stated has also been exemplified. A mechanism has been explained as to how to formulate the research questions and what considerations should be kept in view to make the research questions worth studying.

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 helpful in the formulation of a hypothesis.

Based on these sources, hypotheses are of various types: i) Directional and nondirectional, 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, land (vi) provides a basis for reporting the conclusions of the study.

4.14 GLOSSARY

Declarative knowledge	:	Knowing about things.
Expirical tradition	:	All natural pheomena can be known only through experience and not through deductive reasoning or intuition.
Rationalistic tradition	:	Knowledge is derived through deductive reasoning based on self evident basic truths.
Pragmatic tradition	:	The experimental character of the process of aquiring knowledge.

4.15 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1. Qualitative research, Quantitative research
2. Characteristic features of a research problem are:
   a) A research problem leads to dependable solutions.
   b) It contributes to useful generalizations and theory development.
   c) It provides insight into the hypothesis formulation.
   d) It provides the direction for the choice of research design.
   e) It helps in wise choice of statistical or other relevant methods of interpretation.
3. The three major criteria of a good research problem are :
   a) It should express a relationship between two or more variables.
   b) It should be stated clearly and unambiguously in question form.
   c) It should be stated so as to imply possibilities of empirical testing.

Check Your Progress Exercise 2

1. Due to limited knowledge of the research process, a researcher finds it difficult to identify a suitable area of research.
2. The tasks involved in identifying a research problem are:

a) To accumulate the facts that might be related to the problem

b) To decide whether the facts are relevant.

c) To find out the relationship between facts that might reveal the key difficulty.

d) To propose various explanations for the cause of the difficulty.

e) To ascertain whether these explanations are relevant to the problem.

f) To trace the relationship between explanations that might give an insight into the solution of the problem.

g) To trace the relationship between facts and explanations.

h) To question assumptions underlying the analysis of the problem.

3. The efforts made by the researcher to identify a problem situation are:

a) To decide the area of his/her research

b) To understand the known theories, facts and ideas in the field of researcher's interest.

Check Your Progress Exercise 3

1. The various sources of problem identification are: theory, experience, discussion, dissatisfaction and literature.

2. Experience is a great teacher. You can formulate a research problem based on your own experience or experiences of persons associated with you. Thus, you may decide to focus on aspects such as the significance of the presence of the whole family in psychoeducation pertaining to a family member's physical illness; role of the father in counselling; impact of a couple's interpersonal relationship on their child; mass media influence on adolescents etc.

3. The important advantages of discussion as a source of research problem identification are:

i) Contemporary research areas capture the mind of a researcher,

ii) Certain ambiguities which the researcher initially has get clarified, and

iii) The researcher is able to classify as to whether his problem is fundamental, applied or action research.

Check Your Progress Exercise 4

1. Delimitations are boundaries which are put by the researcher in terms of variables, sample, tool, statistical techniques, etc. They give a broad perspective to view the research problem.

2. Three major forms of formulating research questions are:

a) Question form

b) Relationship form

c) Comparison form

Check Your Progress Exercise 5

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.

2. Experience, background knowledge, versatility of intellect and analogies, scientific theories are importance sources which help in the hypothesis formulation.

Check Your Progress Exercise 6

1 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.

4.16 UNIT END QUESTIONS

1. Go through any five dissertations or theses in a relevant discipline area. Examine the rationale behind selection of the research problems. Do you consider the rationale justified? Substantiate your answers.

2. Why is the research question important?

3. Discuss the importance of hypothesis in experimental studies.

4.17 FURTHER READINGS AND REFERENCES

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UNIT 5 RESEARCH DESIGN

Structure

5.1 Introduction

5.2 Meaning of Research Design

5.3 Purpose of Research Design

5.4 Need for Research Design

5.5 Features of a Good Research Design

5.6 Principles of Research Design

5.7 Research Approaches

5.8 Types of Research Designs

- 5.8.1 Research Design in Case of Exploratory Research Studies
- 5.8.2 Research Design in Case of Descriptive and Diagnostic Research Studies
- 5.8.3 Research Design in Case of Hypothesis-testing Research Studies

5.9 Let Us Sum Up

5.10 Glossary

5.11 Answers to Check Your Progress Exercises

5.12 Unit End Questions

5.13 Further Readings and References

5.1 INTRODUCTION

Research design can be thought of as the structure of research — it is the "glue" that holds all of the elements in a research project together. We often describe a design using a concise notation that enables us to summarize a complex design structure efficiently. From the previous chapters, you are already familiar with the most basic element—the research question. The significance of a research question has to do with the relevance, or point, of the answer to it, and the consideration of its novelty, or what new knowledge it will provide. In order to demonstrate what new light your study will shed on an area, you will need to place your research question into the context of what is already known about it i.e. the review of the literature. The next element is the study design. This unit will throw light on research design and its types.

Objectives

After studying this Unit, you will be able to:

- State meaning of research design;
- Describe purpose of research design; and
- Discuss various types of research designs.

5.2 MEANING OF RESEARCH DESIGN

Before starting a research, the investigator will look for problem, she or he will read books, journals, research reports and other related literature. Based on this, researcher will finalise the topic for research. During this process, she or he will be in close contact with her or his guide. As soon as the topic is decided, first task is to decide about design. Research design is a blue print or structure with in which research is conducted. It constitutes the blue print for the collection, measurement and analysis of data. Kothari (1988) says. "Decisions regarding, 'What?', 'Where?', 'When?', and 'How Much'? by what mean concerning an inquiry or a research study constitute research design". Thus, it can be said that research design is an outline of what the researcher will do from writing of objectives, hypotheses and its operational implications to find analysis of data.

Research design should be able to convey following:

- What is the study about?
- Where will study be carried out?
- What type of data is necessary?
- Where necessary data is available?
- How much time is needed to complete the study?
- What will be the sampling design?
- Which tools will be identified to collect data?
- How data will be analyzed?

Depending upon the types of research the structure of design may vary. Suppose, one is conducting an experimental research, then identification of variables, control of variables, types of experimental design etc. be discussed properly. If someone is conducting qualitative research, then one should stress on understanding of setting, nature of data, holistic approach, selection of participants, and inductive data analysis. Thus, according to nature and type of study the components of design will be decided. In short, any efficient research design will help the researcher to carry out the study in a systematic way.

Check Your Progress Exercise 1

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1) What do you mean by research design?

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2) How is the decision about research design made?

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5.3 PURPOSE OF RESEARCH DESIGN

The research design serves the following purposes in conducting research:

- A research design helps the investigator to obtain answers to research problem and issues involved in the research, since it is the outline of the entire research process.
- Design also tells us about how to collect data, what observation are to be carry out, how to make them, and how to analyze the data.
- Design also guides the investigator about statistical techniques to be used for analysis.
- Design also guides to control certain variables in experimental research.

Thus, design guides the investigator to carry out research step by step in an efficient way.

5.4 NEED FOR RESEARCH DESIGN

Research designs are needed to enable the researcher to answer research questions as validly, objectively, accurately and economically as possible. Research design also facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money. Just as for happy and sound family life we need a strong and cordial relationship between husband and wife, with in-laws, parent and child and among siblings, we need a sound research design or a research plan prior to data collection and analysis of research project.

Research design stands for advance planning of the methods to be adopted for collecting the relevant data and the techniques to be used in their analysis, keeping in view the objectives of the research and the availability of staff, time and money. Research design in fact has a great bearing on the reliability of the results arrived at and as such constitutes the firm foundation of the entire structure of the research work.

Lack of thoughtfulness in designing the research plan may result in rendering the research exercise futile. It is, therefore, imperative that an efficient and appropriate design must be prepared before starting research operations. The design helps the researcher to organize her or his ideas in a form where by it will be possible for her or him to look for flaws and inadequacies. Such a design can even be given to others for their comments and critical evaluation to provide a comprehensive review of the proposed study.

Check Your Progress Exercise 2

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. Why is there a need to make a research design?

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2. How does research design help the researcher in doing a better research?

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5.5 FEATURES OF A GOOD RESEARCH DESIGN

A good research design is often characterized by adjectives like flexible, appropriate, efficient, economical and so on. Generally the design which minimizes the bias and maximizes the reliability of the collected data and analysis is considered a good design. The design which gives the smallest experimental error in supposed to be the best design in many investigations. Similarly, the 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 also 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 the 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:

1) The means of obtaining information,

2) The availability and skills of the researcher and her or his staff,

3) The objective of the problem to be studied,

4) The nature of the research problem, and

5) The availability of time and money for the research work.

If the research study happens to be an exploratory or a formulative one, where in the major emphasis is on 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 accurate

description of a situation or of an association between variables (or in what are called the *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 minimization of bias and maximization of reliability. But in practice it is the most difficult task 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 kinds of studies. It is only on the basis of its primary function that a study can be categorized 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, 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.

Check Your Progress Exercise 3

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1 What factors are considered for making an appropriate research design for a particular research problem?

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2. Explain briefly the features of a good research design.

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5.5 PRINCIPLES OF RESEARCH DESIGN

In designing a social research there are a number of considerations and principles that are worth taking into account that help to create valid results. The conclusions that you can draw from your analysis will depend strongly on the principles you use.

1) Bias Minimization

Researchers can easily introduce bias into results by accidental or subconscious means or otherwise reduce the validity of the methods used. Many of the methods used seek to reduce this bias.

The subjects of research may also introduce their own bias, for example through Social Desirability Bias. What is said to them and what they understand may differ, and needs careful consideration, although this may raise ethical concerns.

2) Sampling

It is seldom possible to research an entire population, so a sample must be selected to represent the population. After the experiment, statistical analysis can be used to enable generalization back to the population. There are many sampling methods that can be used and the appropriate method needs to be carefully selected. Ideally, sampling is done randomly. In practice, samples are often selected based more on convenience and what is feasible. This need not invalidate experiments, but the analysis must be done carefully and conclusions drawn with care.

3) Randomization

If a random sample can be selected, then statistics can be used to generalize, and draw conclusions about the entire population. Randomization is thus at the heart of a true experiment. Randomization also helps remove bias, where choices by the researcher, subject or others may lead to invalid results.

4) Selection and assignment

Randomization starts with selection of target (random selection). It may also apply in deciding what treatments are applied to which subjects, and when (random assignment). Where there are multiple groups, pre-selected subjects may be randomly assigned to groups. Random assignment is sometimes difficult, for example in a study of two school classes, in which natural groups have to be used.

5) Groups

Experiments often use multiple groups, with each group forming a mini-experiment on its own, and with the findings from each group then being compared for further comparison, analysis and conclusion.

There are two main ways in which groups are used; these are as follows:

- Similar people in each group, but with different treatments. For example in cluster sampling.
- Different types of people in each group, but with the same treatment applied to each. For example in stratified sampling.

The same group may also be given the same treatment, but at different times or in different contexts, to see if they have changed or if they are affected by contextual factors (the context thus becomes part of the treatment).

6) Control group

A control group is one which includes the same type of people (preferably randomly assigned) as those in the treatment group. The control group is a useful way of eliminating extraneous variables and reducing noise.

7) Pre-test and Post-test

Experiments that apply some kind of treatment, apply a test or measurement in two places: before the treatment, which is a pre-test and after the treatment, which is a post-test.

This allows for identifying change caused by the treatment by comparing before and after results from a similar test (for example a change in skill, attitude, etc.).

Check Your Progress Exercise 4

Note: a) Read the following question carefully and answer in the space provided below.

b) Check your answer with that provided at the end of this Unit.

1. Distinguish between Pre-test and Post-test.

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5.7 RESEARCH APPROACHES

There are two basic approaches to research, *viz.*, quantitative approach and qualitative approach. The former involves the generation of data in quantitative form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion. This approach can be further sub-classified into inferential, experimental and simulation approaches to research.

- The purpose of inferential approach to research is to form a data base from which to infer characteristics or relationship of population. This usually means survey research where a sample of population is studied (questioned or observed) to determine its characteristics, and it is then inferred that the population has the same characteristics.

- Experimental approach is characterized by much greater control over the research environment and in this case some variables are manipulated to observe their effect on other variables.

- Simulation approach involves the construction of an artificial environment within which relevant information and data can be generated. This permits an observation of the dynamic behaviour of a system (or its sub-system) under controlled conditions. The term *'simulation'* in the context of social science applications refers to "the operation of a numerical model that represents the structure of a dynamic process. Given the values of initial conditions, parameters and exogenous variables, a simulation is run to represent the behaviour of the process over time". Simulation approach can also be useful in building models for understanding future conditions.

Qualitative approach to research is concerned with subjective assessment of attitudes, opinions and behaviour. Research in such a situation is a function of researcher's insights and impressions. Such an approach to research generates results either in non-quantitative form or in the form which are not subjected to rigorous quantitative analysis. Generally, the techniques of focus group interviews, projective techniques and indepth interviews are used.

Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity. Qualitative research, on the other hand, is concerned with *qualitative phenomenon,* that is phenomena relating to or involving quality or kind. For instance, when we are interested in investigating the reasons for human behaviour (i.e., why people think or do certain things), we quite often talk of 'Motivation research', an important type of qualitative research. This type of research aims at discovering the underlying motives and desires, using indepth interviews for the purpose. Other techniques of such research are word association tests, sentence completion tests, story completion tests and similar other projective techniques. Attitude or opinion research that is research designed to find out how people feel or what they think about a particular subject or institution is also qualitative research. Qualitative research is specially important in the behaviour sciences where the aim is to discover the underlying motives of human behaviour. Through such research we can analyze the various factors which motivate people to behave in a particular manner or which make people like or dislike a particular thing. It may be stated, however, that to apply qualitative research in practice is relatively a difficult job.

Check Your Progress Exercise 5

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. What do you mean by Quantitative approach and how is it classified?

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2. Distinguish between Quantitative and Qualitative research.

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5.8 TYPES OF RESEARCH DESIGNS

Different research designs can be conveniently described if we categorize them as: (1) research design in case of exploratory research studies; (2) research design in case of descriptive and diagnostic research studies, and (3) research design in case of hypothesis-testing research studies

5.8.1 Research Design in Case of Exploratory Research Studies

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 fact may necessitate changes in the research procedure for gathering relevant data. 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 'insight-stimulating' examples.

The survey of concerning literature: It 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/her task is to review the available material for deriving the relevant hypotheses from it.

Experience survey: It means the survey of people who have had practical experience with the problem to be studied. The object of such a survey is to obtain insight 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. This survey may as well provide information about the practical possibilities for doing different types of research.

Analysis of 'insight-stimulating' examples: It is also a fruitful method for suggesting hypotheses 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.

Thus, in an exploratory or formulative research study which merely leads to insights or hypotheses, whatever method or research design outlined above is adopted, the only thing 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.

Advantages of Research Design

- Large amount of information can be obtained from a large population in an economical manner which is "surprisingly" accurate.

Disadvantages of Research Design

- Information tends to be superficial as breadth is emphasized.
- Expertise in sampling techniques, questionnaire construction, and interviewing and data analysis is required to produce a reliable and valid study.
- These designs are time-consuming and are sometimes costly.

5.8.2 Research Design in Case of 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. The studies concerning whether certain variables are associated, are examples of diagnostic research studies. As against this, studies concerned with specific predictions, with narration of facts and characteristics concerning individual, group or situation are all examples of descriptive research studies. Most of the social research comes under this category. From the point of view of the research design, the descriptive as well as diagnostic studies share 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 she or he wants to measure and must find adequate methods for measuring it along with a clear cut definition of 'population' she or 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 design in such studies must be rigid and not flexible and must focus attention on the following:

a) Formulating the objective 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 many subjects will be needed?),

d) Collecting the data (where can the required data be found and in what time period should the data be collected?),

e) Processing and analyzing the data, and

f) Reporting the findings.

In a descriptive or 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, etc.), with their merits and limitations, are av. ble for the purpose and the researcher may use one or more of these methods which have been discussed in detail in Block 2 of this Course. While designing data collection procedure, adequate safeguards against bias and unreliability must be ensured. Whichever method is selected, questions must be well examined and be made unambiguous; interviewers must be instructed not to express their own opinion; observers must be trained so that they uniformly record a given item of behaviour.

To obtain data free from errors which are introduced by those responsible for collecting them, it is necessary to supervise closely the staff of field workers 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 analyzed. This includes steps like coding the interview replies, observations, etc.; tabulating the data; and performing several statistical computations. To the extent possible, the processing and analyzing procedure should be planned in detail before actual work is started. This will prove economical in the sense that the researcher may avoid unnecessary labour such as preparing tables for which she or he later finds she or he has no use or on the other hand, re-doing some tables because researcher failed to include relevant data. Coding should be done carefully to avoid error in coding. Finally, statistical computations are needed and as such averages, percentages and various coefficients must be worked out.

Last of all arises 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.

Advantages

- The subject is being observed in a completely natural and unchanged natural environment. A good example of this would be an anthropologist who wanted to study a tribe without affecting their normal behaviour in any way. True experiments, whilst giving analyzable data, often adversely influence the normal behaviour of the subject.
- Descriptive research is often used as a precursor to quantitative research designs, the general overview giving some valuable pointers as to what variables are worth testing quantitatively. Quantitative experiments are often expensive and time-consuming so it is often good sense to get an idea of what hypotheses are worth testing.

Disadvantages

- Because there are no variables manipulated, there is no way to statistically analyze the results. Many scientists regard this type of study as very unreliable and 'unscientific'.
- In addition, the results of observational studies are not repeatable, and so there can be no replication of the experiment and reviewing of the results.

5.8.3 Research Design in Case of Hypothesis-testing Research studies

Hypothesis-testing research studies (generally known as *experimental studies*) are those 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 will permit drawing inferences about causality. Usually experiments meet this requirement. Hence, when we talk of research design in such studies, we often mean the design of experiments.

As such the study of experimental designs has its origin in agricultural research. Professor Fisher found that by dividing agricultural fields or plots into different blocks and then by conducting experiments in each of these blocks, whatever information is collected and inferences drawn from them, happens to be more reliable. Today, the experimental designs are being used in researches relating to phenomena of several disciplines. Since experimental designs originated in the context of agricultural operations, we still use, though in a technical sense, several terms of agriculture (such as treatment, yield, plot, block etc.) in experimental designs.

Depending on the degree of 'control' we may classify the experimental design in the following five categories:

1) Trial and Error Experiment

This is earliest form of experimental design, in which the researcher does not prepare a structured plan of studies but prepares a hypothesis and tries to test it in an actual social condition. Thus, based upon her or his experiences she or he changes the methods and techniques of the study. This design is said to be a poor design.

2) Controlled Observation Studies

As the title indicates, under this design the researcher observes the phenomenon under controlled conditions. The researcher may introduce a new stimulus or a new element in the treatment group and not allow control group to participate in that situation or with the new element. The difference between the two groups vis-a-vis the relevant variable may also occur naturally e.g. smokers and non-smokers, who may be compared without any active manipulation by the researcher.

3) Natural Experiment

The designs which are planned for the study in the natural setting are known as *natural experiment*. This is one of the most commonly used design in the field of psychology, sociology and extension education. The limitation of this design is that the situation can be influenced by growth factors, publicity, propaganda and other variables operating upon the situation.

4) Ex-post-facto Techniques

When the study moves from present to future basing the interpretation on past happenings or the facts that have already occurred, the design employed is known as *ex-post-facto design*. The literal meaning of ex-post-facto is 'from what is done afterwards' or something, occurring after an event, with a retrospective effect on the event.

In this design the researcher cannot manipulate or assign subject for treatment and observe the effect, because the event has already happened.

5) Laboratory Experimental Design

Laboratory experiment connotes a controlled scientific investigation under a lab situation in which an investigator manipulates and controls one or more independent variables and observes the dependent variable or variables for variation concomitant to the manipulation of the independent variables (Kerlinger). Laboratory experimental design, then is one in which the investigator has direct control over at least one independent variable. Thus, the experimental design is the ideal of scientific endeavour which has unique virtue of experimental enquiry that is controlled under laboratory conditions.

Advantages of Experimental Rescarch Design

- This type of research draws a conclusion by comparing subjects against a control group, in cases where the researcher has no control over the experiment. For example, a research study comparing the risk of developing lung cancer, between smokers and non-smokers, would be a good example of an observational study.

- The main reason for performing any observational research is due to ethical concerns.

  With the smoking example, a scientist cannot give cigarettes to non-smokers for 20 years and compare them with a control group. This also brings up the other good reason for such studies, in that few researchers can study the long-term effects of certain variables, especially when it runs into decades.

- For this study of long-term and subtle effects, they have to use pre-existing conditions and medical records. The researcher may want to study an extremely small sample group, so it is easier to start with known cases and works backwards. The thalidomide cases, for example, are an example of an observational study where researchers had to work backwards, and establish that the drug was the cause of disabilities.

- An observational study allows a useful insight into a phenomenon, and sidesteps the ethical and practical difficulties of setting up a large and cumbersome medical research project.

- The results of a true experimental design can be statistically analyzed and so there can be little argument about the results.

- It is also much easier for other researchers to replicate the experiment and validate the results.

- For physical sciences working with mainly numerical data, it is much easier to manipulate one variable, so true experimental design usually gives a yes or no answer.

Disadvantages of Experimental Research Design

- The main problem with observational studies is that the experimenter has no control over the composition of the control groups, and cannot randomize the allocation of subjects. This can create bias, and can also mask cause and effect relationships or, alternatively, suggest correlations where there are none (error in research).

  For example, in the smoking example, if the researcher found that there is a correlation between smoking and increased rates of lung cancer, without knowing the full and complete background of the subjects, there is no way of determining whether other factors were involved, such as diet, occupation or genetics.

- Randomization is assumed to even out external causal effects, but this is impossible in an observational study.

- They can be almost too perfect, with the conditions being under complete control and not being representative of real world conditions.

- For psychologists and behavioural biologists, for example, there can never be any guarantee that a human or living organism will exhibit 'normal' behaviour under experimental conditions.

- True experiments can be too accurate and it is very difficult to obtain a complete rejection or acceptance of a hypothesis because the standards of proof required are so difficult to reach.

- True experiments are also difficult and expensive to set up. They can also be very impractical.

- While for some fields, like physics, there are not as many variables so the design is easy, for social sciences and biological sciences, where variations are not so clearly defined it is much more difficult to exclude other factors that may be affecting the manipulated variable.

- Field experiments can suffer from a lack of a discrete control group and often have many variables to try to eliminate. For example, if the effects of a medicine are studied, and the subject is instructed not to drink alcohol, there is no guarantee that the subject followed the instructions, so field studies often sacrifice internal validity for external validity.

- In ex-post-facto research design the researcher cannot manipulate or assign subject or treatment and observe the effect, because the event has already happened.

Check Your Progress Exercise 6

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. What are the methods followed to prepare a research design for an exploratory research study?

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2. Classify the experimental designs?

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5.9 LET US SUM UP

In this Unit, we have learnt the meaning of research design, purpose and its features. The approaches to any research are qualitative and quantitative. There are the principles of research on which depends the overall research plan. As discussed in the Unit, the research design is the blue print which is similar to what is made for our house before construction. Depending on these, the research can proceed further to arrive at the conclusions.

It all depends on the type of research problem; the research can be directed by one of the types of research designs. The various types of research designs have been discussed in this Unit along with their advantages and disadvantages.

5.10 GLOSSARY

Qualitative phenomenan : Phenomena relating to, or involving quality or kind.

Attitude or opinion research : Research design to find out how people feel or what they think about a particular subject or institution.

Experimental Studies : Hypothesis-testing research studies.

5.11 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1. Research design is an outline of what the researcher will do from writing of objectives, hypotheses and its operational implications to final analysis of data.

2. The decision about research design is made on the basis of type of research; for example, for a qualitative study the researcher should focus on understanding of setting, nature of data, holistic approach, selection of participants and inductive data analysis.

Check Your Progress Exercise 2

1. Research designs are needed to enable the researcher to answer research questions as validly, objectively, accurately and economically as possible.

2. Research design helps the researcher to organize her or his ideas in a form where by it will be possible for her or him to look for flaws and inadequaces.

Chech Your Progress Exercise 3

1. Following are the factors that are considered for making an appropriate research design for a particular research problem:

   i) The means of obtaining information,

   ii) The availability of and skills of the researcher and her or his staff,

   iii) The objective(s) of the problem to be stuidied,

   iv) The nature of the research problem, and

   v) The availability of time and money for the research work.

2. Following are the features of a good research design:

   i) The design should minimize the biases and maximize the reliability of the collected data,

   ii) The design should yield maximal information and provide an opportunity for considering many different aspects of a problem.

Check Your Progress Exercise 4

1. Social desirability bias occurs when subjects of research introduce their own bias as what is said to them is different from what they understand.

2. Pre-test are the experimented stage before the application of treatment to experimental group where as post-test is after the treatment stage.

Check Your Progress Exercise 5

1. Qualitative approach involves the generation of data in quantiative form, which can be subjected to rigorous quantitative analysis in a formal and rigid fashion. The approach can be classified into inferential, experimental and simulation approaches.

2. Quantitative research is based on the measurement of quantity on amount. It is applicable to phenomena that can be expressed in terms of quantity where as qualitative research is concerned with qualitative phenomenon, that is, phenomena relating to quality.

Check Your Progress Exercise 6

1. Following are the methods followed to prepare a research design in the case of an exploratory research study:

   i) The survey of concerning literature,

   ii) Experience survey, and

   iii) Analysis of insight-stimulating examples.

2. The experimental designs can be classified in following categories:

   i) Trial and error experiments,

   ii) Controlled observation studies,

   iii) Natural experiment,

   iv) Ex-post facto technique, and

   v) Laboratory experimental design.

5.12 UNIT END QUESTIONS

1. What is research design? Why do researchers need to formulate a research design?

2. State the principles, that should be followed for preparing a good research design.

3. Formulate a research design for diagnostic research.

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UNIT 6 CHARACTERISTICS OF A GOOD RESEARCH TOOL

Structure

6.1 Introduction

6.2 Tests

- 6.2.1 What is a Test?
- 6.2.2 Types of Tests

6.3 Characteristics of a Good Research Tool

- 6.3.1 Norms
- 6.3.2 Validity
- 6.3.3 Reliability

6.4 Use of Scales in Research

- 6.4.1 Nominal Scale
- 6.4.2 Ordinal Scale
- 6.4.3 Interval Scale
- 6.4.4 Ratio Scale

6.5 Let Us Sum Up

6.6 Glossary

6.7 Answers to Check Your Progress Exercises

6.8 Unit End Questions

6.9 Further Readings and References

6.1 INTRODUCTION

Data collection is an important part of research. In order to collect the requisite data for any theme of research, you have to devise appropriate design and use suitable measuring techniques, and decide on the relevant attributes of the sample drawn. There are several research designs and tools, varying in operations, complexity of features, and interpretation. In this Unit we will learn about the characteristics of good research tool.

Objectives

After studying this Unit, you will be able to:

- Understand test and its types;
- Explain the characteristics of a good research tool; and
- Describe scaling in research.

6.2 TESTS

With the help of tests we can collect quantitative data in research. There are different types of tests. It was the English biologist, Sir Francis Galton, who

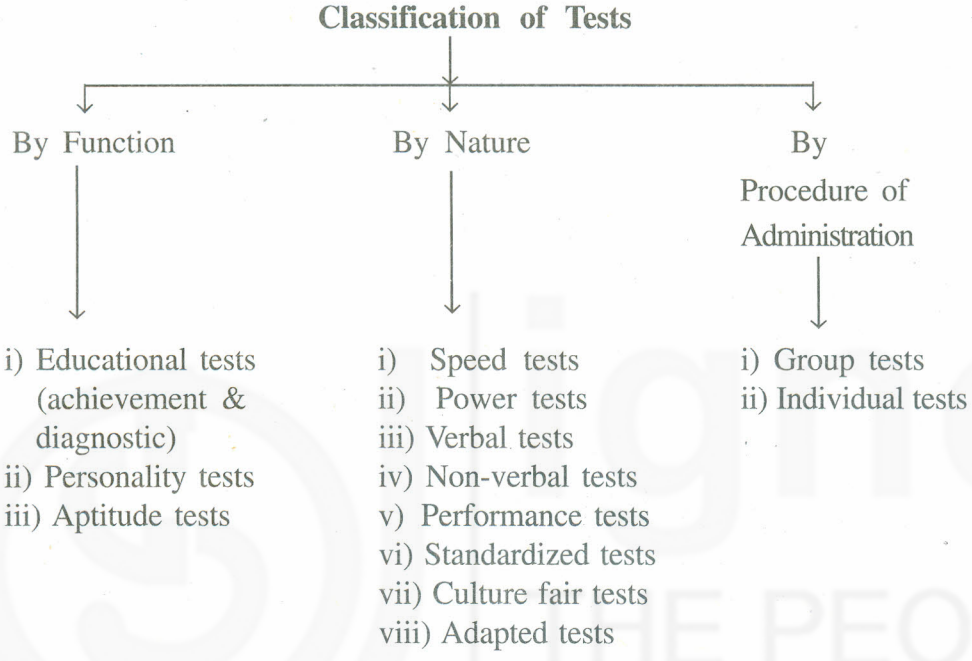
was primarily responsible for launching the testing movement. In an article written by Cattell in 1890 the term 'mental test' was used for the first time. Psychological testing is a relatively young branch of one of the youngest of the sciences.

6.2.1 What is a Test ?

A Test is a systematic procedure for observing a person's behaviour and describing it with the aid of a numerical scale or a category system. A psychological test is essentially an objective and standardized measure of a sample of behaviour.

6.2.2 Types of Tests

Tests are classified in different ways.



Let us now understand the meaning of this classification. We will also get information about various tests in details.

1. Classification of Tests as per their Function

Depending upon what a test aims to measure the tests are classified into one group.

(i) *Educational Tests* – Certain types of tests are developed for use in educational context. They include achievement tests and diagnostic tests.

Achievement tests are designed to measure the effects of a specific programme of instruction or training. An achievement test measures the effects of relatively standardized sets of learning experiences. It generally represents a terminal evaluation of the individual's status on the completion of an instructional programme or training. An achievement test measures developed abilities or skills.

Diagnostic tests are designed to analyze individual specific strengths and weaknesses in a subject and to suggest causes of her or his difficulties.

In connection with the use of all diagnostic tests, one point deserves special emphasis. The diagnosis of the learning disabilities is the prerequisite for a programme of remedial teaching.

(ii) *Personality Tests* – These most often refer to measures of affective aspects of behaviours such as emotional states, interpersonal relations, motivation, interests and attitudes. A personality test could be a self report inventory, a situational test or the third approach could be the application of a projective technique.

(iii) *Aptitude Tests* – These measure the effects of learning under relatively (in comparison with achievement tests) uncontrolled and unknown conditions. They include general intelligence tests, multiple aptitude batteries, special aptitude tests that is creativity tests etc.

Intelligence tests are designed to measure the intelligence of an individual. Here, we must bear in mind that intelligence is not a single, unitary ability but a composite of several abilities. The term is commonly used to cover a combination of abilities required for survival and advancement within a peculiar culture. (for example Standford Binet test of intelligence).

Multiple aptitude batteries yield a profile of test scores in set of relatively independent abilities identified through factor-analysis. One of the most widely used multiple aptitude batteries is Differential Aptitude Test (DAT). This DAT yields scores on eight abilities – Verbal reasoning, Numerical ability, Abstract reasoning, Clerical speed and accuracy, Mechanical Reasoning. Space relations, Spelling and language usage.

Creative Aptitude Batteries have been produced at University of Southern California by J.P. Guilford & his colleagues, and 'Tests of Creative Thinking' by Paul Torrance.

2. *Classification of Tests as per their Nature*

(i) Speed tests are those tests which contain such items which are of somewhat equal difficulty value. To solve the tests the time limits are very much fixed. For example our usual school or college tests.

(ii) Power tests are those tests which contain items of different difficulty value arranged in increasing order of difficulty. For such tests time limit is not fixed, it is flexible.

(iii) Verbal tests include question answer pattern in the form of 'words'. Such verbal tests can be either paper pencil (written) tests or oral tests.

(iv) Non-verbal tests necessarily contain items in the figural or symbolic form that is other than 'words'. Raven's Progressive Matrices test is a non-verbal test.

(v) Performance tests require some action on part of the respondent as her or his response. Bhatia's intelligence test is a performance test.

(vi) Standardized tests imply uniformity of procedure in administering and scoring the tests. Another important aspect of standardized tests is the establishment of norms, reliability and the validity of the tests.

(vii) Criterion-referenced tests have been contrasted with the usual norm-referenced tests in which an individual's score is interpreted by comparing it with the scores obtained by others in the group on the same test. Unlike in a norm-referenced test, in a criterion-referenced test an individual's score is interpreted by comparing it with an external criterion for example '80 × 80 mastery level'.

(viii) Culture fair tests presuppose only such experiences that are common to different cultures. The terms 'culture-fair', 'culture-common', and 'cross-cultural' are used synonymously and have replaced the term 'cultural-free'.

(ix) Adapted tests are the versions of the tests standardized in other countries in dissimilar cultures and modified to suit the culture under consideration.

3. Classification of Tests as per the Procedure of Administration

(i) Group tests are designed as mass testing instruments. They permit the simultaneous testing or examination of large groups. The instruction and administration procedures are simplified so as to demand a minimum of training on the part of the test administrator or examiner.

(ii) Individual tests are those which can be administered to one individual at a time. In view of the testing situation including response in the form of actual performance, the observer can record the entries in the performance sheet for one candidate at a time.

6.3 CHARACTERISTICS OF A GOOD RESEARCH TOOL

The characteristics of a good research tool are discussed below:

6.3.1 Validity

A good research tool must actually measure what it is supposed to measure. A test is valid, if it meets the purpose for which it was designed. Validity is basic. We may consider validity in terms of categories such as high, moderate or low validity. Furthermore validity is specific; a test may be valid for one purpose but not valid for another. A data collection tool must be a valid one.

6.3.2 Reliability

The second important quality of a measuring instrument is its reliability or consistency. A reliable test is one which measures accurately and consistently. If a reliable test is given two or three times to the same group, each person in the group should get approximately the same score on all occasions. Reliability is a statistical concept. To determine the reliability of a test, it must be administered to a group of individuals under appropriate circumstances. Reliability can be expressed by a correlation coefficient.

6.3.3 Objectivity

A test is objective when the examiner's personal judgement does not affect the scoring. An objective test is one for which the items can readily be scored as right or wrong. Such item types as multiple choice, matching, true-false are objective. Objectivity is a prerequisite to reliability in a test. Objective judgements are accurate and hence tend to be reliable. Hence data collection tool must be objective.

6.3.4 Adequacy

The careful test maker never assumes that the instrument he has constructed is capable of measuring all of the factual knowledge or skills that a pupil has

acquired in a school course. Adequacy is a prerequisite to reliability as well as to validity of a test. Hence the data collection tool must be adequate.

6.3.5 Usability

The most valid test in the world will not help if it is not used. Usability or practicality is an important criterion for assessing the value of a test. Usability of a test depends upon a number of factors:

i) Ease of Administration – Directions for administering the test should be simple and clear, and the timing of the test should not be too difficult for adjustment.

ii) Ease of Scoring – If algebraic manipulations are required to get the scores or if the original raw scores require to be converted into complicated derived scores, practitioners will avoid using such a test.

iii) Ease of Interpretation – In the final analysis, the success or failure of a test is determined by the use made of test results.

iv) Economy – Economy is certainly one of the major criteria of a good test. Real economy in testing will not be achieved by the indiscriminate use of cheap tests, but it is equally true that users will avoid buying costly instruments and tests. Economy also refers to the time required for administering and scoring the test.

v) Availability of Equivalent Forms – Equivalent forms of a test measure the same aspects of behaviour by using test items which are alike in content, level of difficulty and other characteristics. Thus one form of the test can substitute the other. Equivalent forms are especially valuable when these are used for research purposes.

The data collection tool must be a usable one.

6.3.6 Discriminating Power

A test discriminates well when it is constructed in such a manner that it will detect or measure small differences in achievement and when it picks out the good from the poor. This quality of a test directly affects its validity, so this also becomes an essential criterion of selecting the data collection tool.

6.3.7 Interest

Tests that are interesting and enjoyable help to gain the cooperation of the subject. Under unfavourable conditions, the test is not likely to yield useful results. Hence, from amongst the available the one satisfying all other criteria, the interesting tool should be selected for data collection.

6.3.8 Norms

Norms represent the test performance of the standardization sample. The norms are empirically established by determining what persons in a representative group actually do on the test. The norms, by converting raw scores into derived scores are expressed in one of the two major ways–

(a) developmental level attained and

(b) relative position within a specified group. Age Norms, Grade Norms are the examples of Developmental Norms, whereas Percentiles, Standard-scores are examples of Within Group Norms.

There are mainly three characteristics of a good research tool. These include validity, reliability, and usability. In selecting tools for collecting data a researcher should evaluate them in terms of these one by one. Existance of norms is of crucial practical significance in using the test at the field level.

Let us now discuss the aspects of validity and reliability in greater detail, given their crucial importance.

• Validity

The validity of a test concerns what the test measures and how well it does it. All procedures for determining test validity are concerned with the relationship between performance on the test and other independent observable facts about the behaviour characteristics under consideration.

A tool used for collecting data must provide information that is not only relevant but free from systematic errors. In other words, it must produce only valid information and measure what it claims to measure. For example, an achievement test in Physics must measure knowledge of student in Physics alone. It should not turn out to be a language test. If a question on frictional force is asked, and a certain student well versed in the English language writes a good 'essay' on it, the researcher should not end up measuring the language ability of the student. A tool, however, does not posses universal validity. It may be valid in one situation but not in another. The tool useful in deciding in a particular research situation may have no use at all for a different situation. So, instead of asking, "Is this research tool valid?", it is important to ask the more pertinent question, "How valid a particular tool is for collecting information which the researcher needs to gather?" Or, more generally, "For what decision is this tool valid?" There are three types of validity: (i) content validity; (ii) validity; (iii) construct validity.

Content validity

Content validity relates to the relevance of the content of a research tool to the objective and nature of a research problem. Content validation involves essentially the systematic examination of the test context to determine whether it covers a representative sample of the behaviour domain to be measured. For example, in the case of tests of achievement, content validity is estimated by evaluating the relevance of the test items to the instructional objectives, the actual subject studied, and the knowledge acquired individually and as a whole. Taken collectively, the items should constitute a representative sample of the variable tested.

Content validity of research tool is based on the judgement of several experts in the field concerned, careful analysis of objectives of the subject of research and the hypotheses, if any, to be tested. Content validity is also known as rational or logical validity or face validity.

Criterion-related Validity

This has two sub-types: predictive validity and concurrent validity. Let us take a closer look at each of these.

Predictive validity – If a test is designed to pick up good candidates for appointment as teachers, and test scores show a high positive correlation with actual performance on the job, the test has a high degree of predictive validity. Thus predictive validity refers to the usefulness of a test in predicting some future performance. It is important particularly for aptitude tests.

Concurrent validity – The coefficient of correlation between the test scores and scores on another test or measure of known validity is the concurrent validity of the test. If both the tests are similar (e.g. creativity tests) then in that case it is known as convergent validity and contrasted with this if the tests are of different type in that case it is known as discriminate validity.

In decision making situations, selection or classification is based on an individual's expected performance as predicted by a research tool. For example, a psychological test or rating scale which predicts the kind of behaviour it was intended to predict, is said to possess 'predictive validity'. The prediction may be regarding success in a job or a course. This validity, refers to the association between present result as indicated by a particular research tool and future behavior. In order to determine the predictive validity of a tool, the results from it must be compared with actual performance or outcome in the future. For example, if a test is designed to select students for a certain medical course, score on the test must indicate a significant positive relationship with their ultimate success in the medical profession. A researcher studies predictive validity if her or his primary interest is in the outcome which she or he wants to improve by some professional decisions.

In some research situations, a researcher may wish to develop a new tool as a substitute for an already existing cumbersome tool (technique or method). If the existing tool is considered useful for decision making and we want to test the validity of the new one, the key question to ask is whether the new tool agrees with the information sought through the existing cumbersome technique. If they disagree, the new one cannot be substituted for the original tool. The agreement between the newly developed tool and the already existing cumbersome technique for which the tool has been developed, is estimated by an empirical comparison. Both, the newly developed tool and the original one are applied to the same sample groups, and the results are compared. This type of empirical check on agreement is called concurrent validation, as the information obtained through the two tools ought to give nearly the same results. The validity of the new tool thus established is called its 'concurrent validity'. Let us suppose that a researcher has developed an achievement test in mathematics. The scores on this test may be compared with score given by the mathematics teacher to the sample students. If the two tests show nearly the same result the concurrent validity of the researcher's newly developed tool can be established.

In case of predictive validity, the measure of the outcome is termed 'criterion'. While estimating concurrent validity the newly developed tool is proposed as a substitute for the existing technique or method, and the information obtained through the existing technique acts as the criterion. Since in both the cases the information sought through the newly developed tool is related

to a criterion, the two types of validation are also termed *'criterion-related validity'*.

Construct validity

Construct validity is concerned with the extent to which a test measures a specific trait or construct. It is the degree to which scores on a test can be accounted for by the explanatory constructs of a sound theory. If one were to study such a construct as 'originality' one would hypothesize that people who have this characteristics will perform differently from those who do not. Theories can be built describing how people with 'originality' behave in a distinctive way. If this is done, such people can be identified by observation, rating them in terms of the theory. A device could then be designed to have construct validity to the extent that the scores on this device are systematically related to the judgment made by observation of behaviour identified by the theory as possessing 'originality'.This type of validity is essential for those tests which are used to asses individuals on certain psychological traits and abilities. Examples of common constructs are anxiety, intelligence, motivation, attitude, critical thinking etc. Construct validity is established by relating a presumed measure of a construct with some behaviour that it is hypothesized to underlie.

- **Reliability**

As used in psychometrics, the term reliability means consistency. Test reliability is the consistency of scores obtained by the same persons when retested with identical or equivalent form of the test.

A tool used for data collection must be reliable, that is, it must have the ability to consistently yield the same results for individuals under the same conditions. For example, if an individual records her or his responses on various items of a questionnaire and thus provides a certain type of responses, he/she should provide similar responses when the questionnaire is administered to him/her on the second occasion. Likewise, if an achievement test is administered to learners and then re-administered after a gap of fifteen days without any special coaching in that subject within these fifteen days, the learners must show similar range of scores on re-administration of the test.

Repeated measure of an attribute, characteristic or a trait by a tool may provide different results. They may be due either to a real change in the individual's behaviour or to the unreliability or inconsistency of the tool itself. If the variation in the results is due to a real change in behaviour, the reliability of the tool is not to be doubted. However, if the variation is due to the tool itself, then the tool is to be discarded.

There are various procedures to assess the reliability of a tool. These include (i) the test-retest method, (ii) the alternate or parallel-form method, (iii) the split half method, and (iv) the rational equivalence method.

The test-retest method

Test-retest Reliability - A test is administered to a sample at two different occasions with some interval in between. The correlation between the two sets of scores is the reliability coefficient. It is the extent to which scores on a test can be generalized over different occasions.

In this method the same tool is re-administered to the same sample of population shortly after its first administration. The relationship or agreement between the information or data sought through the two administrations provides the measure of reliability of the tool. The chief disadvantage of this method is that if the time between two administrations of the tool is short, the immediate memory effects, practice and the confidence induced by familiarity with the tool may give a wrong measure of its reliability. On the other hand, if the interval is too long, the real changes in behaviour in terms of growth may under-estimate the reliability of the tool. Owing to these limitations, the test-retest method is generally less useful than the other methods. However, this type of measurement is commonly used with questionnaires, observations, and interviews.

The equivalent or parallel-forms method

Alternate Form Reliability - Pertaining to the objectives, two parallel tests are constructed and they are administered to the sample with some interval in between. The correlation between these two scores is the reliability coefficient. It is the measure of both temporal stability and consistency of response to different item samples.

This method requires that two equivalent or parallel forms of tool be prepared and administered to the same group of subjects. The items in these tests are parallel. Then, the results in terms of two sets of measures obtained by the use of the tool are correlated to measure the level of its reliability.

In developing the parallel forms of a tool, care has to be taken to match the tool material with the content, the difficulty level and the form. The parallel-form method is widely used for determining reliability of a research tool. The reliability of psychological tests and attitude scales is usually estimated by this method.

The split-half method

Split-half Reliability – The procedure to establish the split-half reliability involves one-time administration of the test. The scores obtained by the sample are grouped into two sets. This grouping is done mostly by separating the even items in one group and odd items in another for every candidate. Thus, we get a pair of total scores for each one. Correlation between those two scores is the reliability coefficient. It is the measure of internal consistency of the test.

In this method, the tool is first divided into two equivalent 'halves'. If there are 60 items in a test, two equivalent halves are made of 30 items each. It may be done by having alternate items. The measure of the first half of the tool is correlated with the measure of the other half. The measures are correlated to find the reliability of tests and attitude scales. The main limitation of this method is that a tool can be divided into two halves in a number of ways and, thus, the estimate of the reliability may not have a unique value.

The rational equivalent method

This method of measuring reliability is considered to be free from the limitations of the other methods discussed so far. Two forms of a tool are defined as equivalent when their corresponding contents are interchangeable. This method is most commonly used in estimating the reliability of psychological tests.

Note that : A valid test may be reliable but a reliable test is always not a valid one.

Check Your Progress Exercise 2

Note: a) Read the following questions carefully and answer in the space provided below.

b) Check your answers with those provided at the end of this Unit.

1. What are the different types of validity?

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2. State 'True' or 'False':

i. Content validity relates to the relevance of the content of a research tool to the objective and nature of a research problem. _____

ii. In test–retest method the tool is first divided into two equivalent 'halves'. _____

iii. In split half method the same tool is re-administered to the same sample of population shortly after its first administration. _____

3. Elaborate on the classification of tests according to the function.

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6.4 USE OF SCALES IN RESEARCH

Research tools are the measuring devices. Every measuring device has some kind of gradation depending upon the system of measurement. For example, the FPS or CGS systems measure length in foot or centimeter. Similarly weight is measured in pounds and grams. The footrule that measures length is marked in inches. There are two major attributes – (1) each inch is of equal length wherever it appears on the footrule, (2) two different objects measured as two inches, for example by same footrule are of same length.

Just as FPS or CGS provides the basis for scaling for physical measurement, it is necessary to provide certain form of scaling for mental measurement – measurement of variables like intelligence, achievement, demographic attributes, etc.

Four types of scales are used in psychological measurement. These are:

- Nominal,
- Ordinal,
- Interval and
- Ratio.

6.4.1 Nominal Scale

It is the most elementary form of the scale. As indicated by the name itself it is only nominal. This form of scale is largely used to classify people or objects in certain categories like male-female, rural-urban, dark-light, tall-short etc. In other words, it labels object of measurement. In the context of research it is concerned with the frequency of occurrence in the various categories. For example in a class or in a counselling session how many are male or how many are female students or how many have read the learning material or how many have not read the material.

6.4.2 Ordinal Scale

This is the second level of scale which is more sophisticated than the nominal scale, though it remains in one of the cruder forms. Wherever the sample of the research is arranged in ascending or descending order on the basis of data on a variable, we are using the ordinal scale, for example, the 10th rank in a class of 60 students is better than 11th rank but lesser than the 12th. However, despite the ranking, not show it does the difference between the 11th and 12th. In other words, the differences between the ranks are either unknown or unequal. The only information that is derived from this case is the relative position of a subject within the sampled population on a variable.

6.4.3 Interval Scale

As the name indicates the scale that has intervals at different points of gradation is called interval scale. This is also called *equally appearing intervals scale.* The most common use of interval scale is the achievement test when the test contains 100 as full marks. It implies 0 as the beginning. Hence it could be a 0 to 100 point scale graded by one score at a time. This form of scale is extensively used in a large majority of studies of psychological variables like interest, attitudes, aptitude, etc. As mentioned earlier it is also called equally appearing intervals. There is a significant implication of the word appearing. Apparently the difference 28 and 30 is the same as that between 88 and 90, since both have a scale difference of two points. However, practical experience will indicate that moving from 28 and 30 score points is far easier than moving from 88 to 90. In other words, despite the apparent difference of two, the actual difference between 88 to 90 is much larger than the difference 28 and 30. Although, it is by far the most sophisticated scale in social research, it has the limitation of being inexact compared to the ratio scales used in physical measurement.

6.4.4 Ratio Scale

Ratio Scale as mentioned above is primarily used in physical measurement. It is exact and accurate. It is very similar to interval scale except that it has no absolute zero. For example, if a length is indicted by 0 cm., it means

non-existence whereas a score of 0 in mathematics does not indicate the absence of mathematical knowledge. The other major feature of ratio scale is the ratio itself. It implies that in a 100 cm., or 1 meter long rod, distance between the 28th and 30th cm. is exactly equal to the distance between the 88th and 90th cm. of the rod. In this case the intervals in the scale are not apparent but real. However, ratio scale has very little if at all application in social research in general and counselling and family therapy in particular. However, the basic philosophy of ratio scale is the basis of the intervals scale that is extensively used in counselling and family therapy.

As mentioned above, there are four types of scales Nominal, Ordinal, Interval and Ratio. The nominal scale and the ratio scale are the crude end and the sophisticated end of the continuum. The most extensively used scaling technique in social science research is interval scale. However, choice of scaling technique depends upon the nature of the variable to be studied.

Check Your Progress Exercise 2

Note: a) Read the following question carefully and answer in the space provided below.

b) Check your answer with that provided at the end of this Unit.

Fill in the blanks:

1. _____ scale is largely used to classify people or objects in certain categories.
2. In _____ scale the data is arranged in ascending or descending order.
3. _____ scale is also called equally appearing intervals scale.
4. _____ scale is primarily used in physical measurement.

6.6 LET US SUM UP

In this Unit, We have provided information about scaling in research. We studied that there are four types of scales that are nominal, ordinal, interval and ratio scale. Nominal scale is the most elementary form of the scale. As indicated by the name itself it is only nominal. Ordinal scale is the second level of scale which is more sophisticated than the nominal scale, though remains in one of the cruder forms. The scale that intervals at different points of graduation is called interval scale. Ratio Scale as mentioned above is primarily used in physical measurement. It is exact and accurate. We have also studied about the validity and reliability as characteristics of good research tool. There are three types of validity: (i) content validity; (ii) criterion- related validity; (iii) construct validity.

There are various procedures to assess the reliability of a tool. These include (i) the test-retest method, (ii) the alternate or parallel-form method, (iii) the split half method, and (iv) the rational equivalence method. We have also learn about test its different types and the basic characteristics of good test.

6.6 GLOSSARY

Construct validity : The degree to which scores on a test can be accounted for by the explanatory constructs of a sound theory.

Criterion related validity : It refers to two types of validity under different time frames.

Reliable : Tool must have the ability to consistently yield the same individuals under the same conditions.

Test : A systematic procedure for observing a person's behaviour and describing it with aid of a numerical scale or a category system.

Validity : A tool used for collecting data must provide information that is not only relevant but free from systematic errors.

6.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1. There are three types of validity: (i) content validity; (ii) criterion- related validity; (iii) construct validity.
2. i) True
   ii) False
   iii) False
3. Classification of tests as per the function:
   i) Educational tests,
   ii) Personality test, and
   iii) Aptitude tests.

Check Your Progress Exercise 2

1. i) Nominal
   ii) Ordinal
   iii) Interval
   iv) Ratio

6.8 UNIT END QUESTIONS

1. What are the different scales used in research?
2. Explain different types of reliability with help of examples.
3. How do you calculate the validity and reliability of a test?

6.9 FURTHER READINGS AND REFERENCES

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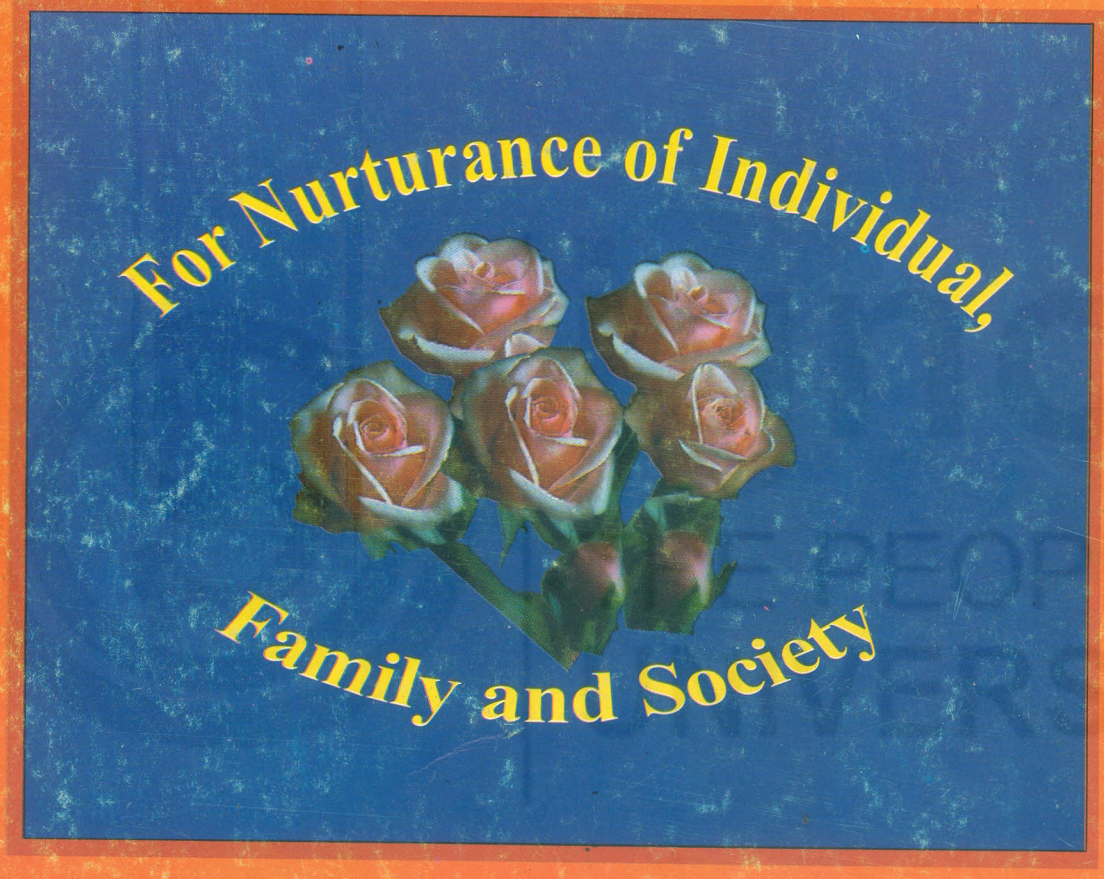
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