
UNIT 10 IDENTIFICATION OF PROBLEM AND FORMULATION OF RESEARCH QUESTIONS

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10.1 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 blindness 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 difficult 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.

10.2 OBJECTIVES

After studying this unit, you will be able to:

- discuss the nature of research problem;
- identify/ select the problem of research;
- list the criteria of selecting a suitable problem of research;
- describe the important sources of problem selection; and
- discuss the nature of research questions.

10.3 NATURE OF A PROBLEM

The research process has some important steps. Out of the most crucial steps is the selection of a problem. The problem of research has to be well focused and pinpointed. If a problem is meaningfully selected and formulated, it makes subsequent research efforts easier. Problem identification and its formulation makes the researcher psychologically engrossed, creates a sense of restlessness, arouses curiosities about finding solution to the problem in his/ her mind. Problems do not come from a vacuum; they are context specific.

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 type 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 8th 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, and
- helps in wise choice of statistical or other relevant methods of interpretations.

Kerlinger (1993) states the 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.
- 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

Notes: a) Space is given below for writing your answers.

b) Compare your answers with those given at the end of the 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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10.4 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 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 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 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

Notes: a) Space is given below for writing your answers.

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

4. What difficulties are faced by a beginning researcher?

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

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6. Detail the efforts made by researcher to identify a problem situation.

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10.5 SOURCES FOR SELECTING A RESEARCH PROBLEM

After the broad area of research interest has been identified, the researcher will proceed towards narrowing down it to a highly specific and focused research problem. At this juncture, it is not possible to list all the educational problems that are needed to be researched. 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 researcher and which help him to identify and specify the meaningful problem of research. These are mainly:

- Theory
- Experience
- Discussion
- Dissatisfaction
- Literature

10.5.1 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. 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/ 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.

10.5.2 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 can not be successfully accomplished.

Examining the everyday experiences gives and inspires the problem. Everyday while encountering with students, equipments, tests, text-books, guidance, discipline, parents, curriculum and administration etc., some sorts of problems are faced. 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 s/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.

10.5.3 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 concerning education. 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/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 a 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 his/ her problem-whether it will be fundamental, applied or action research.

10.5.4 Dissatisfaction

When a researcher attempts the identification of problem, s/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 s/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 he reviews the literature, discusses with people, consults recent books and journal and traces some flaws, gaps and inadequacies in his thinking. He may find it difficult to give a proper shape to his thinking and it becomes a gigantic task for 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 him problem sensitive, 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, and so it has deeply entered into the orbit of an educational system, consequently posing new challenges and input for thinking. The researcher experiences dissatisfaction in himself when he comes out with such problem situations as, impact of these technologies on mechanization of learning, impact on the source literature, etc.,

10.5.5 The Literature

The review and the survey of literature may help the researcher to expand his knowledge background, examine new findings in his field, identify gaps in knowledge, discover contradictions in findings and the need for fresh studies and their direction. Through his various readings he comes to know about various methods and techniques of research used by other researchers, learn about facts, phenomena concept, theories related to his field of research which may be useful to him/ her in the formulation, description and conduct of 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. Some specialized sources are Survey of Research in Education brought by NCERT, Dissertation Abstracts International, Handbook of Research on Teaching, Encyclopaedia of Educational Research, Psychological Abstracts, Educational Technology Abstracts, etc.

Check Your Progress

Notes: a) Space is given below for writing your answers.

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

7. What are various sources of problem identification?

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8. Illustrate the situations where theory helps the researcher.

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9. Explain the contexts where experience helps the researcher.

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

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10.6 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 situations of need. 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 of 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.

10.7 RESEARCH QUESTIONS

10.7.1 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 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 his interest, the researcher tries to ultimately decide what exactly should be his/ her problem of research. It is not always possible for the researcher to formulate his problem simply, clearly and completely. 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 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 not possible to study. 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.

10.7.2 How to Specify the Delimitation?

Before the research problem is carried out, it should be bounded by boundaries, which gives an ample opportunity to view it from varied vistas, and also suggests 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 creep 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 smaller geographical area, sample and segment of time. The researcher may break down the original problem into several sub-problems or sub-questions. Some times 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 i.e. socio-economic status and academic achievement are the variables, sample i.e. 8th grade researchers 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 technique etc.

10.7.3 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 his/ her 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 and population

Three popular forms are available to frame the question statement i.e. question, relationship and comparison. The following examples appropriately explain the three form 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 researchers?

Comparison

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

10.7.4 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 of 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 e.g. 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 resolve some of the inconsistencies or the interpretation of known facts.
- 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.

10.7.5 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 an answer. Good research questions must have the following characteristics:

- Research questions must be amenable to research.
- Research questions 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 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 must provide an advance knowledge in the field appreciably without violating the human rights of the people.
- The solution of the research question should be of a practical or theoretical value to educators, parents social workers or others.
- 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 competency, accessibility to data, financial resources, time at his disposal, his/ her 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?
- What is the relationship between the learning styles and learning types of gifted and creative children studying at secondary level?
- How the communication network influences 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?

10.7.6 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 far.
- 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.

When considering a problem which the researcher may undertake for investigation, s/he is required to ask himself/herself a series of questions about it. The questions are: Is the problem researchable? Is the problem new? Is the problem significant? Is the problem feasible for the particular researcher? These questions are helpful in the evaluation of the problem on the basis of personal suitability of the researcher that on social value of the problem. All these questions must be answered affirmatively before the study is undertaken.

Check Your Progress

Notes: a) Space is given below for writing your answers.

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

11. What are delimitations in research? Why should a research have delimitations?

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

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10.8 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 i.e. theory, experience, discussion, dissatisfaction and literature have to be relevantly used. How the research questions are stated have 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.

10.9 UNIT-END ACTIVITY

- Go through any five M.A. (Education) or M.Ed. dissertations. Examine the rationale behind selection of the research problems. Do you consider the rationale justified? Substantiate your answers.

10.10 POINTS FOR DISCUSSION

1. Do you think that the nature of research questions would be different for science and education? Why?
2. Why is the research question important?

10.11 SUGGESTED READINGS

- Ary, D., Lucy C. Jacobs, and Asghar Razavieh (1972): *Introduction to Research in Education*. New York: Holt, Rinehart and Winston, Inc.
- Best, J.W. and James, V. Kahn (1992): *Research in Education*. New Delhi: Prentice Hall of India Pvt. Ltd. (Indian Edition)
- Kerlinger, F.N. (1993): *Foundations of Behaviourial Research: Educational and Psychological Inquiry*. New York: Holt, Rinehart & Winston.
- Koul, Lokesh (1997): *Methodology of Educational Research*. New Delhi: Vikas Publishing House Pvt. Ltd. (Third Revised Edition).
- Travers, R.M.W. (1969): *An Introduction to Educational Research*. 3rd ed., New York: Macmillan Co.
- Van Dalen, V. (1973): *Understanding Educational Research*. New York: McGraw Hill Book.
- Wiersma, W. (1986): *Research Methods in Education: An Introduction*. Boston: Allyn and Bacon Inc.

10.12 ANSWERS TO CHECK YOUR PROGRESS

1. Qualitative research, Quantitative research
2.
 - 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 interpretations.
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.
4. Due to limited knowledge of the research process, a researcher finds it difficult to identify a suitable area of research.
5. 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.
6. 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.

- c) To identify a problem situation in the light of life situations, relationships established by related researchers and implications advanced by technological development.
 - d) To identify a problem for research in the light of knowledge received from books, journal and researches.
 - e) To identify a problem for research from the suggestions for further research given at the end of research reports.
7. Theory, Experience, Discussion, Dissatisfaction, Literature.
 8. Various educational, psychological, philosophical and sociological theories provide a researcher a lot of insight to identify a research problem. For example, how learning is constructed by a learner is a problem which can be researched by a researcher after going through constructivism.
 9. Experience is the great teacher. One can formulate research problem based on his/her experience as a teacher while teaching in the class, organizing some co-curricular activities, guiding some project assignments or evaluating students' responses in the examination.
 10.
 - i) Contemporary research areas capture the mind of a researcher.
 - ii) Certain ambiguities the researcher initially has to get clarified.
 - iii) The researcher is able to classify as to whether his problem is fundamental, applied or action research.
 11. 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.
 12. Three major forms of formulating research questions are:
 - a) Question form
 - b) Relationship form
 - c) Comparison form

UNIT 11 HYPOTHESIS: NATURE OF FORMULATION

Structure

- 11.1 Introduction
- 11.2 Objectives
- 11.3 Meaning of the Hypothesis
- 11.4 Sources of Hypothesis
 - 11.4.1 Experience and Creativity of the Researcher
 - 11.4.2 Background Knowledge
 - 11.4.3 Versatility of Intellect
 - 11.4.4 Analogies
 - 11.4.5 Scientific Theory
 - 11.4.6 Authentic Knowledge
- 11.5 Types of Hypothesis
 - 11.5.1 Directional and Non-directional
 - 11.5.2 Research Hypothesis and Null Hypothesis
- 11.6 Testing of the Hypothesis
- 11.7 Characteristics of a Good Hypothesis
- 11.8 Significance and Importance of a Hypothesis
- 11.9 Let Us Sum Up
- 11.10 Unit-end Activities
- 11.11 Points for Discussion
- 11.12 Suggested Readings
- 11.13 Answers to Check Your Progress

11.1 INTRODUCTION

Once the selection and definition of the research problem have been accomplished, the derivation of the hypothesis is the next most important step in the research process.

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

This unit describes the nature, importance and formulation of hypothesis. It also deals with various ways of stating a hypothesis and explains how it can be tested.

Various sources of hypothesis along with the characteristics and significance of hypothesis have also been explained.

11.2 OBJECTIVES

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

- define hypothesis;
- list the sources which are helpful in hypothesis formulation;
- differentiate between various types of hypotheses;
- discuss various methods to test hypotheses; and
- describe the significance of hypothesis.

11.3 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.

11.4 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:

11.4.1 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 requires hard work to solve them.

For example, a researcher who is working on the 'Classroom Correlates of Effective Teaching' can think of a host of factors such as teacher's mastery over the subject, effective use of teaching skills, decision-making, capability, perception of his competence, perception of student's capacity for better interaction, use of communication skills etc.

A critical analysis of these factors may facilitate the task of studying the relationship among the variables. Personal experiences of the researcher as a result of his personal readings of biographies, autobiographies, newspapers, research activities, relevant literature, informal talks with friends, socio-political speeches, etc. can be the potential sources in the generation of a hypothesis.

11.4.2 Background Knowledge

It is necessary for a researcher to be thoroughly familiar with established facts, existing theories and previous researches relating to the problem. The related literature is an important source of hypothesis formulation. It sharpens the perspective of a researcher as to how to hypothesize the relationship among the variables, which aspects of relationship have been already studied and which still remain to be tested. A rich background of knowledge enables the researcher to locate the key association among the variables and to find out the missing data needed to explain a phenomenon. The researcher should have intensive knowledge in the area in which he is carrying out an investigation and should be insightful so that she/he may deduce a hypothesis inductively after making observation of behaviour noticing trends or probable relationships.

Hypothesis is the product of considerable speculation and imaginative guess work. It is based partly on known facts and explanations. In formulating hypothesis, rich experiences and profound academic background of a researcher are helpful. Significant researches have not taken place accidentally but are the result of hard work. A researcher must have a rich background knowledge which may enable him/ her to perceive relationships among the variables.

11.4.3 Versatility of Intellect

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

11.4.4 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.

11.4.5 Scientific Theories

A systematic review and analysis of theories developed in field of psychology, sociology, political science and even in biological sciences may help the researcher to provide a suggestive base to formulate a hypothesis. For example, a researcher working on 'Modification of Teacher Behaviour' may be benefited by the Skinnerian theory of behaviour shaping.

11.4.6 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.

Chech Your Progress

Notes: a) Space is given below for writing your answers.

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

1. What is the meaning of hypothesis?

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2. List various sources of hypothesis.

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11.5 TYPES OF HYPOTHESIS

11.5.1 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 being directional or non-directional. The hypotheses which stipulate the direction of the expected differences or relationships are termed as directional hypotheses. For example, "There is positive relationship between the academic achievement and study habit of students" is a directional hypothesis. This hypothesis stipulates that students with good study habits will have high academic achievement. Similarly, the hypothesis: "Students with high test anxiety will score badly in examinations as compared to students with low anxiety" is a directional research hypothesis because it stipulates the direction of the difference between the groups.

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

Null hypothesis is used to test statistically the research hypothesis, which has been stated in directional or non-directional form. Null hypothesis is also called 'testing hypothesis' when a directional (declarative) or non-directional hypothesis is tested statistically by converting it into null form. A null hypothesis challenges the assertion of a declarative hypothesis.

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

11.5.2 Research Hypothesis and Null Hypothesis

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

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

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

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

11.6 TESTING OF THE HYPOTHESIS

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, hence 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 change, 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 errors increase.

In case of historical research, by using external or internal criticism, a hypothesis is never proved; it is merely sustained or rejected. Although hypotheses are not always explicitly stated in historical researches, they are usually implied. The historian gathers evidence and carefully evaluates its trustworthiness. If the evidence is compatible with the consequences of the hypothesis, it is confirmed. If the evidence is not compatible, or negative, the hypothesis is not confirmed. It is through such synthesis that historical generalization are established (Best and Kahn, 1992, P. 64).

11.7 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.

- iii) It must suggest a tentative solution to the problem under study.

For example, 'Academic achievement varies according to the level of intelligence.' This hypothesis suggests that intelligence influences the academic achievement.

- iv) It must be clear and stated in a precise manner. A clear statement of hypothesis generally involves concise technical language and definition of terms that are better defined than those in common language. Vague terms or constructs are difficult to define operationally. Use of general terms and words such as good, bad, poor, personality, social class etc make a hypothesis vague. The researcher should use 'personality' as measured by 16 PF (16 personality factors), 'Intelligence' as measured by Raven's Progressive Matrices (intelligence test) etc. in the statement of a hypothesis.
- v) The hypothesis should be limited in scope. The hypothesis of global significance may not yield the usual consequences. Sometimes an over-ambitious researcher formulates an ambiguous hypothesis of global significance. It is partly because of his earnestness and partly because it takes maturity of view point to realize how little can be accomplished in a specified time. It is desirable to formulate hypotheses that are simple to test, and yet are highly significant.
- vi) A hypothesis must be consistent with known facts. It must be consistent with a substantial body of established facts. A good hypothesis is grounded in well established theories and laws.

- vii) A hypothesis must explain what it intends to explain.
- iv) 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.
- viii) 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.

- ix) 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.

11.8 SIGNIFICANCE AND IMPORTANCE OF A HYPOTHESIS

- i) A hypothesis directs, monitors and controls the research efforts. It provides tentative explanations of facts and phenomena and can be tested and validated. Such explanations, if held valid, lead to generalizations, which help significantly in understanding a problem, and thereby extend the existing knowledge in the area to which they pertain and thus help in theory building and facilitate extension of knowledge in an area.
- ii) The hypothesis not only indicates what to look for in an investigation but how to select a sample, choose a design of research, how to collect data and how to interpret the results to draw valid conclusions.
- iii) The hypothesis orients the researcher to be more sensitive to certain relevant aspects of problem so as to focus on specific issues and pertinent facts. It helps the researcher to delimit his study in scope so that it does not become broad and unwieldy.
- iv) The hypothesis provides the researcher with rational statements, consisting of elements expressed in a logical order of relationships, which seek to describe or to explain conditions or events that have not yet been confirmed by facts. Some relationships between elements or variables in hypotheses are known facts and others transcend the known facts to give reasonable explanations for known conditions. The hypothesis helps the researcher relate logically known facts to intelligent guesses about unknown conditions. (Ary, et. al 1972, pp. 73-74)
- v) Hypothesis formulation and its testing add a scientific rigour to all type of researches. A well thought set of hypothesis places a clear and specific goal before the researcher and equips him with understanding. It provides the basis for reporting the conclusions of the study on the basis of these conclusions. The researcher can make the research report interesting and meaningful to the reader.

The importance of a hypothesis is generally recognized more in the studies which aim to make predictions about some outcome. In an experimental study, the researcher is interested in making prediction about the expected outcomes and, therefore the role of hypothesis is considered to be of utmost importance. In historical or descriptive studies, on the other hand, the researcher is investigating the history of an event, life of a man, or is seeking facts to determine the status quo of some situation and thus may not have a basis for making a 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/him.

Check Your Progress

Notes: a) Space is given below for writing your answers.

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

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

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4. How is hypothesis tested?

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11.9 LET US SUM UP

Hypothesis is tentative solution or an intelligent guess about a research problem under study. It is not simply an educated guess, rather it is based on past research where the researcher gathers the evidence to advance a hypothesized relationship between variables. Thus, it is a conjecture statement about the solution of a problem, which the researcher goes on to verify on the basis of relevant information. Various sources, namely, experience, creativity, background knowledge, scientific theories etc. are important sources, which are important sources which are helpful in the formulation of a hypothesis.

Based on these sources, hypotheses are of various types: i) Directional and non-directional, and ii) Research and null hypothesis.

After the hypothesis is formulated, it is subjected to testing. Some hypotheses are simple and can be tested directly. In most situations, however, they are complex and can not be so tested. They are tested in terms of their deduced consequences.

A good hypothesis is one which is testable, and states the expected relationship between variables. It is clearly and precisely stated. A good hypothesis should state the expected relationship between the variables. It is limited in scope and should be consistent with the most known facts.

A hypothesis has great significance in the research process. It (i) directs, monitors and controls the research effort, (ii) helps in drawing generalizations to build theories, (iii) suggests the method of problem solving, (iv) helps in studying cause-effect relationship between the variables, (v) facilitates extension of knowledge in an area, and (vi) provides a basis for reporting the conclusions of the study.

11.10 UNIT-END ACTIVITY

- Refer to any five M.Ed. or M.A. (Education) dissertations. Find out the nature of hypotheses used in the dissertations.

11.11 POINTS FOR DISCUSSION

1. Discuss the importance of hypothesis in experimental studies.
2. Discuss the nature of hypothesis in Survey and Experimental Research.

11.12 SUGGESTED READINGS

- Ary, D., Lucy C. Jacobs, and Asghar Razavieh (1972): *Introduction to Research in Education*. New York: Holt, Rinehart and Winston, Inc.
- Best, J.W. and James V. Kahn (1992): *Research in Education*. New Delhi: Prentice Hall of India Pvt. Ltd. (Indian Edition).
- Kerlinger, F.N. (1993): *Foundations of Behavioural Research: Educational and Psychological Inquiry*. New York: Holt, Rinehart & Winston.
- Koul, Lokesh (1997): *Methodology of Educational Research*. New Delhi: Vikas Publishing House Pvt. Ltd. (Third Revised Edition).
- Mouly, George J. (1963): *The Science of Educational Research*. New Delhi: Eurasia Publishing House.
- Siegel, S. (1956): *Non-parametric Statistics for the Behavioural Sciences*. Tokyo: McGraw-Hill Ltd.
- Travers, R.W. (1969): *An Introduction to Educational Research*. 3rd ed. New York: Macmillan Co.
- Van Dalen, V. (1973): *Understanding Educational Research*. New York: McGraw Hill Book.
- Wiersma, W. (1986): *Research Methods in Education: An Introduction*. Boston: Allyn and Bacon.

11.12 ANSWERS TO CHECK YOUR PROGRESS

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.
3. A good hypothesis should (i) be clearly and precisely stated; (ii) be testable; (iii) state the expected relationship between variables; (iv) be limited in scope; and (v) be consistent with most known facts.
4. Hypothesis is subjected to empirical and logical testing. The nature of the hypothesis can be tested directly. A complex hypothesis is tested in terms of its deduced consequences. The process involved is to collect evidence by selecting or developing data collecting tools, to analyse data, and then to interpret results in the light of hypothesis and its deduced consequences.

UNIT 12 SAMPLING

Structure

- 12.1 Introduction
- 12.2 Objectives
- 12.3 Meaning of Population and Sample
- 12.4 Methods/Designs of Sampling
 - 12.4.1 Probability Sampling
 - 12.4.2 Non-probability Sampling
 - 12.4.3 Criteria for Selecting Sampling
- 12.5 Probability Sampling
 - 12.5.1 Simple Random Sampling
 - 12.5.2 Systematic Sampling
 - 12.5.3 Stratified Sampling
 - 12.5.4 Cluster Sampling
 - 12.5.5 Multi-stage and Multi-phase Sampling
- 12.6 Non-probability Sampling
 - 12.6.1 Incidental Sampling
 - 12.6.2 Purposive Sampling
 - 12.6.3 Quota Sampling
- 12.7 Characteristics of a Good Sample
- 12.8 Let Us Sum Up
- 12.9 Unit-end Activity
- 12.10 Point For Discussion
- 12.11 Suggested Readings
- 12.12 Answers to Check Your Progress
- 12.13 Glossary

12.1 INTRODUCTION

In Unit 11, we have discussed the meaning and type of hypothesis. We also know by this time that testing the hypothesis is central to the research. In order to accomplish this it is imperative to collect requisite, recent and most relevant data. This helps us to decide from whom and how to collect these data.

The primary purpose of research is to discover principles that have universal application. But to study a whole population in order to arrive at generalizations would be impracticable if not impossible. Some populations are so that their characteristics cannot be measured, because before the measurement could be completed, the populations would have changed. Imagine the difficulty of conducting an experiment with all fifth-grade Indian children [as subjects] on numerical ability. The study of this population would require the services of thousands of researchers, the expenditure of millions of rupees and thousands of class hours. In view of this it becomes imperative to collect the data from a smaller group of the population instead of collecting from the whole population.

There are various ways to achieve this. We will discuss these in this unit.

12.2 OBJECTIVES

After completing the study of this unit, you will be to :

- define the terms 'population and sample',
- justify the need of selecting a sample,
- explain the meaning of probability sampling,
- describe various probability sampling methods,
- explain the meaning of non-probability sampling,
- describe various non-probability sampling methods,
- state the characteristics of a good sample.

12.3 MEANING OF POPULATION AND SAMPLE

A "population" is any group of individuals / units that have one or more characteristics in common which are of interest to the researcher, for a particular research. A population may include all the individuals of a particular type or a more restricted part of that group, e.g. a group of all the university teachers, or a group of male / female university teachers, or distance learners enrolled with IGNOU. For assessing the study habits of adolescent girls in city, all the adolescent girls of that city who are studying in schools and colleges, make up the population for this study.

A "sample" is a small proportion of a population selected for the study. By observing the characteristics of the sample, one can make certain inferences about the characteristics of the population from which it is drawn.

The term sampling refers to the strategies which enable us to pick a subgroup from a larger group and then use the subgroup as a basis for making judgement about the larger group. In order to use such a subgroup to make decisions about the larger group, the subgroup has to resemble the larger group as closely as possible.

12.4 METHODS/DESIGNS OF SAMPLING

In the earlier section we studied the concept of sampling. Now we shall study different sampling methods. The sampling method was used in social sciences research as early as in 1754 by A.L. Bowley. Since then the method is increasingly used. The sampling methods are broadly classified into two types: (i) Probability sampling and (ii) Non probability sampling

12.4.1 Probability Sampling

Probability Sampling is based on some statistical concepts such as the 'Law of Large Numbers', 'Central Limit Theorem and the Normal Distribution' etc. In this type of sampling, the units of the population are not selected at the discretion of the researcher, but by means of certain procedures which ensure that every unit of population has one fixed probability of being included in the sample. It is also called random sampling.

- The Law of Large Number states that as the sample size becomes large, probability that the estimate differs from the parameter to a greater extent, becomes small. Or in other words a larger number provides a more precise measure of the parameter under consideration. However, one precaution must be taken. While increasing the size of the sample care should be taken to maintain the representiveness of the sample, because a large sample does not automatically guarantee representiveness.

- As per the second concept, sampling distribution approaches normal distribution provided – more the irregular distribution in the population, larger is the sample and sample is selected to avoid biases.

12.4.2 Non-probability Methods

The non-probability methods are based on the judgements of the investigator as the most important element of control. The guiding principles in non-probability methods are – availability of the subjects, the personal judgement of the investigator, and convenience in carrying out the research.

12.4.3 Criteria for Selecting Sampling

- Because there are various sampling methods it becomes crucial to select appropriate sampling method. Young has suggested three criteria to be considered while selecting a sampling method –
 - A measurable or known probability sampling technique should be used to control the risk of errors in the sample estimate.
 - Simple, straightforward and workable methods, adapted to available facilities and personnel, should be used.
 - Achieving optimum balance between expenditure incurred and maximum of reliable information should be the guiding principle.
- The decision whether a probability sampling or a non -probability sampling is to be applied rests on the constraints which are not very different from those stated earlier. These are – objectives of the study, type of study and availability of the resources for the study.

If the objective of the research is to apply the results of the study to a small local group then sampling may not be given as much consideration as in a study the results of which are to be applied to a larger group. In experimental research internal validity is of more concern than the external validity.

- Action research generally does not require sampling from a larger group. Most of the times sampling is not very essential in historical research also. Whereas survey studies generally have a more rigorous sampling.
 - The availability of time, funds, manpower and equipment required is another important consideration in deciding about the size and technique of sampling.
- If one is interested in obtaining an estimate of the sampling error, one may resort to probability sampling rather than to a non-probability one.

Check Your Progress

Notes: a) Space is given below for writing your answer.

b) Compare your answer with that given at the end of the unit.

- State the meaning of the following terms:

Population, Sample, Probability Sampling, Non-probability Sampling.

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12.5 PROBABILITY SAMPLING

We know the meaning of and requirement for probability sampling. Now we will take a brief account of different methods of probability sampling.

12.5.1 Simple Random Sampling

Theoretically, this is a method of selecting 'n' units from N units in such a way that everyone in the population of N units, has an equal chance of being selected. This can be done through the following steps –

- defining population by specifying its various limits.
- preparing the sampling frame.
- incorporating the names or serial numbers of individual units in the sampling frame (every unit is to be listed, order does not make any difference).

It is important to note that random sample is not necessarily as identical representation of the population. After this, to get the required 'n' units different techniques are available. Let us get acquainted with these techniques one by one.

i) Lottery Method

After naming or numbering every unit in the population, they are well mixed. The required numbers of units are then drawn from all these well-mixed chits. The individuals/objects with these identification names/numbers are then picked up for inclusion in the sample.

However this technique has some objections. When the population is very large and includes such individuals/objects, which are of such nature that could not be mixed and further if 'well mixing' is not attained despite all efforts, the principle of randomness in the population may be violated.

ii) Random Table Method

In view of the above mentioned objections it is advised to use the random number tables instead of lottery method. The use of random numbers or manual lot drawing

Row → Column ↓	1	2	3	4	5	...	N
1	2315	7548	5901	8372	5993	...	6744
2	0554	5550	4310	5374	3508	...	1343
3	1487	1603	5032	4043	6223	...	0834
4	3897	6749	5094	0517	5853	...	1695
5	9731	2617	1899	7553	0870	...	0510
6	1174	2693	8144	3393	0862	...	6850
7	4336	1288	5911	0164	5623	...	4036
8	9380	6204	7833	2680	4491	...	2571
9	4954	0131	8108	4298	4187	...	9527
10	3676	8726	3337	9482	1569	...	3880
11	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...
N	3914	5218	3587	4855	4881	...	5042

will be too cumbersome to recommend in case of large population. In such situation, computer generated random selection should be resorted to, in order to save time and labour.

Tables of random numbers have been generated by computers producing a random sequence of digits e.g. random digit table by Rand Corporation and prepared by Kendall & Smith, by Fisher & Yates and by Tippet are frequently used.

The required number of units are selected from such a table in any convenient and systematic way. Now suppose we have select to 20 distance learners for interview from 80-distance learners registered at a study centre. We may start with any column and any row. Because we want 20 numbers i.e. two digit numbers, we have to select only the first two digits from each number. If we select the first column and start from first row then we will get following twenty two digit numbers – 23, 05, 14, 38, 97, 11, 43, 61. You will notice that numbers greater than 80 will have to be deleted from this list and for the remaining numbers selecting any other column and the row the procedure will have to be repeated, till we get required number i.e. 20. If any number is repeated in this list, it is to be substituted by selecting the next number. Until a sample of desired size is obtained, the selection procedure is to be continued.

Advantages

1. This method calls for no special expertise and training or even insight. It can be used mechanically by anybody.

However, best results are achieved by adopting simple random sampling method. Still, it is not free from criticism.

Limitations

Practically listing of all the units in the population may not be possible.

1. In case of population with infinite numbers, listing is out of the question.
2. It is difficult though not impossible, but it involves high cost.
3. In case of heterogeneous population the selected random sample may not truly represent the characteristics of the population.

12.5.2 Systematic Sampling

A variation of the random process of sampling is the systematic sampling. It is the selection of the required number of elements of the population to include in the sample. It involves the following steps :

- Listing the population elements in some order, say alphabetically, meritwise etc.
- Determining the desired number to be selected from the population e.g. 10 % of 1000 means 100 out of 1000.
- Starting with any number from among the numbers 1 to 10 (i.e. 1 to k, both inclusive), to select every 10th (or kth) element from the list. If the number chosen from 1 to 10 is 4 , then the selected numbers will be the 4th, 14th, 24th,, 994th elements making the sample with 100 elements.

As the elements are chosen from regular intervals, this technique is also known as sampling by regular intervals, this technique is also known as sampling by regular intervals, sampling by fixed intervals or sampling by every kth unit.

Advantages

1. It is more practical in that it involves less labour.
2. Because it is simpler to perform, it may reduce errors.
3. The procedure is speedy in comparison with simple random sampling.

4. The systematic sample is spread more evenly over the population which makes this method more precise than stratified random sampling.

Limitations

1. Selection of every element other than the first selected randomly is linked with the first element. This makes the process different from the simple random method where selection of every element is independent of other one.
2. When the list of elements has a **periodic arrangement**, there is a risk that the sample interval may coincide with the periodic interval in the list. Suppose, A, B, C, D and E are the 5 schools selected and from each school 100 students are selected. The students from school A are placed starting from 1, from school B starting from 2, from school C starting from 3, from school D starting from 4 and from school E starting from 5 with an interval of 5. Thus the school A students will hold the numbers 1,6,11,16,21,.....496. The school B students will hold the numbers 2,7,12,17,22,.....497. Now in systematic sampling procedure suppose we decide to select 5 % of the total and randomly choose any number from 1 to 5 say '3' then starting from 3 we will have to select every 5th number. These numbers will be 3,8,13,18,.....498. Have you noticed that all these numbers belong to school C? Why has it happened so?

The answer is

Because every school is repeated in the list with an interval of '5' and elements are selected with an interval of '5'.

3. Another limitation of the systematic sampling method is the **trend** of the listed population. This is explained below -

Suppose 100 students are listed in the decreasing order of academic merit. We want to draw a sample of 20 students from this using systematic sampling method. 20 out of 100 means the size of interval is '5'. We can draw many samples from this listed population. If we randomly pick up a number from amongst 1 to 5, say 3 then the sample will comprise the elements 3rd, 8th, 13th, 18th,.....98th instead, if we randomly pick '5' then the sample will comprise the 5th, 10th, 15th,.....,100th elements. Is it not obvious that the two samples will not be comparable in terms of merit? The mean average of these two samples would be significantly different with respect to merit and other associated variables. Calculations made from such samples cannot pinpoint the sources of variability.

12.5.3 Stratified Sampling

One question may arise in your mind is that :

How to increase the precision of the sample?

By increasing the size of the sample, its precision can be increased.

But this is not the only way. Let us see which is the other one. It is the 'stratified sampling'. The term 'stratified' is very much self-explanatory. It involves dividing the population into such sub-populations(strata) that each one of them is homogeneous within itself.

The steps to be followed in this method are as under –

- deciding upon one or more characteristics on the basis of which strata will be formed e.g. location of schools – rural, urban, suburban, urban-slums, metropolitan etc.
- dividing the population under consideration into strata on the basis of stratification characteristics/criteria.
- listing the units in each stratum separately.

- selecting requisite number of elements from each stratum using appropriate random selection technique.

Thus all the elements selected from all the strata compose the required sample.

Important points to be noted –

- i) The criteria for dividing the population into strata should be correlated with the variable being studied.
- ii) The criteria should be practical. It should not yield a unwieldy number of strata.
- iii) A good measure of the stratification criteria should be available; e.g. if reliable and valid tool of determining socio-economic status is not available, stratification on this basis would lead to confounding of the results.
- iv) Selection of the elements at random from each stratum in the same proportion as that of the actual size of the stratum in the population improves the representativeness of the sample and helps in achieving higher efficiency at a reduced cost.
- v) In some studies (like census) stratification is not possible before the data have been collected. After collecting the data stratification as per sex, age, educational level is effected. Or a simple random sample of the required size is selected and the classification into strata is observed.

Advantages

1. Stratified random sampling is very useful when a list of the elements in the population is not available.
2. It is the most applicable method of sampling when the population is heterogeneous.

12.5.4 Cluster Sampling

When listing of population or at least the total strength of the population is possible and available or in other words when the population is **finite** we saw that the sampling methods applicable were – simple random, systematic or stratified random sampling.

But what to do when the population is **infinite** ?

In such a case, the method applicable is called as '**cluster sampling**'.

Cluster sampling is used when the population under study is relatively infinite, where the list of the elements is not available, the elements/units are geographically scattered or when sampling of individual elements is not required or is not convenient.

A cluster is an intact group as available in the field. It is not formed by the researcher for the purpose of data collection. For example a school complex (a group of schools) is a cluster. Some such clusters are selected to make a sample. Here a sampling element/unit is a group/cluster.

In social survey, the cluster sampling is described as '**area sampling**'.

This method involves following steps –

- deciding the nature of the cluster required.
- indentifying/locating such clusters to make the population.
- selecting the clusters in required number at random.

Advantages

This method of sampling is economic, especially when the cost of measuring a unit is relatively small.

Limitations

When the sampling unit is to be an individual element/unit or number in the population, this method is not applicable.

12.5.5 Multi-stage and Multi-phase Sampling

In the multi-stage sampling selection of different types of sampling units such as some Districts in a State, some Taluka places in those Districts and then some schools, is involved at different sampling stages. Whereas in the multi-phase sampling, the researcher is concerned with the same type of sampling unit at each phase but some members are asked for more information than others, e.g. information regarding study habits of distance learners can be collected from 100 distance learners through a questionnaire and 20 out of them can be interviewed for more information.

The main distinction between the multi-stage and the multi-phase sampling is the use of unit of sampling at different levels.

Advantages

1. In both the methods burden on respondents is reduced.
2. Relative cost also gets reduced.
3. Two-phase sampling is useful in studying rare cases.
4. In two-phase sampling resulting gain in precision is more due to possibility of getting more information in details.

Check Your Progress

Notes: a) Space is given below for writing your answers.

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

2. Match the Pairs.

I) Sampling Method

Limitations

i) Simple Random

a) Sampling unit is not an individual element

ii) Systematic

b) Not applicable to heterogeneous population

iii) Cluster

c) Listing the elements in sub-population necessary

iv) Stratified random

d) Periodic arrangement of elements

e) Periodic arrangement of elements

II) Sampling Method

Special Feature

i) Stratified random

a) Every unit in the population has equal chance of being selected

ii) Simple random

b) Spread more evenly over the population

iii) Systematic

c) Useful in case of heterogeneous population

iv) Cluster

d) Applicable in case of infinite population

e) Same type of sampling unit at each phase

3. Distinguish between multi-stage and multi-phase sampling methods.

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12.6 NON-PROBABILITY SAMPLING

In 12.4.2 earlier we have understood the meaning of non-probability sampling. It is reiterated here. Where the selection of the units in the sample is based on the researcher's judgement and not on equal or known probability, it is the non-probability sampling method. A non-probability sample is termed as '**non-random sample**' due to the very fact that it is selected through non-random method. The main feature of such a sample is the lack of control of the sampling error on account of which this method of sampling is referred to as '**uncontrolled sampling**' method. This description of the non-probability sampling should not be taken in negative sense. In spite of all this many a times it is the demand of the situation to go for non-probability sampling method. Let us now study the different non-probability sampling methods one by one.

12.6.1 Incidental Sampling

Incidental Sampling is also known as accidental or convenience sampling. When a readily or easily available group is selected as a sample, it is termed as an '**incidental sample**'. A teacher-educator e.g. may select the students from a school situated in the same campus which serves as a practicing school for the concerned college of education, to experimentally find the effectiveness of concept attainment model to teach a mathematical concept say, a quadrilateral.

Advantages

The administrative convenience of obtaining sample for the study, the ease of testing, saving in time, completeness of the data collected are some of the merits of this method.

Limitations

Since there is no well-defined population and no random sampling method is applied to select the sample, the standard error formulae apply with a high degree of approximation. Hence no valid generalization can be drawn. Any attempt at generalization based on such data and conclusion thereof will be misleading.

12.6.2 Purposive Sampling

Another non-probability sampling method is 'purposive sampling'. In this method samples are expressly chosen because in the light of available information they resemble some larger group with respect to one or more characteristics. The controls/criteria for categorization in such samples are usually identified as representative areas such as a state, a district, a city etc or representative characteristics of individuals such as age, sex, socio-economic status etc. or representative types of groups such as elementary school teachers, secondary school teachers, college teachers, university teachers etc. These controls/ criteria may be further sub- divided e.g. the group of college teachers can be divided into male and female teachers or teachers in science/arts/commerce colleges etc.

Have you noticed that upto this stage the controls are somewhat similar to stratification criteria? After deciding upon the category required for the research, the researcher has to select the sample.

Actual selection of the units for inclusion in the sample is done purposively and not randomly; e.g. in order to tackle the problem of indiscipline only the undisciplined students are selected as the sample excluding others, on the basis of past experience.

Advantages

1. This method of sampling is useful where a small sample is required.
2. It is focused on solving problems of particular groups.

Limitations

This method is applicable only for the selection of samples including typical/special cases such as 'best teacher award winners' from the population of teachers or 'meritorious past students of the school' from the population of the past students.

12.6.3 Quota Sampling

This is another method of non-probability sampling. It involves the selection of the sample units within each stratum, on the basis of the judgement of the researcher. What distinguishes it from probability sampling is that, once the strength of the sample (e.g. how many women teachers from among the college teachers) is decided which forms the 'quota', the choice of the actual units to fit into this framework is left to the researcher.

Quota Sampling is thus a method of stratification sampling in which selection of sample units within the stratum is non- random.

These quotas are determined by the proportion of the groups, e.g. in order to study the attitude of school teachers towards environment education, first of all the school teachers will be stratified into men and women teachers, quotas for these strata will be fixed and will be selected (not randomly).

12.7 CHARACTERISTICS OF A GOOD SAMPLE

1. It is free from error due to bias or due to deliberate selection of the units of the sample.
2. There is no substitution of originally selected unit by some other more convenient way.
3. It does not suffer from incomplete coverage of the units selected for study.
4. It includes such units, which are as far as possible independent.
5. It represents the population in the strict sense that it is a miniature or replica in all respects of the population from which it has been drawn. This should at least apply to the characteristics directly under the investigation or those likely to affect these characteristics indirectly.
6. It is adequate or sufficient in size to allow confidence in the stability of its characteristics. An adequate sample is one that contains enough cases to ensure reliable results.

Check Your Progress

Notes: a) Space is given below for writing your answers.

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

4. What do you understand by an incidental sample?

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5. Compare and contrast the purposive and quota sampling methods.

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6. State any five characteristics of a good sample.

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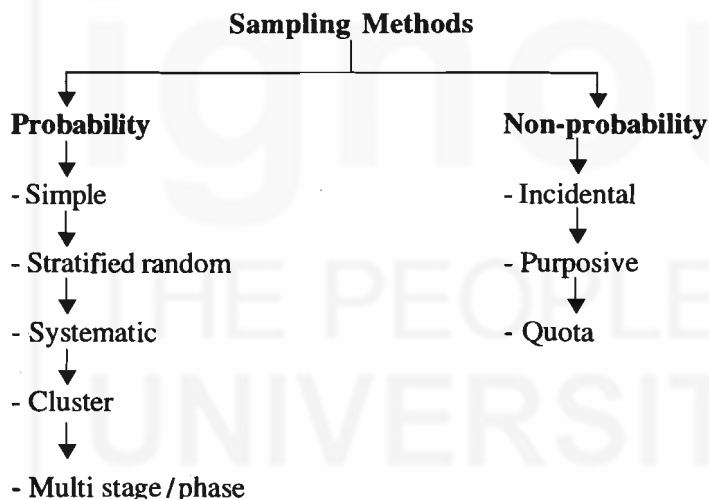
12.8 LET US SUM UP

In this Unit you got acquainted with the concept of population and sample. We elaborated the two types of sampling, namely, the probability and non-probability sampling.

We discussed in details various probability sampling methods including simple random sampling, stratified random sampling, systematic sampling, cluster sampling, and multi stage/ phase sampling.

You also got an explanation of the non-probability sampling methods including incidental sampling, purposive sampling and quota sampling.

At the end of the Unit we have tried to state the characteristics of a good sample.



12.9 UNIT-END ACTIVITY

- Get five Theses/Dissertations based on different research methods e.g. case study, survey, research etc. Study the sampling methods adopted in these studies and prepare a chart including the following columns – Research method, Sampling method, Sample size, rationale for adopting the sampling method.

12.10 POINT FOR DISCUSSION

- How do you determine the sample size when different research methods are adopted?

12.11 SUGGESTED READINGS

- Aggarwal, Y.P. (1998): *Better Sampling*. New Delhi: Sterling Publisher Private Ltd.
- Best, John W. and Kahn, James V. (1992): *Research in Education*. New Delhi: Prentice Hall of India Pvt. Ltd.

1. **Population** – A group of individuals / units having one or more characteristics in common which are of interest to the researcher for a particular research.

Probability Sampling – Sampling based on some statistical concepts such as the ‘Law of Large Numbers’, ‘Central Limit Theorem’, and the ‘Normal Distribution’ is known as probability sampling.

2.	I)	i)	—	(b)	II)	i)	—	(c)
		ii)	—	(e)		ii)	—	(a)
		iii)	—	(a)		iii)	—	(b)
		iv)	—	(c)		iv)	—	(d)

5. i) **Similarity** – Purposive and quota sampling both include stratification.
- ii) **Difference** – In purposive sampling actual selection of the units from a stratum, to be included in the sample is done purposively rather than by random methods.

6. Characteristics of a good sample –

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12.13 GLOSSARY

Parameter	:	It is a population value representing any trait or characteristic of the population as a whole.
Sampling	:	It is the process of selecting a sample from the population.
Sampling Bias	:	When the mean of the sampling distribution does not coincide with the parameter, it is said to be biased.
Sampling Distribution	:	It is the relative frequency distribution of an infinity of determinations of the value of this statistic.
Sampling Error	:	It is the difference between the value of parameter and that of corresponding statistic or the difference between population value and sample value of a characteristic.
Sampling Frame	:	It is a complete, accurate, and up-to-date list of all the units in a population.
Statistic	:	It is the sample value representing any trait or characteristic of the members of the sampling.

UNIT 13 TOOLS AND TECHNIQUES OF DATA COLLECTION

Structure

- 13.1 Introduction
- 13.2 Objectives
- 13.3 Tools of Data Collection
 - 13.3.1 Questionnaire
 - 13.3.2 Rating Scale
 - 13.3.3 Attitude Scales
 - 13.3.4 Check List
 - 13.3.5 Tests
 - 13.3.6 Inventory
- 13.4 Techniques of Data Collection
 - 13.4.1 Interview
 - 13.4.2 Observation
- 13.5 Documents
- 13.6 Characteristics and Criteria for Selection of a Good Tool
 - 13.6.1 Validity
 - 13.6.2 Reliability
 - 13.6.3 Objectivity
 - 13.6.4 Adequacy
 - 13.6.5 Usability
 - 13.6.6 Discriminating Power
 - 13.6.7 Interest
- 13.7 Let Us Sum Up
- 13.8 Unit-end Activities
- 13.9 Point for Discussion
- 13.10 Suggested Readings
- 13.11 Answers to Check Your Progress
- 13.12 Glossary

13.1 INTRODUCTION

In order to get relevant and adequate data it is necessary to use appropriate data collection device(s). The data-gathering devices that have proven useful in educational research include tools e.g. psychological tests and inventories, questionnaires, opinionnaires, checklists, rating scales and techniques, namely, observation, interview, sociogram, content analysis and guess-who technique. A researcher depending upon the nature of the research may select one of these devices or may employ a number of them in combination. But before selecting the devices, it is also necessary for a researcher to develop skill in constructing the required devices and using them effectively.

In this Unit we have made an effort to familiarize you with some of the data collection devices.

13.2 OBJECTIVES

On the completion of the study of this Unit, it is expected that you will be able to:

- state the meaning of a Questionnaire;
- describe the types of a Questionnaire;
- explain the characteristics of a good questionnaire;
- identify the advantages and limitations of a questionnaire;
- state the meaning of a Rating Scale;
- describe the types of a rating scale;
- explain the requirements of a good rating scale;
- identify the advantages and limitations of a rating scale;
- define an Attitude scale;
- describe the types of attitude scale;
- explain the characteristics of a good attitude scale;
- identify uses and limitations of an attitude scale;
- state the meaning of a Check List;
- describe types of check list;
- identify uses and limitations of a check list;
- define a test;
- describe various types of a test;
- explain basic characteristics of a standardized test;
- state the meaning of Interview technique;
- explain the types of interview;
- describe the process of interview;
- identify the advantages and limitations of interview;
- state the meaning of Observation technique;
- explain the types of observation;
- describe the process of observation;
- identify the advantages and limitations of observation; and
- decide the criteria for selection of a good tool of data collection.

13.3 TOOLS OF DATA COLLECTION

For acquisition of the required data many procedures have been developed to construct different types of tools. Depending upon the nature of the required data the researcher has to decide which tool will be appropriate under the circumstances. Some tools help in getting descriptive/qualitative data and some in getting quantitative data. Let us get information about some of the tools one by one.

13.3.1 Questionnaire

A questionnaire is an important instrument in normative-survey research, being used to gather information from widely scattered sources and also used when factual information is desired.

Meaning

Barr, et.al (1953), define questionnaire as “a systematic compilation of questions that are submitted to a sampling of population from which information is desired”. Its scope is very vast. It has been used for studying a wide range of problems.

Types or Forms of Questionnaire

1. Structured Vs. Non-structured Questionnaire

A structured questionnaire contains definite, concrete and directed questions, whereas non-structured one may consist of partially completed questions or statements. A non-structured questionnaire is often used as the interview guide, which is non-directive.

2. Closed form Vs. Open form

The questions that call for short check responses are known as restricted or closed form type. They provide for marking a ‘yes or no’ short response. It restricts the choice of response for the respondent.

The open form including open end or unrestricted type of questions calls for a free response in the respondent’s own words. No clues are provided. It probably provides for greater depth of response.

Example of Open-ended Questionnaire.

Question : What should be the role of Open and Learning System to promote access of the people to educational opportunities?

Example of Close-ended Questionnaire.

Question : Should performance of the teachers be evaluated by their students?

Answer: a) Yes b) No c) Undecided.

Characteristics of a Good Questionnaire

1. A good questionnaire deals with a significant topic so that it enthruses respondent to give response. Its significance is carefully stated on the questionnaire itself or on its covering letter.
2. It seeks only that data which cannot be obtained from the resources like books, reports and records.
3. It is as short as possible, though comprehensive and clear enough for securing all the essential information.
4. It is attractive in appearance, neatly arranged and clearly duplicated or printed.
5. It contains directions which are clear and complete. Important terms are clarified and each question deals with a single idea in unambiguous terms, so that it is valid and reliable.
6. Items are arranged in categories to ensure easy and accurate responses.
7. The questions are objective, with no clues, hints as to the responses desired. Heading questions are carefully avoided.
8. Questions are presented in good psychological order proceeding from general to more specific responses.
9. Double negatives and putting two questions in one question are also avoided.
10. The questions carry adequate number of alternatives.
11. It is easy to tabulate and interpret, based on a preconstructed tabulation sheet and a visualized final analysis of data.

Advantages

1. As an instrument of data collection the questionnaire has great potentialities when it is properly used.
2. It is economical both for the sender and for the respondent in time, effort and cost.
3. It is easy to plan, construct and administer.
4. When the subjects of the study are scattered far and wide, it will be a better tool as compared to the tools like interview. It permits nationwide or even international coverage.
5. It permits group administration and is adaptable to any objectives.
6. It is generally regarded as dependable when used to obtain statement of fact.
7. Information of a personal nature often may be obtained more readily by means of questionnaires.
8. It places less pressure on the subject for immediate response.
9. It helps in focusing the respondent's attention on all the significant items. It does not permit much of variation.
10. It may be used as a preliminary tool for conducting indepth study later on by any other method.
11. The responses given by the subjects are available in their own language and version.

Limitations

1. Its reliability and validity is low. It seeks secondary information concerning facts when primary evidence is not at hand.
2. Frequently questionnaire research constitutes simply a pooling of ignorance. It is compilation of the opinions of many persons who may not know the answer.
3. It gives a biased sample. The matter of non-response is always a big question mark.
4. The respondents who return the questionnaires may not constitute a representative section of the entire group.
5. If the subject misinterprets a question or gives an incomplete or indefinite response, nothing can be done.
6. A questionnaire is more or less rigid in its structure about complex emotional subjects.
7. Some respondents may not like to put their views on controversial issues in writing.
8. The behaviours, gestures, reactions, emotions of the respondent remain unnoticed.
9. Some of the research areas are so delicate, sensitive and confidential in nature that it becomes difficult to frame questions on them.
10. The questionnaire cannot be used with illiterate subjects and children.

13.3.2 Rating Scale

Meaning

“Rating is a term applied to expression of opinion or judgement regarding some situation, object or character. Opinions are usually expressed on a scale of values. Rating techniques are devices by which such judgements may be quantified” – Barr, et. al (1953), Rating scale is a device for obtaining judgements of the degree to which an individual possesses certain behaviour traits and attributes not readily detectable by

objective tests. A rating scale consists of a set of characteristics or qualities to be judged and some type of scale for indicating the degree to which each attribute is present. Descriptions of different degrees of quality are arranged along a line from high to low and this line is the scale.

Types of Rating Scale

1. Numerical Rating Scale

One of the simplest type of rating scales is that where the rater checks a number to indicate the degree to which a characteristic is present. Typically, each of a series of numbers is given a verbal description which remains constant from one characteristic to another. This type of scale is useful when the characteristic to rate can be classified into a limited number of categories.

2. Descriptive Rating Scale

This rating form uses descriptive phrases to identify the points on a graphic scale. The descriptions convey in behavioural terms what the individuals are like at different step along the scale. It is also called 'Behavioural Statement Scale'.

3. Graphic Rating Scale

The distinguishing feature of the graphic rating scale is that each characteristic is followed by a horizontal line. The rater's evaluation is indicated by placing a check or cross on a line to indicate presence or absence of a given trait.

4. Ranking Methods

Some rating procedures do not require a printed scale. Probably the most applicable and best known of these is the simple rank order method. With this approach, the pupils (or products) being rated are merely ranked in the order in which the rater estimates they possess the characteristics being judged.

5. Standard Scales

In standard scales a set of standards is presented to the rater. The standards are usually objects of the same kind to be rated with pre-established scale values. For example, in case of rating the drawing skill in science, a set specimen can be provided for comparison.

a) The percentage of group scale

Here the rater is asked to give the percentage of the group that possesses the trait on which the individual is rated.

b) Man to Man scale

The rater is asked to rate the ratee by comparing him to the person mentioned on the scale and assign the ratee his position.

6. Forced Choice Scales

In forced choice rating method the rater is asked to only mention whether the ratee has one or more traits. Instead of deciding whether particular quality of a person/object is above average, average, or below average certain observable characteristics are stated for rating. These statements differ in the degree of that quality, e.g.

- the student is very much regular in attending the fitness programme.
- the student is not regular in attending the fitness programme.
- the student rarely attends the fitness programme.

*** Requirements of a good rating Scale**

1. Traits must be clearly defined. The specific mode of behaviour must be defined properly.

2. Number of divisions on the scale should be neither too numerous nor too few. Optimum number of divisions is perhaps five to seven.
3. The rater may be asked to quote instances in support of his judgement.
4. Rater should be instructed to omit ratings of characteristics, if he had no opportunity to observe the traits.
5. The rater should be instructed to avoid the generosity and the logical error and the error due to halo effect.
6. Rating from several observers should be combined wherever possible.
7. The directions should be clear and comprehensive.
8. Items may be arranged in ascending or descending order from left to right.
9. Well informed and experienced persons should be selected for rating.
10. The number of characteristics to be rated should be limited.
11. In the rating scale card, some space may be provided for the rater to write some supplementary material.

Advantages of Rating Scale

1. A simple form of rating scale is commonly employed in judging contests of various kinds such as speaking and music competitions.
2. Rating Scales have been put to extensive uses in the field of rating teaching and teachers. This process extends to the selection of teachers and the prediction of teaching success.
3. Rating Scales are also used for testing the validity of many objective instruments like paper-pencil inventories of personality.
4. These scales are also employed for school appraisal including appraisal of courses, practices and programmes.
5. The rating scales are advantageous in several other ways. They are –
 - i) helpful in writing reports to parents.
 - ii) helpful in filling out admission blanks for colleges.
 - iii) helpful in filling out student needs.
 - iv) helpful in recommendations to employers.
 - v) helpful in supplementing other sources of understanding about the child.
 - vi) helpful in their stimulating effect upon the individuals who are rated.

Limitations of Rating Scale

1. People differ markedly in their ability to make ratings.
2. People differ in their reliability as subjects for ratings.
3. Immediate emotional reactions affect ratings.
4. Self-ratings tend to be too high on desirable traits and too low on undesirable traits.
5. Raters are frequently unable to justify ratings or are apt to give absurd rationalizations.
6. Generosity Error -The raters would not like to run down their own people by giving them low ratings. The result is that high ratings are given in almost all cases. The raters are also inclined to be unduly generous in rating aspects which they have had no opportunity to observe.
7. The Halo Error -It is difficult for rater to get rid of the halo effect which causes him to carry qualitative judgement from one aspect to another. Halo effect appears

frequently when the rater has to rate a number of factors on some of which he has no evidence for judgement.

8. The Error of Central Tendency -There is a tendency in some observers to rate most of the ratees near the mid points of the scale.
9. Stringency Error -The opposite of generosity error may be called stringency error. Some raters are so cautious and hesitant that they have a tendency to rate all individuals low.
10. The Logical Error -It is difficult to convey to the rater just what quality one wishes him to evaluate. An adjective or adverb may have no universal meaning.

An example of a rating scale

Dissection of Rate to expose Arterial System

<i>Steps followed in the Dissection</i>	<i>Weightage</i>	<i>Rating</i>	<i>Weighted</i>
a) Keeping the animal ventrally in the dissection tray filled with 1/3 level of water	03%	5	0.15
b) Fixing the pins on the arms and legs of the rat	05%	4	0.20
c) Giving deep incision from the center of thoracic region thereby removing the fat bodies and exposing the internal organs	07%	3	0.21
d) Puncturing the veins	15%	3	0.45
e) Exposing the arteries (Note: Here it is important to see the number of arteries, e.g., internal and external carotid)	35%	4	1.40
f) Display of arterial system by putting blackpaper strips or photographic film strips	25%	3	0.75
g) Diagram of arterial system	10%	3	0.30
			3.46

Source: IGNOU (2004): *Evaluation Perspectives in Higher Education, Instruction in Higher Education*. New Delhi: School of Education, IGNOU.

Validity and Reliability of a Rating Scale

Rating for intelligence and for special aptitudes can be validated against objective test scores, but rating of personality traits cannot be so validated, since no objective test scores are available for personality traits. In general reliability and validity increase with the number of agreements when ratings are made independently.

Check Your Progress

Notes: a) Space is given below for writing your answers.

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

1. Write the definition of a questionnaire and a rating scale.

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2. State different types of a questionnaire and a rating scale.

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3. In case of a questionnaire and a rating scale mention one major advantage and one limitation.

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13.3.3 Attitude Scales

Attitude scales have been designed to measure attitudes of a subject or group of subject towards issues, institutions and group of people.

Allport referred to attitude as 'the most distinctive and indispensable concept in contemporary American Social Psychology'. Thurstone boldly asserted that 'attitude can be measured'. In view of these two quotes it is no surprise that attitude has become an important concept in the field of education.

Meaning

Allport attempted to glean from the various definitions and arrived at three common features –

- a) preparation or readiness for favourable or unfavourable responses.
- b) which is activated in the presence of all objects and situations with which the attitude is related.

As per Barr, et. al (1953) – “An attitude may be defined as a learned emotional response set for or against something”.

Thurstone (1929) defines attitude as the degree of positive or negative affect associated with some *psychological objects*. By a psychological object, he means any institution, ideal, symbol, phrase, slogan, job or idea towards which people can differ with respect to positive or negative affect. The attitude is a personal disposition which impels an individual to react to an object, situation or proposition in favourable or unfavourable ways. For an attitude, there is continuous extending from favourableness through neutral to unfavourableness.

Types of Attitude Scales

The most prevalent means of measuring attitudes is providing individuals with a list of sentences or adjectives and asking them to respond to each sentence or adjective in accordance with their true feelings. These lists are called as 'Scales'. Various 'scaling techniques' have led to the development of different types of attitudes scales. The most frequently used scales are Linkert scale, Guttman scale, Thurstone scale and Semantic Differential scale.

1) Likert Scale

Likert scale consists of a series of statements all of which are related to a person's attitude towards a single object (e.g. – attitude toward school). Two types of statements appear on Likert scales.

- i) The first type of statements whose endorsement indicates a positive or favourable attitude toward the object under consideration (called as favourable statements).
- ii) The second type includes statements whose endorsement indicates a negative or unfavourable attitude toward the object (called as unfavourable statements).

Equal number of favourable and unfavourable statements are included in a Likert scale.

Modifications of Likert Scale

- i) Modification of the response options – the original Likert scale included five response options. In the use of odd number of options the respondent tends to choose the 'not sure' option to avoid making real choice. With an even number of option the respondent is forced to choose between favourable and unfavourable responses to the attitude object.
- ii) Modification of the statement format has also been made. Incomplete statements rather than complete statements have been used.

Advantages of Likert Scale

- i) easy to construct.
- ii) adaptability to a wide variety of attitude objects, situations, settings
- iii) ability to assess both – directions and intensity of attitude

Disadvantages of Likert Scale

Different response patterns can produce the same total score, hence not as sensitive as Guttman and Thurstone scales.

Example of an Attitude Scale

Directions: Indicate how much you agree or disagree with each statement by circling the appropriate letter(s).

Key	SA -	Strongly Agree
	A -	Agree
	U -	Undecided
	D -	Disagree
	SD -	Strongly Disagree

SA A U D SD	1. Science classes are interesting.
SA A U D SD	2. Science laboratory is dull and boring.
SA A U D SD	3. It is fun working on science problems.
SA A U D SD	4. Class activities are good.
SA A U D SD	5. Reading the textbook is a waste of time.
SA A U D SD	6. The laboratory experiments are interesting.
SA A U D SD	7. Most class activities are monotonous.
SA A U D SD	8. I enjoy reading the textbook.
SA A U D SD	9. The problems we are studying are unimportant.
SA A U D SD	10. I am not very enthusiastic about science.

Figure 13.1: Likert-type attitude scale for measuring attitude towards a science course.

Source: N.E. Gronlund (1981): *Measurement and Evaluation in Teaching*. 4th ed. New Delhi: MacMillan.

2) Guttman Scale

Guttman scale includes a set of statements which relate to a person's attitude towards a single object. Guttman scale possesses two characteristics –

- i) the statements included on such a scale represent increasingly positive feelings with respect to the attitude toward an object.
- ii) the endorsement of any statement implies the endorsement of each less positive statement.

3) Thurstone Scale

Thurstone's technique is also known as the technique of equal appearing intervals. If attitude is accepted as a uni-dimensional linear continuum, then Thurstone's proposal to measure it by statements scaled by the method of equal-appearing intervals would apply.

4) Semantic Differential Scale

It is a method for measuring aspects of the meaning of various concepts. It is widely used as an attitude measurement technique. It consists of a set of seven-point-bipolar scales and a set of concepts. Each concept is rated on each scale.

Uses of Attitude Scale

- 1) Attitude scales are used in educational research, especially for finding the attitudes of persons on issues like co-education, religious education, international cooperation etc. depending upon the need of the situation.
- 2) To obtain the measure of the belief of an individual or a group of individuals towards some phenomenon the inquiry form attitude scale is used.

Limitations of Attitude Scales

1. As already stated, an individual may express socially acceptable opinions and conceal his real attitude.
2. An individual may not be a good judge of himself and may not be clearly aware of his real attitude.
3. He may not have confronted with a real situation to discover what his real attitude towards a specific phenomenon was.
4. There is no basis for believing that the five positions indicated in the Likert Scale are equally spaced.
5. It is unlikely that the statements are of equal value in 'far' or 'against' a proposition.
6. It is doubtful whether equal scores obtained by several individuals would indicate equal favourableness towards a given position.
7. It is unlikely that a respondent can validly react to a short life-qualifying situation.
8. In spite of anonymity of response, individuals tend to respond according to what they should feel rather than what they really feel.

Characteristics of a Good Attitude Scale

- 1) It provides for quantitative measure on a uni-dimensional scale of continuum.
- 2) It uses statements from the extreme positive position to extreme negative position.
- 3) It generally uses a four point scale as Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD). The individual gets the score as the sum of items credits.

- 4) It is usually standardized and norms are worked out.
- 5) It disguises the attitude object rather than directly asking about the attitude on the subject.

It may require the judges to pile up the given statements and compute the scale values according to the percentage of judges who place each statement in the score on the basis of the median scale values of the statements he has endorsed.

Validity of Attitude Scales

The attitude as denoted by the test score is compared with observable behaviour in a corresponding situation, and the extent to which they agree is taken as a measure of the validity of the scale.

Reliability of Attitude Scale

Most attitude scales have quite high reliability often between +0.75 and +0.90. The more varied the items included in a scale, the greater is likely to be its reliability, because variations in opinions about individual items are more likely to cancel out in this case than when the items are all very similar.

The reliability of a test also depends on the heterogeneity of opinions expressed by the individuals being tested, for greater the range of scores obtained, the higher will be the correlation between sets of scores obtained on different occasions.

13.3.4 Check List

The check lists consist of a list of items or behaviours with a place to check or to mark 'yes or no'. The chief purpose of the check list is to call attention to various aspects of an object or situation, to see that nothing of importance is overlooked. It is a simple laundry-list type of device, consisting of a prepared list of items. It is a type of questionnaire in the form of a set of categories for the respondent to check. It is used to record the presence or absence of the phenomena under study.

Four Common Styles of Constructing Check Lists

Types of Check Lists –

1. In one of the arrangements, all items found in a situation are to be checked, for example, a subject may be asked to check by putting (P) in the blank beside each activity undertaken in a school e. g.
 - Games and sports ()
 - Mass drill ()
 - Dramatics ()
2. In the second form, the respondent is asked to check with a yes or no and is asked to encircle or underline the response to the given item.
3. In the third form all the items are positive statements with checks (P) to be marked in a column on the right.
4. In the fourth form, the items are presented in sentences and the appropriate response out of the supplied responses is checked, underlined or encircled.

Hints on Constructing and using a Check List

1. The list of items in the check list may be continued or divided into groups of related items.
2. These lists are formulated on the basis of the judgement of experts and then each item is evaluated in respect of the number of favourable and unfavourable responses.

3. The items are arranged in categories and the categories are in a logical or psychological order. Related items are grouped together.
4. Terms used in the items are clearly defined.
5. An intensive survey of the literature is made to determine the type of check list to be used in an investigation.
6. Items are arranged in such a way that they are discriminative in quality to secure the required information and details.
7. Check lists have the quality of completeness and comprehensiveness. A pilot study is quite helpful in this direction.

Uses of Check Lists

1. The check list is an important tool in gathering facts for educational surveys.
2. It may also be used as a form for recording in observational studies of behaviour.
3. When used as a sort of scale to yield a score, it is an instrument often used in educational appraisal studies of - school buildings, property, plan, textbooks, instrumental procedures etc.
4. There are check lists designed for possible economies in a school, in the purchase of school supplies, appraising of the superintendent's report and the organization of high schools.
5. Check lists are also applied to classroom instructional activities, the studying of the working habits of students, the supervision of classroom instruction and teacher - pupil relationships.
6. The check lists which were built up in the Commonwealth Teacher Training Study may be used in a number of ways both for analysis and for evaluation.
7. Another use of the check list is the checking of textbooks which deal with topics related to teaching.
8. Personality is also sometimes rated by means of a check lists.
9. Many have made use of check lists in the Character Education Inquiry.
10. Check list is used for knowing the interest of the subject also, Kuder's Interest Inventory and Strong's Interest Blank are essentially Check Lists.

Example of a Check List

Measurement of 'Y' by the Method of Flexure			
Check List			
(Put a tick against those steps enumerated below, which the student performed correctly).			
1.	a) Determine	:	The vernier constant of the calipers
	b) Measure	:	The breadth of the beam
2.	a) Determine	:	The least count of the gauge
	b) Measure	:	The depth of the beam
3.	Set the beam properly between the knife-edges to have the desired length under study.		
4.	Measure the vernier constant of the trowelling microscope(TM).		
5.	Place the frame containing the indicator (pin) properly on the beam (i.e. it should be at the center perpendicular to the beam).		
6.	Focus the pin at the TM.		
	a) Measure the height of the tip of the pins from the surface of the table and bring the operating part of the TM at the same height.		

- b) Use the hand to place the paper (or anything easily identifiable) a little away from the outer end of the objective lens of the TM. See through the microscope and use the other hand to rotate the knob till the object is sharply focused. Now measure the approximate distance of this object from the objective lens. Let this distance be 'X'
 - c) Adjust the knob of the microscope so that the front side of the operating tube is approximately as a distance 'X' from the pin. The pin should get focused by this arrangement. If not, then give slight movement to the operating tube in the possible directions and you will get the sharply focused image of the pin. Make sure that there is no parallax between the tip of the pin and the horizontal cross-wire.
7. Take load vs. depression data
 8. Draw load vs. depression graph
 9. Take any one point on the graph, other the experimental point to calculate 'Y'
 10. Point out the source of errors.

Source: IGNOU (2004): *Evaluation Perspectives in Higher Education, Instruction: A Higher Education*. New Delhi: School of Education, IGNOU.

The above check list is an example of assess a particular instructional process. It aims to find out whether a particular item/object exists or not but not its extent/proportion or quality.

13.3.5 Tests

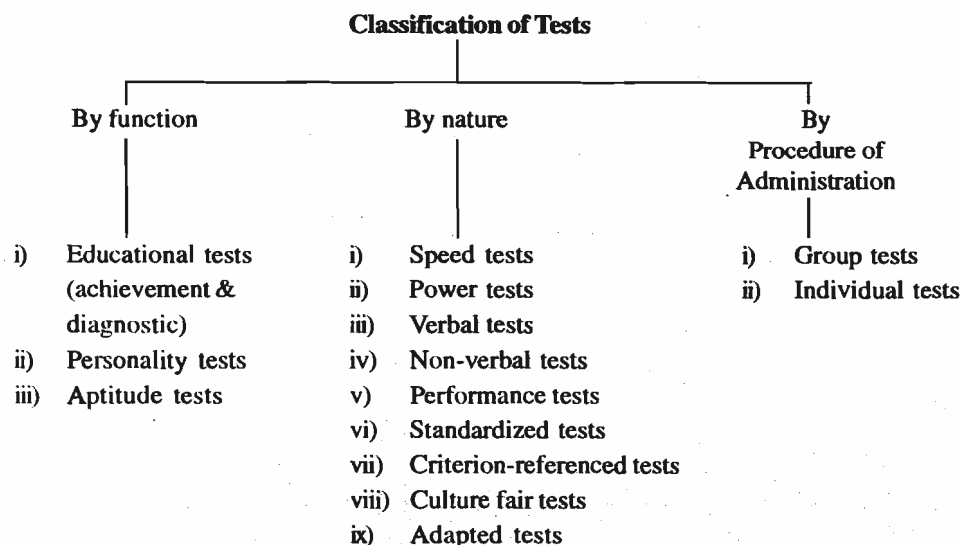
With the help of tests we can collect quantitative data in research. There are different type of tests. It was the English biologist, Sir Francis Galton, who was primarily responsible for launching the testing movement. In an article written by Cattell in 1890, the term 'mental test' was used for the first time. Psychological testing is a relatively young branch of one of the youngest of the sciences.

What is a Test ?

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

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 the Tests as per their Nature

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/skills.

Diagnostic tests are designed to analyze individual specific strengths and weaknesses in a subject and to suggest causes of his/her 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 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 (e.g. 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. (e.g. Stanford 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. 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 the 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. e.g. our usual school/college tests.
- (ii) **Power tests** are those tests which contain items of different difficulty value arranged in increasing order of difficulty value. 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 i.e. 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 his/her 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 e.g. '80x80 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 'culture-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/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/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.

4. Basic Characteristic of a Standardized Test

- i) **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 the examples of within Group Norms.
- ii) **Reliability of a Test** - 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) **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.
 - (b) **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.
 - (c) **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.

iii) Validity of a Test

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. The specific methods employed for investigating these relationships are classified under three principal categories - content, criterion-related and construct validity.

- (a) **Content Validity** - 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. It is commonly used in case of achievement tests.
- (b) **Criterion related Validity** - It refers to two types of validity under different time frames.

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 discriminant validity.

- (c) **Construct validity** - 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 judgement made by observation of behaviour identified by the theory as possessing 'originality'.

Note that -

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

Check Your Progress

Notes: a) Space is given below for writing your answers.

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

4. State the definition of the following –

Attitude Scale, Check List, Test.

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5. What are the different types of Attitude Scale?

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6. Elaborate the classification of tests, with one example each.

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13.3.6 Inventory

An inventory is a kind of self-report instrument. The individual checks responses to certain questions or statements. Inventories yield scores which are assumed or have been shown to measure certain tendencies or traits.

Interest inventories attempt to yield a measure of the types of activities that an individual has a tendency to like and to choose. In 1907, Hall, a psychologist, standardized Recreational Interest Inventory and in 1934, Kuder, another psychologist, standardized Occupational Interest Inventory.

Types of Interest Measurement

1. Direct Questioning – It presents questions like – ‘Do you like to play cricket?’
2. Direct Observation – Behaviour of the individual is observed and it is found out in which activities the individual is more interested.
3. Tested Interest – The individual is exposed to various experiences related to different types of interests and it is observed in which area the individual is showing more interest.
4. Interest Inventory – This is most preferred way of measuring interest. It consists of various statements and the individual is asked to arrange them in order of preference. Mostly interest inventories are of verbal type.
5. A Personality Inventory attempts to measure certain personality traits such as individual need, adjustment, etc. It consists of questions of ‘Yes /No’ type.

Advantages

- 1) Interest inventories are useful in educational and vocational guidance.
- 2) They are helpful to the teachers to provide educational facilities to the students as per their interests.
- 3) Individual as well as group administration is possible.
- 4) Personality inventories have been proved valuable in diagnosis in clinical situations for the psychiatrists.
- 5) An inventory is not very much time-bound.
- 6) For administering the inventory trained person is not required.

Limitations

- 1) Because of individuals’ inability or unwillingness to report their own reactions accurately or objectively these instruments may be of limited value.

Part of this limitation may be due to the inadequate theories of personality upon which some of these inventories have been based.

13.4 TECHNIQUES OF DATA COLLECTION

We can collect the requisite data for the research in hand employing some techniques. Following particular techniques, interview schedules and observation schedules can be prepared for the purpose of data collection. Let us get information about these in details.

13.4.1 Interview

Interview is a two-way method which permits an exchange of ideas and information. As a research technique, the interview is a conversation carried out with the definite purpose of obtaining certain information by means of the spoken word.

Types of Interviews

- 1) In structured interviews the same questions are presented in the same manner and order to each subject and the choice of alternative answers is restricted to a predetermined list. These interviews are rigidly standardized and formal, but they are more scientific in nature than unstructured ones.
- 2) Unstructured interviews are flexible, few restrictions are placed in respondent's answers. In this interview, one can penetrate behind initial answers, follow up unexpected clues.

Procedure of Interview

As a technique of data collection good interview requires

i) Preparing for interview -

The following factors need to be determined in advance of the actual interview.

- A clear conception of the purpose and of what information is needed.
- The kind of interview – individual or group.
- A clear outline or schedule of the best sequence of questions.
- A well thought plan for recording responses.

ii) Conduct of interview (execution) –

The initial task of securing the confidence and co-operation of the subject what is called – rapport – requires an expertness and sensitivity almost amounting to art.

- securing desired information through asking questions in the planned sequence should be done in not too rigid a manner but with stimulating and encouraging comments and necessary explanations and recordings.
- The recording device selected should be used without distracting the interviewee.

Before an interview study is undertaken, the interviewer should undergo rigorous training.

iii) Recording and Interpreting Responses –

- it is best to employ, if possible, a device of recording which would retain the actual wording of the responses. Tape-recording is convenient and not too expensive if tape-recorder is available.
- If the responses to questions in the interview have to be noted down, it can be done either simultaneously with the interview or immediately after it.
- Sometimes, instead of recording responses, the interviewers tend to record their evaluations of them as the interview goes on.

Advantages of Interview

- i) The interview, with skillful interviewers, is much superior to other data gathering devices.
- ii) It is specially appropriate when dealing with young children, illiterates and in an abnormal state of mind.

- iii) It is used for practical purposes rather than for gathering data for research. It is used for student counseling, selection of candidates for education etc.
- iv) In interview the investigator can create a right type of friendly atmosphere which is very conducive for obtaining desired data.
- v) If necessary the interviewer can give assurance to the interviewee that the facts will be properly used.
- vi) It permits even exchange of ideas and information. It provides opportunity for give and take.
- vii) The respondent's difficulties like bad handwriting, poor expression are also avoided as every schedule is filled by the interviewer.
- viii) The personal contact with the respondent enables the interviewer to probe more deeply into the character of the respondent.
- ix) The data gathered through interviews have been found to be fairly reliable.
- x) There is possibility of cross-questioning and putting supplementary questions.

Limitations of Interview

- i) This technique is time-consuming and one of the most difficult ones to employ successfully.
- ii) There is constant danger of interviewer bias.
- iii) The objectivity, sensitivity and insight of the interviewer is crucial. This procedure requires a level of expertness not ordinarily possessed by an average research worker.
- iv) A busy person may prefer to fill out a questionnaire at leisure rather than submit to a long interview.
- v) The respondent suffers from four limitations –
 - a) his experience as an interviewee.
 - b) his judgement about himself.
 - c) his accessibility and readiness to divulge the information.
 - d) his ability to express himself clearly.
- vi) The recording of data from an interview is full of difficulties.
- vii) Tape recording of the entire interview is likely to be expensive of time and money.
- viii) It does not work well with infants, shy people, deaf people and mad people.

13.4.2 Observation

Observation is a more natural way of gathering data. It seeks to ascertain what people think and do. By watching them in action as they express themselves in various situations and activities.

Types of Observation

1. Participant and Non-participant Observation – In participant observation; the observer becomes more or less one of the group under observation. In such situations, the observer will be in sight of the person being observed and may actually take part in some activity with the individual or group. The observer may play as one of several roles in observation, with varying degree of participation, as a visiting stranger, an attentive listener, an eager learner, or a more complete role as participant observer.

In Non-participant observation, the observer remains aloof from the group. He keeps his observation as inconspicuous as possible. It is used with such groups as those of infants, children or abnormal persons.

2. Structured and Non-structured Observation – In structured observation the investigator must be ready to shift from his original plans to the study of aspects which he sees as more significant.

The observation is wide and unstructured in the early stages, it gets restricted and structured as the investigation proceeds.

Stages in the process of Observation

As a good data collection technique observation needs –

1. Planning for Observation

The factors one must consider in detail while planning to employ observation as a research tool includes:

- Definition of specific activities.
- An appropriate group of subject to observe.
- Scope of observation – individual or group.
- Determination of length of each observation period.
- Deciding about the instruments and the form of recording and physical position of the observer.
- Determining the special conditions required for subjects.
- Preparation of proper tools for recording observation.
- Getting oneself trained in terms of expertness of an observer.

2. Execution of Observation

An expert execution demands :

- Proper arrangement of special conditions for the subjects.
- Assuming the proper physical position for observing.
- Focusing attention on the specific activities or units of behaviour under observation.
- Observing directly, the length and number of periods and intervals decided upon.
- Handling well the recording instruments to be used.
- Utilizing the training received in terms of expertness.

3. Recording and Interpreting Observations

The two common procedures for recording observation are –

- **Simultaneous-** when the observer goes on recording his observations simultaneously with the occurrence of the phenomena observed, as in time sampling.
- **Soon after the observation -** when the observer undertakes to record his observations not simultaneously with his actual observation process, but immediately after he has observed for a unit of time, while the details are still fresh in his mind.

Advantages of Observation

1. Observation as a research technique is being refined and made exact to an extent that it is likely to make an important contribution in descriptive research.
2. Significant aspects of personality which express themselves in behaviour can be best studied directly through observation rather than indirectly through questionnaire and interview.

3. Simple observation of physical aspects of school buildings or students and teachers, etc. is made through physical examination, measurement, assessment and comparison with fixed standards.
4. Observation of physical activities as in games and in the workshop is made directly very often for coaching purposes.
5. Observation in the classroom is made to analyse learning behaviour which is a more complex phenomenon, and to improve classroom performance.

Limitations of Observation

1. Establishing the validity of observation is always difficult. Many of the items of observation cannot be defined with sufficient precision.
2. The problem of subjectivity is also involved. A person tends to see what he knows.
3. There is also the danger of concentrating in an observation on the aspects of limited significance simply because they can be recorded objectively and accurately.
4. There is the possibility of distortion of the phenomena through the very act of observing.
5. Also the observer tends to see only those things which he wants to see.
6. Usually when an observer goes to the scene, the situation is new to him.
7. The incidents described may be samples of rarely occurring behaviour. The observer fails to obtain an adequate sample of data on the basis of which conclusions can be drawn.
8. The lack of competence of the observer may hamper validity and reliability of observation.
9. The people being observed become conscious and begin to behave in an unnatural manner.
10. It is a slow and laborious process. A particular situation which is desired to be observed might not occur for a very long time.
11. The data may be unmanageable. It would be difficult to arrange the behaviours along a continuum.
12. It is going to be a costly affair. It involves expenses on traveling, staying at the place of phenomena.

13.5 DOCUMENTS

Documents are the ready-made records which provide data to the researcher in relation to the research problem under consideration. They contain the data of remote periods and places for scientific analysis. Since the content of the document is itself the data, it does not depend upon a specific investigator. The system of recording the data is already determined by the person(s) other than the researcher.

Types of Documents – Documents are categorized in three ways

1. Expressive Documents

These specify the process of social interaction and include personal letters, diaries, biographies, autobiographies. Such types of documents are more used and useful for data collection in historical researches and in case studies.

2. Official Records

These documents provide useful information about the time and frequency of the occurrence of an event. Such data cover a wide range of events e.g. birthdate,

attendance and progress records of the students; data related to particular courses, result sheet etc. They also include the records of the minutes of the school committee meetings, minutes of various university meetings such as the meetings of academic council, board of studies etc. The annual reports, budgets and the pictorial records (e.g. photographs, videos) also comprise the official records.

The official records are useful in knowing and understanding past events and trends so as to gain perspective on the present and the future. They are helpful in studying the administrative pattern of the institution. They yield the data useful in historical and survey type researches and also in case studies.

13.6 CHARACTERISTICS AND CRITERIA FOR SELECTION OF A GOOD TOOL

13.6.1 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.

13.6.2 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.

13.6.3 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.

13.6.4 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 the reliability as well as to validity of a test. Hence the data collection tool must be adequate.

13.6.5 Usability

The most valid test in the world will do nothing to improve the school programme 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, teachers will avoid to use such a test.

- iii) **Ease of Interpretation** – In the final analysis, the success or failure of a testing programme 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.

13.6.6 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.

13.6.7 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.

Check Your Progress

Notes: a) Space is given below for writing your answers.

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

7. Define the terms – Interview and Observation.

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8. State different types of Interview and Observation.

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9. Give one major advantage and one limitation of interview and observation as techniques of data collection.

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10. List different criteria of selecting a good tool of data collection.

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11. State the importance of Document in data collection .

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13.7 LET US SUM UP

In this unit we have provided information about data gathering tools and techniques. Questionnaire, rating scales, attitude scale, checklist, tests are the major tools and interview and observation are the major data gathering techniques.

We discussed the meaning of questionnaire, rating scale, attitude scale, test, interview and observation. Along with the meaning of each one of these, we also explained their advantages/uses and limitations.

Because each data-gathering device has its own particular limitations, it is advisable to use multiple methods, supplementing one with others to counteract bias and generate more adequate data.

Many writers have argued the superiority of the interview over the questionnaire, or the use of the psychological test over the interview. The late Arvil S. Barr, University of Wisconsin, a teacher and a researcher, resolved discussions of this sort by asking, 'Which is better, a hammer or a handsaw?' Like the tools in the carpenter's chest, each is appropriate in a given situation.

13.8 UNIT-END ACTIVITIES

1. Refer to the dissertations/theses available in the local universities/post graduate colleges. List the tools used for data collection, along with the objectives and type of the tool.
2. Go through the various psychological tests and read the manuals as well.

13.9 POINTS FOR DISCUSSION

1. What are the different phases of standardizing a test?
2. How to frame a good question?

13.10 SUGGESTED READINGS

Barr, A.S., Robert, A. Davis and Plamer, O. Johnson (1953): *Educational Research and Appraisal*. Chicago: J.B. Lippincott.

Best, John. W. and Kahn, James. V. (1995): *Research in Education*. 7th edition, New Delhi: Prentice Hall of India.

Borg, Walter R. (1989): *Applying Educational Research, A Practical Guide for Teachers*. 2nd edition, New York: Longman.

Dandekar, W.N. (1986): *Evaluation in Schools*. Poona: Vidya Prakashan.

Kerlinger, Fred. N. (1993): *Foundations of Behavioural Research*. New York: Holt, Rinehart and Winston.

Sukhia, S.P., Mehrotra, P.V., Mehrora, R.N. (1996): *Elements of Educational Research*. 2nd edition, New Delhi: Allied Publishers Pvt. Ltd.

Keeves, John. P. (ed.) (1998): *Educational Research, Methodology and Measurement, An International Handbook*. London: Pergamon Press.

Evans, K. M. (1972): *Attitudes and Interest in Education*. London: Routledge and Kegan Paul.

Edwards, Allen. A. (1969): *Techniques of Attitude Scale Construction*. New York: Appleton Centruart Crofts.

Groundlund, N.E. (1981): *Measurement and Evaluation in Teaching*. 4thed., New Delhi: McMillan Publishing Co.

Koul, Lokesh (1997): *Methodology of Educational Research*. New Delhi: Vikas Publishing House Pvt. Ltd.

Thrustone, L.L. & E.J. Chave (1929): *The Measurement of Attitude*. Chicago: The University of Chicago Press.

Tuckman, B.W. (1972): *Conducting Educational Research*. New York: Harcourt Brace Jovanovich.

13.11 ANSWERS TO CHECK YOUR PROGRESS

1. Questionnaire – A set of questions prepared to obtain factual information with regard to the topic under study.

Rating Scale – It is the qualitative description of some aspects of a thing or of traits of a person, classified into five to seven categories.

2. Types of Questionnaire

- i) Structured Vs. Non-Structured – Where the former includes directed questions and the latter non-directed.
- ii) Closed form Vs. Open form – The first one calls for fixed responses and the second one calls for free responses.

Types of Rating Scale

- i) Numerical rating scale – where the ratee checks a number to indicate the degree of presence of a characteristic.
- ii) Descriptive – Graphic rating scale – uses descriptive phrases to identify the points on a graphic scale.
- iii) Graphic rating scale – the rater marks a cross or a check on a horizontal line representing a characteristic, to indicate the presence/absence of a given characteristic/trait.
- iv) Ranking method – in terms of possessing the characteristic being judged, the rater simply ranks in order.
- v) Standard scale – against a standard provided to the rater, rating is done.
- vi) Forced Choice scale – the rater is supposed to only mention whether or not the rater has one or more traits.

3. Advantage of

Questionnaire - Most preferred tool when the respondents are scattered far and wide.

Rating Scale - Useful in the field of rating teaching and teachers.

Limitation of -

Questionnaire - Respondents who return the questionnaire may not constitute a representative sample.

Rating Scale - Dominated by subjectivity.

4. Attitude scale – is a list of sentences or adjectives to obtain responses from an individual, to each sentence or adjective as per his/her true feelings.

Check list – is a list of items or behaviours to indicate the presence or absence of that item behaviour.

5. Types of Attitude scale –

Likert scale, Guttman scale, Thurstone scale and Semantic Differential scale are the four types of Attitude Scale.

6. Classification of Tests -

As per the Function-

- i) Educational tests.
- ii) Personality tests. (Allport – Vernon)
- iii) Aptitude Tests (DAT)

As per the Nature -

- i) Speed Tests (usual school/college tests)
- ii) Power Tests (Raven's Progressive Matrices Test)
- iii) Verbal Tests (usual school tests)
- iv) Non-verbal Test (Raven's Progressive Matrices Test)
- v) Performance Test (Kohs's Blocks Tests)
- vi) Standardized Test (Raven's Progressive Matrices Test)
- vii) Criterion – referenced Tests.
- viii) Culture fair Test (Raven's Progressive Matrices Test)
- ix) Adapted Tests (Kuhlman's Test of Intelligence adapted by Gnyan Prabodhini, Pune)

As per the mode of Administration -

- i) Group tests (Cattell's personality test)
- ii) Individual test (A Performance Test)

7. Interview – is a technique of asking questions and getting responses orally and face-to-face.

Observation – is a technique of collecting data directly by attending activities of an individual in different settings.

8. Types of Interview –

- i) Structured interview – same questions are asked in same order.
- ii) Unstructured interview – has flexibility in framing and deciding the order of the questions.

Types of Observation –

- i) Participant Vs Non-participant Observation – In the first one, observer is one of the members of the group being observed whereas in the other one observer is outsider to the group.
- ii) Structured Vs Non-Structured Observation – Observer plans as per the significant aspects of situation in structured observation whereas in non-structured one, initially it is wide.

9. Advantage of -

Interview - Useful in case of young children, illiterates and in an abnormal state of mind.

Observation- Significant aspects of behaviour can be studied directly.

Limitation of -

Interview - Time consuming, very much dependent on the interviewer.

Observation - All the significant aspects can not be observed simultaneously.

10. Criteria of selecting a good tool of data collection –

The tool to be selected should be –

- i) reliable
 - ii) valid
 - iii) objective
 - iv) adequate
 - v) usable
 - vi) possessing satisfactory discriminating power and
 - vii) of interest to the respondents.
11. The documents are very important tools of data collection. Expressive documents specify the process of social interaction. The official records provide information regarding the time and frequency of occurrence of past events and trends. Hence the documents are useful in historical and survey researches and in case studies.

13.12 GLOSSARY

Attitude	:	A moderately intense emotion that prepares or predisposes, an individual to respond consistently in a favourable or unfavourable manner when confronted with a particular psychological object.
Attitude Scale	:	It is the most prevalent means of measuring attitude which provides individuals with a list of statements and asks them to respond to each statement in accordance with their true feelings.
Observation	:	A technique of collecting data by directly examining the activities of an individual in different settings.
Qualitative Data	:	Descriptive narrations, responses to open ended questions, quotations, field notes etc are qualitative data.
Quantitative Data	:	Numerical figures or ratings are quantitative data.
Questionnaire	:	A set of questions dealing with psychological, social, educational or any other topic sent to an individual or a group with the purpose of obtaining factual information with regard to the topic under study.
Rating Scale	:	It is the qualitative description of a limited number of aspects of a thing or of traits of a person. The classifications may be set up in five to seven categories.
Reliability	:	It is the extent to which a tool is consistent in measuring whatever it may measure.
Test	:	A psychological test is an instrument designed to describe and measure a sample of certain aspects of human behaviour.
Check List	:	A Check List is a prepared list of behaviours or items to indicate the presence or absence of the behaviours or the item.
Data	:	All relevant materials, past and present, serving as basis for research study and analysis is the data.
Interview	:	It is a technique of asking questions and getting responses orally in face-to-face situation.
Validity	:	The extent to which a device does the job for which it is designed is its validity.

NOTES

