MAEDN-403

Methodology of Research in Education

MA EDUCATION

1st Semester

Rajiv Gandhi University
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METHODOLOGY OF RESEARCH IN EDUCATION

MA [Education]

First Semester

MAEDN 403

RAJIV GANDHI UNIVERSITY

Arunachal Pradesh, INDIA – 791112

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About the University

Rajiv Gandhi University (formerly Arunachal University) is a premier institution for higher education in the state of Arunachal Pradesh and has completed twenty-five year of its existence. Late Smt. Indira Gandhi, the then Prime Minister of India, laid the foundation stone of the university on 4th February, 1984 at Rono Hills, where the present campus is located.

Ever since its inception, the university has been trying to achieve excellence and fulfill the objectives as envisaged in the University Act. The University received academic recognition under Section 2(f) from the University Grants Comission on 28th March, 1985 and started functioning from 1st April, 1985. It got financial recognition under section 12-B of the UGC on 25th March, 1994. Since then Rajiv Gandhi University, (then Arunachal University) has carved a niche for itself in the educational scenario of the country following its selection as a University with potential for excellence by a high-level expert committee of the University Grants Commission from among universities in India.

The University was converted into a Central University with effect from 9th April, 2007 as per notification of the Ministry of Human Resource Development, Government of India.

The University is located atop Rono Hills on a picturesque tableland of 302 acres overlooking the river Dikrong. It is 6.5 km from the National Highway by the Dikrong Bridge.

The teaching and research programmes of the University are designed with a view to play a positive role in the socio-economic and cultural development of the State. The University offers Undergraduate, Post-graduate, M.Phil and Ph.D programmes. The Department of Education also offers the B.Ed Programme.

There are fifteen colleges affiliated to the University. The University has been extending educational facilities to students from the neighbouring states, particularly Assam. The Strength of students in different departments of the University and in affiliated colleges has been steadily increasing.

The faculty members have been actively engaged in research activities with financial support from UGC and other funding agencies. Since inception, a number of proposals on research projects have been sanctioned by various funding agencies to the University. Various departments have organized numerous seminars, workshops and conferences. Many faculty members have participated in national and international conferences and seminars held within the country and abroad. Eminent scholars and distinguished personalities have visited the University and delivered lectures on various disciplines.

The academic year 2000-2001 was a year of consolidation for the University. The switch over from the annual to the semester system took off smoothly and the performance of the students registered a marked improvements. Various syllabi designed by Boards of Post-graduate Studies (BPGS) have been implemented. VSAT facility installed by the ERNET India, New Delhi under the UGC-Infonet program, provides Internet access.

In spite of infrastructural constraints, the University has been maintaining its Academic excellence. The University has strictly adhered to the academic calendar, conducted the examinations and declared the results on time.The students from the University have found placements not only in State and Central Government Services, but also in various institutions, industries and organizations. Many students have emerged successful in the National Eligibility Test (NET).

Since inception, the University has made significant progress in teaching, research, innovations in curriculum development and developing infrastructure.

About IDE

The formal system of higher education in our country is facing the problems of access, limitation of seats, lack of facilities and infrastructure. Academicians from various disciplines opine that it is learning which is more important and not the channel of education. The education through distance mode is an alternative mode of imparting instruction to overcome the problems of access, infrastructure and socio-economic barriers. This will meet the demand for qualitative higher education of millions of people who cannot get admission in the regular system and wish to pursue their education. It also helps interested employed and unemployed men and women to continue with their higher education. Distance education is a distinct approach to impart education to learners who remained away in the space and/or time from the teachers and teaching institutions on account of economic, social and other considerations. Our main aim is to provide higher education opportunities to those who are unable to join regular academic and vocational education programmes in the affiliated colleges of the University and make higher education reach to the doorsteps in rural and geographically remote areas of Arunachal Pradesh in particular and North-eastern part of India in general. In 2008, the Centre for Distance Education has been renamed as "Institute of Distance Education (IDE)."

Continuing the endeavor to expand the learning opportunities for distant learners, IDE has introduced Post-Graduate Courses in 5 subjects (Education, English, Hindi, History and Political Science) from the Academy Session 2013-14.

The Institute of Distance Education is housed in the Physical Sciences Faculty Building(First floor) next to the University Library. The University campus is 6 kms from NERIST point on National Highway 52A. The University buses ply to NERIST point regularly.

Outstanding Features of Institute of Distance Education :

(i) At per with Regular Mode.
Eligibility requirements, curricular content, mode of examination and the award of degrees are on par with the colleges affiliated to the Rajiv Gandhi University and the Department(s) of the University

(ii) Self-Instructional Study Material (SISM)
The students are provided SISM prepared by the Institute and approved by Distance Education Council (DEC), New Delhi. This will be provided at the time of admission at the IDE or its Study Centres.SISM is provided only in English except Hindi subject.

(iii) Contact and Counselling Programme (CCP)
The course curriculum of every programme involves counsellig in the form of personal contact programmes of duration of approximately 7-15 days. The CCP shall not be compulsory for BA. However for professional courses and MA the attendance in CCP will be mandatory.

(iv) Field Training and Project
For professional course(s) there shall be provision of field training and project writing in the concerned subject.

(v) Medium of Instructions and Examination
The medium of instruction and examination will be English for all the subjects except for those subjects where the learners will need to write in the respective languages.

(vi) Subject /Counselling Coordinators
For developing study material, the IDE appoints subject coordinators from within and outside the University. In order to run the PCCP effectively Counselling Coordinators are engaged from the Departments of the University, The counseling-Coordinators do necessary coordination for involving resource persons in contact and counseling programme and assignemt evaluation.The learners can also contact them for clarifying their difficulties in then respective subjects.

SYLLABUS

Objectives:

1. To familiarize the students about the basic concepts of educational research
2. To develop the skill of conducting the research in education
3. To enable the students know various methods of educational research
4. To enable the students understand tools and techniques in educational research

Course Content :

UNIT-1. Educational Research:

- Scientific enquiry and Theory development:
- Meaning, Nature, scope and principles of educational research, Need & Purpose
- Types of Educational Research: Fundamental, Applied and Action research

UNIT-II. Research Process in Education:

- General steps, formulation of problem and its objectives, review of related literature and variables in research problems
- Hypothesis: meaning, sources, types and testing

UNIT-III. Methods of Educational Research

- Historical Research Descriptive Research, Survey Research
- Experimental Research: Designs of experimental research, characteristics,
- Internal and external validity in experimental research
- Qualitative Research: Phenomenological, Ethnographical

UNIT-IV. Tools and techniques in educational research:

- Inquiry forms, observation, interview, sociometry, rating scale and questionnaire
- Sampling Techniques in Educational Research
- Data collection procedure.
- Analysis of data and reporting
- Organization and statistical analysis of data
- Interpretation of data
- Writing of research proposal and report.

Practicum :

1. Selecting a research problem and identification of variables
2. Formulating the objectives and hypotheses

UNIT- 1
EDUCATIONAL RESEARCH

Structure

1.0. INTRODUCTION

Research in common parlance refers to a search for knowledge. One can also define research as a scientific and systematic search for pertinent information on a specific topic. In fact, research is an art of scientific investigation. The Advanced Learner's Dictionary of Current English lays down the meaning of research as "a careful investigation or inquiry specially through search for new facts in any branch of knowledge." Redman and Mory define research as a "systematized effort to gain new knowledge." Some people consider research as a movement, a movement from the known to the unknown. It is actually a voyage of discovery. We all possess the vital instinct of inquisitiveness for, when the unknown confronts us, we wonder and our inquisitiveness makes us probe and attain full and fuller understanding of the unknown. This inquisitiveness is the mother of all knowledge and the method which man employs for obtaining the knowledge of whatever the unknown can be termed as research.

Research is an academic activity and as such the term should be used in a technical sense. According to Clifford Woody research comprises defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis. D. Slesinger and M. Stephenson in the Encyclopedia of Social Sciences define research as "the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art." Research is, thus, an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison and experiment. In short, the search for knowledge through objective and systematic method of finding solution to a problem is research. The systematic approach concerning generalization and the formulation of a theory is also research. As such the term 'research' refers to the systematic method.

On the other hand , simply defined, research is a search for knowledge. One can also define research as a scientific and systematic pursuit of information on a specific topic. Scientifically, research can also be termed as scientific investigation. Thus, research and scientific enquiry can be considered synonymous. The only difference between the two is that while it is possible to employ scientific method without research, it is not possible to conduct any research without employing scientific methods. Thus, research is a more specialized form of scientific enquiry which in turn is the result of gathering of data, information and facts for the specific purpose. There are several types of research designs depending on the type of research study being conducted. The quality

of a good research design depends on the extent of its flexibility, efficiency and economy. Research design is also determined by adhering to certain basic principles of research design, such as the randomization principle and the local control principle. This unit will discuss the research process and the research proposal. A research proposal is like a foreword to the exhaustive research paper or dissertation and thus acts as a presentation paper for the researcher. Once the research proposal is approved, the researcher can go ahead and perform his/her research process.

You will also learn how a research design functions as a proactive tool for the researcher. It involves the technique of determining the methods of data collection and the ways in which the research work should be performed, giving due consideration to time and cost constraints. Educational research is a systematic attempt to gain a better understanding of educational process, which is generally meant for improving its efficiency. A research design is a predefined part of a research study. It is a statement that clearly defines the problem for which the research is being done. In this unit, you will be also familiarized with the concept of scientific method, research design, need and significance of research in education in detail.

1.1. UNIT OBJECTIVES

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

- Describe the significance of scientific enquiry and the theory developed using scientific method
- Explain how scientific theory is used in research
- Discuss the nature and scope of educational research
- Elaborate the objectives, the characteristics and types of educational research
- Identify the purpose, process and scope of educational research
- Recognize problems faced by researchers in India

1.2. SCIENTIFIC INQUIRY AND THEORY DEVELOPMENT

To understand any complex human activity we must grasp the language and approach of the individuals who pursue it. So it is with understanding science and scientific research. Science is a cumulative and endless series of empirical observation which results in the formation of concepts and theories, with both concepts and theories being subject to modification in the light of further empirical observations. Science is both a body of knowledge and the process of acquiring and refining knowledge. Since 19^{th} century science has become imperative of life. This is why, present age is called the "Age of Science". Modern educational system has become very complex and problematic. To carry research in this field systematically the researcher has to adopt scientific method or scientific inquiry method. How does scientific inquiry or scientific method acquired its importance it can be clear from "four sources of knowledge" or "four methods of knowing."

❖ **Four Methods of Knowing**

Charles Peirce (Kerlinger, 1984, p.5), the great American philosopher said that there are four general ways of knowing or as he put it, of fixing belief. They are

a. Method of tenacity
b. Method of Authority
c. Method of Intuition
d. Method of Science

Among these four methods of knowing, the fourth method that is the 'Method of Science' is more appropriate than others because it made little contribution to the advancement of human knowledge. So scientific method is -

1.3. Scientific Method

In order to conduct research work systematically and scientifically we have to accept scientific method. This method is generally attributed by Charls Darwin who integrated the most important aspects of inductive and deductive methods. In other words we can say that scientific method involves a double movement of reasoning from induction to deduction in its simplest form. It consists of working inductively from observations to hypothesis and then deductively from the hypotheses to the logical implications of the hypotheses in relation to what is already known.

Karl Pearson defines, "there is no shortcut to truth, no way to gain knowledge of the universe except through gateway of scientific method."

In the words of R.A. Sharma (1993), the method or the procedure which the scientists use in the pursuit of science may be termed as scientific method. Basically the scientific method is a problem solving method or in other words it is a method of solving a problem scientifically."

1.4. Scientific Inquiry

Scientific inquiry is the search for knowledge by using recognized methods in data collection, analysis and interpretation. The term "Scientific" refers to an approach and is not synonymous with science. Science is a body of established knowledge where as "Scientific" refers to the way the knowledge was generated. The scientific method is usually a sequential research process.

Definitions of Scientific Inquiry

According to Mc. Millan**, "**Scientific inquiry is simply an approach to developing valid and trustworthy knowledge"

According to Kerlinger, “Scientific, inquiry is systematic, controlled, empirical and critical investigation of hypothetical prepositions about the presumed relations among natural phenomena.”

According to Weinberg and Sabat, “Scientific inquiry is a definite method of looking at the World”

According to Lundberg, “Scientific inquiry consists of systematic observation classification and interpretation of data.”

1.4.1. Steps of Scientific Inquiry

The typical steps in the scientific inquiry are-

i. Define a problem.
ii. State the hypothesis to be tested.
iii. Collect and analyse data.
iv. Interprete the results and draw conclusions about the problem.

When a researcher is applying Scientific Inquiry, there are certain natures or characteristics of scientific inquiry to be taken into account. They are:

1. Verifiability: the results of scientific inquiry are invariably correct and dependable. They do not differ according to place, person and time. Thus, results can be verified by applying to similar situations.
2. Definiteness: a particular conclusion drawn out of scientific investigation is definite. It is so, because of interpretation, observation and verification of the data as well as any person can judge and check the definiteness of the data.
3. Objectivity: It is the most important characteristics of scientific inquiry. There is no place of subjectivity or inner and internal feelings here. All the things are to be perfectly objective and based on facts.
4. Generality: The conclusions drawn out of scientific inquiry are applicable for all the persons in all the circumstances.
5. Predictability: The conclusion drawn as a result of scientific study is helpful in prediction. These conclusions predict about similar new problem in new circumstances.
6. System: In scientific inquiry the conclusions are systematic. The elements of the system points out the means through which conclusion are drawn are scientifically planned and systematically prepared.

1.4.2. Scientific Inquiry in Educational Research

Educational research as the systematic and scholarly application of the scientific method interpreted in its broadest sense to the solution of educational problems or the development of education as a science and directed towards the development of a

science of behavior in educational situations. Generally, it involves critical analysis of;

1. **Objectivity**
    - It is both procedure and characteristics.
    - Objectivity means unbiased, open-minded, and not subjective.
    - As a procedures from which only one meaning or interpretation can be made.
    - Standardized tests in education are objective. Objectivity thus refers to the quality of the data produced by the procedures for collecting and analyzing data and not the researcher's personal characteristics.

The importance of objectivity is broader and pervades the entire research process. Educational research is seldom conducted in a laboratory, and it involves the study of human beings. Although objectivity is important in all the research, it is more difficult in research on humans. So here scientific inquiry is not applicable to objectivity of educational research.

2. **Precision**

The concept of classroom atmosphere, leadership, creativity or students engagement have precise meanings in research that may differ from conventional meanings.

- The most precise experience in quantitative research is a mathematical equation or statistical findings.
- Precision in qualitative research is achieved through words rather than numbers.

Precision in research also refers to precise measurement. In studies which use instruments such as tests, rating scales, observation schedules or closed response questionnaires and interviews, precise measurement is crucial. So here scientific inquiry is critical to the precision character of educational research.

3. **Verification**
    - Results can be verified in different ways, depending on the purpose of the original study.
    - The characteristics of verification or extension also refer to sharing the results of the study.
    - Research is a social enterprise, and its information is presented to the professional community for public scrutiny.
    - Through this process, researcher develops a body of knowledge and identifies new research questions.

As the result of scientific inquiry are invariably correct and dependable and do not differ according to place, person and time, so scientific inquiry here can be applied to the verification character of educational research.

4. **Parsimonious Explanation**
   - Research attempts to explain relationship among phenomena and to reduce the explanation to simple statements.
   - The theory "frustration leads to aggression" is an explanation that predicts, and it can be tested for verification.
   - The ultimate aim of research is thus to reduce complex realities to simple explanations.

As the scientific inquiry is a systematic controlled, empirical and critical investigation so here to the parsimonious explanation of educational research the scientific inquiry is not applicable.

5. **Empiricism**
   - Research is characterized by a strong empirical attitude and approach.
   - The lay meaning of empirical is that which is guided by practical experience, not by researcher.
   - To the researcher, empirical means guided by evidence obtained from systematic research methods rather than by opinions or authorities.

Here in educational research, empiricism and empirical attitude requires a temporary suspension of personal experience and beliefs, so that it cannot remain permanently as a whole by which scientific inquiry is affected to the empiricism of educational research.

6. **Logical Reasoning**
   - All research requires logical reasoning.
   - Reasoning is a thinking process using prescribed rules of logic, in which one proceeds from a general statement to the specific conclusion (deduction) or the reverse, from specific statements to a generalization (induction)

Deductive reasoning for example-

A- All living organisms breathe.
B- Breathing organism die.
C- Dogs are breathing organism.
D- Dogs die.

Inductive reasoning for Example-

A- Every dog which died in the last 5 years was overweight.
B- Therefore, every dog dies from being overweight.

It is important to note that neither system of logical reasoning is totally satisfactory, but when both are integrated into a research process, they make a single study more effective. So that in educational research scientific inquiry can be applied to the logical reasoning of educational research.

7. **Probabilistic Thinking**
   - Probabilistic thinking is central to research.
   - All scientific and applied disciplines are probabilistic.
   - Both quantitative and qualitative research statements have an implicit or explicit probabilistic meaning.

The behavioural and social sciences have more uncertainty than the physical sciences. It does not offer certainty. All it offers is probabilistic knowledge. So, one way of defining research might be to say that it is a method of reducing uncertainty. Research can never tell us that something is so certainty that no doubt exists. Hence due to this, in probabilistic thinking of educational research, the scientific inquiry cannot achieve.

1.5. EDUCATIONAL RESEARCH

Research in education as in other field is necessary for providing knowledge and skills for improving the process of education. As such, educational research refers to a systematic attempt to acquire knowledge, understanding and skill of the educational process with a view to improve it efficiently. Research is formal, systematic application of scientific method to the study if problems, Educational research are the formal, systematic, application of the scientific method to the study of educational problems. Educational research refers to a systematic attempt to gain a better understanding of educational process generally for the purpose of improving its efficiency. It is actually an application of scientific method to study educational problems. The main purpose educational research is to explain, predict and control educational phenomena. So, educational research is the process of solving problems related to educational phenomena or event by applying scientific principles. The educational research differs from other scientific research on the basis of nature of the phenomena studied. In educational research we study the human behaviour which is very complex in nature and difficult to explain, predict and control.

Travers Opines: "Educational research represents an activity directed towards the development of an organized body of scientific knowledge about the events with which educators concerned. Its central importance is the behaviour pattern of pupils and particularly those to be learned through the educational process. A scientific body of knowledge about education should enable the educators to determine just what teaching and other learning conditioning to provide in order to produce desired aspects of learned behaviour among young people who attend school".

G. G. Mouly: "The systematic scholarly application of scientific method, interpreted in its broadest sense, to the solution of educational problem, conversely any systematic study designed to promote the development of education as a science can be considered educational research".

Since education is a behavioural science, the major concern of educational research is to understand, describe, predict and control human behavour. It is the activity for developing knowledge and skills in different educational areas.

1.5.1. Nature of Educational Research

Educational research is a process of systematic approach to solve the problems related to educational situations and better understanding of educational processes. We can sum up the nature of educational research under the following headings-

- A sound Philosophy of education forms the basis of educational research.
- Educational research is directed towards the solution of problems related to educational phenomena or events.
- It needs imagination and insight as much as scientific attitude of mind.
- It is based upon the observable behaviour or empirical evidence.
- It requires an inter-disciplinary approach.
- It usually employs deductive reasoning the sciences of mind commonly.
- It is the formal, systematic application of the scientific method to the study of educational problems.
- It is not exact as research in physical sciences.
- It is considerably more difficult and complex than other scientific researches.
- It is difficult to generalize or replicate findings about variables in any educational environment.
- Rigid controls cannot be established and maintained in an educational research.
- In educational research the observation is difficult and subjective.
- It is based on inter-dependence of causes and effect.
- Educational research cannot be a mechanical process.
- It is not only the field of specialists.
- It generally requires inexpensive material.

1.5.2. Scope of Educational Research

The field of educational research can be classified into the following categories:

1. **Educational Psychology:** Researchers in this field help the teacher to understand the child in the classroom in order to improve the teaching-learning process. This research provides the following information:
    - Relative effectiveness of socio-cultural forces on the development of children.
    - Usefulness of learning theories in various educational settings.
    - Relative effectiveness of various learning theories via field experiments.

- Identification of factors conducive to learning.
- Role of physical/intellectual inefficiencies and defects in learning.
- Understanding the personality of children in the class.
- Effects of parental and teacher's attitude toward children on learning.
- Understanding the problems of physically and socially handicapped children in the school system.
- Role of teachers and textbooks in removing delinquency in adults.

2. **Philosophy of Education:** Research in this field can provide us the following information:
   - Role of logic in various areas of education from concept information to theory development.
   - Role of knowledge, beliefs and values in developing educational theories.
   - Role of ideologies and religion for improving educational practices.
   - Development of a practical philosophy in the Indian context.
   - Discovering new implications of ancient Indian philosophies in the present scenario.
   - Determining the contributions of various Indian philosophers and their implications at present.
   - Reorganization of the social structure and educational system in India.

3. **Sociology of Education:** Various dimensions of research in this field are given below:
   - Effects of changes in the demographic structure on education.
   - Effects of the New Education Policy (NPE-1986& POA- 1992) on expansion of education and employment.
   - Role of educational institutions in bringing about social change and vice versa.
   - Role of social and cultural factors in bringing about social and educational equity.
   - Role of teachers as agents of social change, modernization and social equity.
   - Education in disadvantaged sections of the society.
   - Minorities and their problems.
   - Reservation policy and its impact on the social system.

4. **Educational Management and Administration:** Research in this field can help us understand the following aspects:
   - Problems of educational administration in India and its impact on performance of students.

- Impact of educational planning and legislations on performance of students.
- Development of management theories and their implications on educational institutions.
- Role of teachers and principal in enhancing the performance of students.
- Impact of recruitment policies on output.
- Supervision and performance.
- Contribution of NGOs to education.
- Effects of liberalization and privatization of higher education in India.

5. **Comparative Education:** Research in this field helps us understand the following aspects of education:
   - Administrative and educational policies of different countries and their impact on society as a whole.
   - Impact of various systems of education in the world on each other.
   - Comparison of educational progress in various countries of the world.
   - Impact of economic progress on education.
   - Allocation of budget on education in different countries and its impact on educational progress.

6. **Curriculum Development:** Nature and scope of research in this field can be understood by the following topics:
   - Structure of the curriculum in India from the primary to higher level.
   - Analysis of psychological demands of learners at different stages of education.
   - Analysis and organization of curriculum in various subjects.
   - Curriculum in relation to needs of the learner and the society.
   - Analysis of textbooks at different stages of learning.
   - Modernization of curriculum in relation to changing needs.
   - Inculcation of national values through curriculum development.

7. **Guidance and Counselling:** Research in this field helps us to understand the following aspects of education:
   - Role of the family and neighborhood in teaching children to adjust to society.
   - Construction of tools for diagnosing adjustment problems of students.
   - Methodology of vocational guidance for children belonging to different strata of society.
   - Identification of factors contributive to success in the life of students.
   - Adaptation of foreign tests and inventories to Indian situations.

8. **Educational Technology:** Research in this field contributes in the:
    - Development of new teaching strategies by action researches.
    - Role of technology in teaching-learning process.
    - Application of psychology in solving teaching problems:
    - Application of technological equipment and laws in education.
    - Development of new audio-visual aids.

9. **Problems of Indian Education:** This research covers:
    - Pre-primary education
    - Primary education
    - Secondary education
    - Higher education
    - Vocational and technical education
    - Non-formal education
    - Distance education
    - Recommendations of commissions and committees on education
    - Continuous and comprehensive evaluation
    - Value education
    - Women's education
    - Inclusive education
    - Teacher education

10. **Inclusive Education:** Physical handicaps can be genetic or acquired. From diagnosis to their rehabilitation, we come across a number of problems that are to be investigated scientifically to arrive at a definite solution.

1.5.3. Principles of Educational Research

Research is a systematic process for developing a theory by applying scientific methods. It is an impartial, objective, empirical and logical analysis and recording of controlled observation that will finally lead to the development of a theory, principles, laws, etc., and will help us to predict about the phenomenon in future.

A research is said to begin with a question or a problem. The purpose of a research is to find out solutions through the application of systematic and scientific methods. Thus, research is a systematic approach to a purposeful investigation. Several authors and management gurus have defined research in different ways. Some of the proposed definitions of research are as follows:

- Redman and Mory have defined research as a systematized effort to gain new knowledge.

- In the words of the renowned researcher Clifford Woody, research comprises defining and redefining problems, formulating hypothesis or suggested solutions, collecting, organizing and evaluating data, making deductions and reaching conclusions, and carefully testing the conclusions to determine whether they fit the formulating hypothesis or not.
- D. Slesinger and M. Stephenson in the *Encyclopedia of Social Sciences* define research as manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in practice of an art.

The main aim of research is to uncover answers to questions by applying scientific procedures. Research aims to discover hidden truths. While each research initiative has a particular purpose, the objectives of research can be broadly characterized as follows:

i. **Exploratory/Formulative Research:** It attempts to get familiar with a concept or to develop new insights into it.
ii. **Descriptive Research:** It seeks to accurately portray the key characteristics of an individual, a situation or a group.
iii. **Diagnostic Research:** It establishes the frequency with which an event occurs, or the frequency with which it is associated with something else.
iv. **Hypothesis-Testing Research:** This type of research tests the hypotheses of a causal relationship between variables.

1.5.4. Need and Importance of Research in Education

Research enables us to develop useful and dependable knowledge in any field. Thus educational research is a process through which the education can be made effective and more dependable. Following are the some of the important consideration which emphasize the need of educational research.

1. **It helps in developing sound theories in education:** all the fields if education like philosophy, history, psychology, economics, technology and sociology are based on conceptual frame of theory. Educational research can establish sound theories in these fields.
2. **It helps in enrichment and improvement of teaching:** the act of reaching a science as well as an art. Adaptation of modern technology and improved methods of teaching can make it more effective and maximum communicative. Educational research helps in developing teaching technologies and new modes of communication.
3. **It helps the teacher to solve class-**room problems: a teacher faces numerous problems in a class room like individual difference, truancy, motivation etc. educational research helps the teacher to deal with these problems.

4. **Educational research helps in developing reliable and valid measuring instruments:** Quantification is one of the most important aspects of education. It helps the teachers to assess the child's needs and difficulties and to suggest feedback and remedial measures. Educational research helps in this direction by developing valid and reliable measuring instruments.
5. **Educational research helps in developing effective curriculum:** Curriculum is the means to achieve the objectives of education. Without an effective and live curriculum the educational process cannot be successful. Therefore,, educational research provides a lot of effort to develop effective and child centered curriculum.
6. **Education is considered to be both science and arts**. So, there is a need to add scientific knowledge to it for enrichment and improvement. This helps in adjusting educational programmes according to the situation. Research aids in giving suggestions on what to do and what not to do.
7. **Meeting with New Paradigm Shifts**: Meaning and application of many concepts of education have changed today. So the limits of educational research have to be extended from the formal and conventional modes of education to the non-formal and innovative system based on ecological and cybernetic models.
8. **Interface for Innovations in Education:** The 21st century has seen many new changes taking place in the field of knowledge due to scientific and technological development. Education has to play a convincing role here too so that we can accept these changes with pleasure and adapt to them. Educational research will help us in this regard to construct curriculums, to prepare new textbooks and to adopt new methods of teaching.

1.5.5. Purpose of Educational Research

Researches in education are conducted for fulfilling the following purposes:

a) To solve the immediate local problems in education.
b) To ascertain principles and develop procedures for use in the field of education.
c) To determine the extent we should go to for educating children and adults.
d) To answer the questions related to education through reflective thinking, to determine what should be done in the future on the basis of what is as present, and what was in the past.
e) To discover new applications of principles and laws in the field of education.

1.5.6. Steps in Educational Research

The following steps are followed for all educational researches:

1. Identification and Definition of the Problem

The problem to be researched is selected either by surveying material available on the topic or through experience when the researcher comes across a problem in an actual situation. This problem is actually a question that can be answered using scientific enquiry and procedure. After studying various concepts, the problem is defined in definite and clear terms so that it becomes clears what data or evidence will be required to solve this issue.

2. Formulating the Research Problem

The two types of research problems are those that relate to states of nature, and those that study relationships between variables, at the start, the researcher must identify the problem he/she will focus on, i.e., he/she must decide the area of interest, or specific characteristic of a subject that he/she would be probing. At the outset, the problem can be generalized and then the ambiguities, if any, can be resolved. Thereafter, the workability of an identified solution needs to be taken into account before a working formulation of the problem can be finalized. As is apparent from this, the starting point of any scientific enquiry process is to formulate the general topic into a specific research problem.

There are two logical steps involved in the process of formulating the research problem, viz., understanding the issue comprehensively, and rephrasing it into relevant terms to prepare for the subsequent analysis. One of the effective methods that may be used to understand the problem is to discuss it with colleagues, associates or experts on the matter. In an academic environment, the researcher can approach a guide or colleague who has successfully conducted several research studies. Often, the guide will summarize the issue generally and then leave it to the researcher to fine tune and rephrase the problem into operational terms. On the other hand, in private businesses or public/government institutions, the problem may be put forward by administrative agencies with which the researcher can discuss the origins of the problem and also take on board the issues that need to be considered while determining possible solutions.

The researcher must simultaneously study relevant literature so that he/ she gets acquainted with the problem. In this matter, he/she can review two broad types of literature—conceptual literature covering the relevant concepts and theories, and empirical literature where the subject matter comprises similar studies undertaken earlier. The purpose of this review is to obtain information regarding the data and other materials that are available and will enable the researcher to set out his/her research problem meaningfully. Subsequently, the researcher will rephrase the problem in as specific terms as possible. This activity—formulating or defining a research problem—is one of the most important steps in the entire research process. By defining the problem clearly, it

will be possible to distinguish relevant data from irrelevant data. There, however, needs to be focus on determining the objectivity and validity of the background data.

Professor W.A. Neiswanger correctly states that the statement of the objective is of basic importance because it determines the data which are to be collected, the characteristics of the data which are relevant, relations which are to be explored, the choice of techniques to be used in these explorations and the form of the final report. If the researcher identifies certain pertinent terms, he/she should clearly define these while formulating the problem. We note that the final formulation of a problem is often done in several steps; wherein a number of interim formulations are arrived such that each one is more specific, analytical and realistic than the preceding one.

3. Development of Working Hypotheses

After concluding a comprehensive study of the available literature, the researcher should state the working hypothesis or hypotheses clearly. A working hypothesis is an assumption which is made in order to establish and test its logical or empirical consequences. The development of appropriate research hypotheses is particularly important as these hypotheses provide the focal point and a direction for the research activity. They also have a bearing on which tests are to be conducted to analyse the data and, indirectly, on the quality of data which is to be used for the analysis. The hypotheses must be specific to the piece of research which is to be tested. A hypothesis provides guidance to the researcher by ring-fencing, or clearly identifying, the area of research and thereby ensuring that he/she remains on the right track. It sharpens his/her focus onto the key aspects problem. The hypothesis also determines the type of data required and the methods which are to be followed for the data analysis. The following approaches can be useful for developing working hypotheses:

- Discussing the problem with colleagues, associates and experts in order to understand its origin as well as the key objectives in seeking a solution.
- Examining the data and other available information, in order to identify trends, peculiarities and other nuances.
- Reviewing studies that have been conducted on similar problems.
- Personally conducting exploratory investigation, such as field surveys, or sample surveys with interested parties so as to obtain insight into the practical side of the problem.

Hence, good working hypotheses can be developed through forward thinking, discussions with colleagues or experts, and a study of the available information (including data as well as similar studies). Working hypotheses are effective when they are precisely and clearly defined. It should be noted that there are occasions where the

nature of the problem is such that working hypotheses are not required. This could be in the case of exploratory or formative researches, i.e., which do not seek to test the hypothesis. As a general practice, however, specification of working hypotheses is a basic step in the research process.

4. Clarification of Research Procedure

The procedure and method of research are clarified here. This refers to the general strategy to be followed for collecting and analysing data. The research method depends on the nature of the problem under study and the type of data required.

5. Collection of Data

The method or technique to be used for collecting data is specified at this stage. First, the sample is chosen and then research tools, such as questionnaires, tests, interviews, etc., are used on the sample.

6. Analysis and Interpretation of Data

In this step, data are first arranged in systematic form, and then they are analysed and interpreted in the context of the hypothesis. Appropriate quantitative as well as qualitative techniques are used for processing the data. This step helps in testing the hypothesis.

7. Drawing Conclusions and Development of Theory and Principles

This is the final step where conclusions are drawn on the basis of results and laws or principles (generalizations) are developed for general use.

8. Preparation of the Report or the Thesis

Finally, the researcher prepares a report of his/her work. This report must be written very diligently keeping certain guidelines in mind. The layout should have the following format:

a) The preliminary pages or introduction.
b) The main body of text.
c) The conclusion.

The preliminary pages of the report should comprise its title and the date, followed by acknowledgments and the foreword. This should be followed by the contents

and then the lists of tables, graphs and charts that are present in the report. The main text of the report should carry the following:

a) ***Introduction:*** The introduction should clearly mention the objective of the research and explain the methodology that has been employed in the report. It should also touch upon the scope of the study and its limitations, if any.
b) ***Summary of Findings:*** Following the introduction, the report should state the findings and recommendations in simple language. If there are many findings, they should just be summarized here.
c) ***Main Report:*** The main body of the report should be arranged logically and should comprise clearly distinguished sections.
d) ***Conclusion:*** At the end of the main text of the report, the researcher should again summarize the key findings. This should be done clearly and precisely in the manner of final summing up.

The appendices must be provided at the end of the report and should enlist all technical data. Also, the bibliography listing all the books, journals, reports, etc., that has been consulted, should be provided at the end of the report. Finally, the report must provide an index, particularly in the case of a published research report.

1.5.7. Research Approaches

Almost all types of research primarily follow the two basic approaches depending on the need of quality and the amount of data available. These two approaches are: (a) Quantitative approach and (b) Qualitative approach.

a) Quantitative Approach

This approach involves creation of data in quantitative terms. It can be further classified into the following approaches:

- **Inferential Approach:** It is used to form a database to infer features or relationships of population. This usually means survey research in which a model of population is studied.
- **Experimental Approach:** This approach attempts to establish a cause-effect relationship among the groups of subjects that make up the research study. It is characterized by a greater control over the research environment where some variables are operated to scrutinize their effect on other variables.
- **Simulation Approach:** This entails the creation of an artificial environment within which relevant information and data can be produced. It is useful in building models for understanding future conditions.

b) Qualitative Approach

This approach is concerned with the subjective assessment of human attitude, opinions and behaviour. It generates results either in non-quantitative form or in non-numerical data. This technique focuses on group interviews and in-depth interviews in its approach. It can be further classified into the following approaches:

- **Ethnographic Approach:** This is concerned with studying an entire culture. The researcher studies an integral cultural group in a natural setting over a specific period of time. By a cultural group, we mean any group of individuals, who share a common social identity, location or any other characteristics of interest. For example, an ethnographic study of hurricane victims in crisis, a group of children in kindergarten, or a cultural group in tribal India.
- **Phenomenological Approach:** This focuses on the subjective experiences of people over a long period of time. It aims at understanding the 'lived experience' of the individuals being studied.
- **Field Research:** This is a broad approach to qualitative research that facilitates collection of data. The basic idea involved in this research is that the researcher goes into the field to observe the phenomenon in its natural state. He/She takes extensive field notes, which are then coded and analysed in various ways.

1.6. TYPES OF EDUCATIONAL RESEARCH

Researches in education can be classified into different types on the basis of purpose and method.

❖ **Classification of Educational Research by Purpose:**

Research in education can be classified by purpose / objectives on the basis of the degree to which findings have direct educational application and the degree to which they are generalizable to other educational situation. According to the purpose or objective, we can categorize educational research as following:

a) Fundamental or Basic or Theoretical or Pure Research.
b) Applied Research or Field Research.
c) Action Research.

❖ **Classification of Educational Research by Approach or Method:**

All the research studies follow certain identifiable method or pattern. Certain procedure like statement of problem, collection of data and drawing of conclusions are

common to all studies. Still then some studies have specific procedures. Each of these methods is designed to answer a different type of question. Using method as criteria we can classify research into five types under two sub-sections given as below:

1) Longitudinal Research – includes-

(a) Historical Research.

(b) Case- study Research.

(c) Genetic Research.

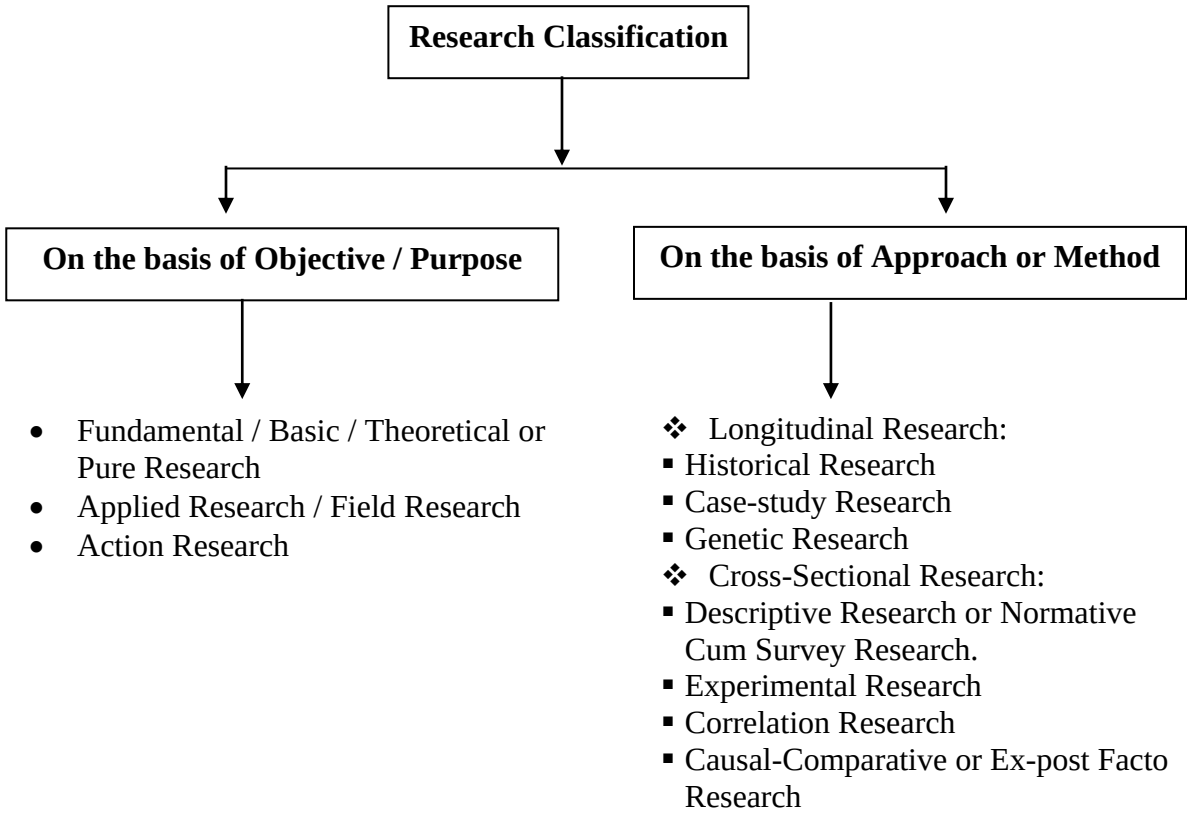
2) Cross – Sectional Research – includes-

(a) Descriptive Research or Normative Cum Survey Research.

(b) Experimental Research.

(c) Correlation Research.

(d) Causal – Comparative or Ex-post Facto Research.



1.6.1. Classification of Educational Research by Purpose

1. Basic Research

It is also called as pure, fundamental or theoretical research. The main aim of basic research is to discover basic truth and principles and to develop theories. It is not concerned with direct field problems, day to day phenomena and immediate application. According to *Travers* "Basic research is designed to add to an organized body of scientific knowledge and does not necessarily produce results of immediate practical value".

Basic research is primarily concerned with the theory development and refinement. Its major purpose is to obtain and use the empirical data to formulate, expand or evaluate theory. This research draws its pattern and spirit from the physical sciences. It represents a rigorous and structured type of analysis. It employs careful sampling procedure in order to extend the findings beyond the group or situation. It gives its results in the form of broad generalization or principles and theories. The main aim of basic research is the discovery of knowledge for the sake of knowledge. It has little concern for the application of the findings or social usefulness of the findings. It is usually carried out in well- equipped laboratory condition. Because 'precision and control' is the central focus of the basic research, since it is concerned with fundamental principles of behaviour, it may use animals rather than human beings as subject of study. In the field of education discovery of such useful concept motivation, reinforcement, concept formation in learning are the results of fundamental type of research. Therefore, the characteristics of basic research are basically based on.

- Generalization
- Precision
- Abstractness
- Expertiseness
- Verification
- Empiricism
- Logical Reasoning
- Well- stated Specific Hypotheses.
- Careful Unbiased or Random Sampling Procedure
- Exhaustive and Thorough Review of Literature.

2. Applied Research

It is also called as field research. This type of research work, in which the result of has direct application in the field. It is concerned with theories, principles and laws which work in the field. A basic research may propound a theory or discover a law, but applied research is concerned primarily with the testing of such theories or laws in the actual field

setting. The theories established through basic research on certain samples are tested upon and applied to other sample. So *Traver* opined that "Applied research is undertaken to solve an immediate problem and the goal of adding to scientific knowledge is secondary".

So applied research on the other hand directed towards the solution of immediate, specific and practical problems and under the condition in which they are found in practice. Moreover, the findings of applied research are evaluated in terms of local applicability and not in terms of universal validity. Applied research is mainly intended to improve school practices and add to greater teacher effectiveness in a practical manner. Most of the problems faced by the teachers, policy makers and administrators are solved through applied researches. In the true sense, most of the educational research is applied research for it attempt to develop generalizations about teaching and learning and instructional material. So the characteristics of applied research involves-

- Local level problems
- Practical problems
- Scientific procedure
- Immediate application
- Involvement
- Improvement of school practices
- Individual and group problems.

(3) Action Research

Action research is similar to applied research in several ways. But the difference is that the applied research usually involves a large samples resulting into more universally applicable finding, whereas action research is primarily conducted on the small samples available immediately in order to solve the immediate problem for the same small group.

Action research in education is a form of enquiry undertaken by the practitioners (teachers) in the educational situations (class-room or school) in order to improve.

a) *Their own educational practices*.

b) Their understanding of practices and

c) The situations in which the practices are carried-out.

The problems in action research relate to 'action' or 'practices' of teaching in classroom or in school. In action research many research project may be undertaken in a single class-room by a single teacher. Some other projects may be undertaken by all teachers in a school. Action research is directed towards the solution of immediate, specific and practical problems. It is performed in relation to actual problems and under the condition in which they are found in practice. It places importance on a problem here and now and adds little importance to scientific enquiry. So it is said that, action research is not generally concerned in obtaining generalized scientific knowledge about educational problems but in obtaining specific knowledge about the subjects involved in the study. It is mainly intended to improve school practices and add to greater teacher-effectiveness in a practical manner. As such action research is a type of applied research conducted by the teachers, supervisors, policy-makers and administrators themselves for dealing with class-room problems and improving class-room practices. It is more specific and objective- oriented. The technique which was developed earlier called as operational research, now it is appeared in the form of 'Action Research in Education'. The person most responsible for development of Action Research – **Stephen M. Corey**, who is called the *father* of action research whose publication "Action Research to improve school practices" help the teachers to solve their day to day problems.

According to S. M. Corey:- "Action Research is one of the best ways to enable people to improve their curricular practices and to make it possible for them to study what they are doing to experiment with ideas, that seem to be more promising and to get evidence to find-out if they are better".

Lehmann and Mehrens (1971) Point out that:- "Action research is a type of applied or decision- oriented research but with the stipulation that the researcher is the same person as the practitioner who will make and live with the decision".

J. Franseth Opines:- "Action Research is a systematic examination conducted by individuals or groups studying their own practices in search of sound answers to unresolved problems in their work and aimed at improving their own performance on their own jobs".

C. V. Good defines:- "Action Research is used by the teachers, supervisors and administrators to improve the quality of their decisions and actions.

According to Hopkins:- "Action Research as a way of learning rather than a process that results in publication or reporting of results: So from the above definitions, it is to be understood that the major objectives of action research in education are-

1. To adopt new practices / policies in the school / class-room.
2. To improve the working conditions of the school plant.
3. To study the effectiveness of innovative practices which have direct applicability in the class-room.
4. To prove into the causes of problems in school education and find solutions to tackle those.
5. To improve teaching- learning process.
6. To improve school administration and supervision.
7. To study and develop school curriculum.
8. To develop ability and understanding among the school personnel.
9. To raise the level of performance of the students.
10. To remove unhealthy environment of the school and create healthy atmosphere.
11. To make all-round development in the functioning of the school system.

❖ **Steps of Action Research**

The teacher/researcher should know the following steps are generally followed in conducting action research. These are as follows-

1. Identification/ Selection of the Action Research Problem:
    - Title of the Action Research Problem
    - Drawing the Rationale
    - Statement of the Problem for Action Research
2. Formulation of Objectives.
3. Formulation of Hypotheses.
4. Delimitations of the Study.
5. Design and Methodology of the Study:
    a) Subject/Sample

b) Selection of Instrumentations/ Tools or Development of Tools for Collection of Data required for the Study
c) Materials/Apparatus
d) Design
e) Procedures for Collection of Data;
    - ✓ Sampling
    - ✓ Tools
f) Techniques to be used for Analysis and Interpretation of Data

6. Tabulation, Analysis and Interpretation of Data.
7. Drawing Conclusion and Reporting the Results.

1. Identification/ Selection of Action Research Problem

The researcher has to identify and select a problem form his/her working situation for finding out a solution through action research. The area from which he/she is interested to select the problem, that must be the area of interest of the researcher. He /she must be capable of demonstrating necessary skill, initiative, originality and judgments in that area. If the researcher is acquainted with the area and has an idea about the studies already conducted in that area, he/she will not find difficulty in solving the problem. Some of the important fields of action research are:

- Educational Administration and Supervision
- Text-Book Preparation
- Curriculum Development
- Educational Measurement and Evaluation
- Educational Guidance and Counseling
- Educational Technology
- Educational Psychology
- Educational Philosophy
- Elementary Education
- Secondary Education

❖ **Title of the Action Research Problem**

The title of the action research should not be more than the name of the topic. It should be so worded that it suggests the theme of the study.

- The title of the research should be stated in precise term, short, pin-pointed.
- The title may be stated either in question form or a declarative statement or in the form of cause and effect relationship.

- It should neither be too long nor be too short.
- The title should not be burdened by pompous words and should not include terms of unscientific, rhetorical, argumentative, emotional or biased nature. The language in the title should be professional in nature but not pedantic.
- The title should be specific to the area of study. An adequate title for a study is one which represents a reasonable restriction and implies an objective approach.
  Example: *Non- participation of girls of class IV in classroom questioning: Identification of causes and corrective measures.*

❖ **Drawing the Rationale/Rationale of the Study**

The action research plan has a basis. The basic difficulty enables the researcher to draw a rationale of the problem, i.e. why the researcher is interested to conduct such a problem?

❖ **Statement of the Problem:**

Statement of the problem is not exactly the same as the title of the study. It has a definite place in the introductory chapter and is an attempt of focus on a clear goal. Statement to the problem should primarily be an expansion of the title. It should be either in question form or as a declarative statement. The major question on statement may be followed by several minor questions or statements.

2. Formulation of Objectives/Objectives of the Study

Taking into consideration the different aspects of the problem the action researcher has to formulate objectives of the study which may help the research work to be pin-pointed and goal-specific. It is nothing but the statement of what the researcher wants to achieve specific objectives of the study should be very clearly stated without any ambiguity. The objectives should be tangible to ensure that these can be achieved through the research study. This would help the researcher in deciding upon his tools, sample, delimiting of the area of the study. Care should be taken to include that which one is going to include in the study and exclude that which is not feasible during the study. However, the list of objectives should not be too lengthy. It should be worked out keeping all the constraints in mind like limitation of time and resources, etc.

3. Formulation of Hypotheses

On the basis of the nature of objectives the researcher may have to formulate a set of hypotheses for the study which are to be tested in the processes of research work to reach at the conclusion.

Hypotheses are the projection of the possible outcomes of the research formulated according to the number of objectives. They are the tentative solutions of the problem or likely relationship between dependent and independent variable. These are likely to be

modified during investigation of the facts discovered in the course of inquiry demand it. The very process of investigation is directed towards testing hypotheses in null or positive forms. It should be reasonable, consistent with known facts or theories, stated in the simplest possible way. In experimental and action research studies the researcher formulates hypotheses. In non-experimental studies it is also possible to formulate hypotheses. But at times some action research worker prefer to raise certain research questions and try to answer them on the basis of evidences collected through the action research. Thus, the investigator may state either hypotheses or research questions to be awarded.

4. Delimitations of the Study

Boundaries of the action research study should be made clear with reference to (a) the scope of the study by specifying the areas to which the conclusions will be confined and (b) the procedural treatment including the sampling procedures, the techniques of data collection and analysis, the development of measuring tools and their use in the study.

5. Design and Methodology of the Study

The method part of action research proposal is very important. It includes a description of the subjects, measuring instruments/tools, design and procedure.

a) Subject / Sample

The investigator of the action research has to decide the sample on which the study is to be conducted. Selection of sample should be made with reference to the population for which the study is conducted. In some action researches the entire population may constitute the sample. Usually the description of subject should clearly define the population and its major characteristics the reader should be able to understand exactly from where and how the subject will be selected. These are as follows

- Units of sample – Students, teachers, boys, class, etc.
- Size of sample – Number of each unit.
- Its structure / sampling frame.
- Process of selection.

b) Selection and Development of Instrumentations / Tools

After the selection of sample for the research study is over, the investigator has to decide whether he is going to use an instrument prepared by him / self developed scale or developed by someone else / standardized scale.

c) Material / Apparatus

Materials such as booklets and programmed units, or computer programmes that are going to be developed should be described in details in the action research plan.

d) Design

Design indicates the basic structure of the study, the nature of the hypotheses, the variables involved.

e) Procedures for Collection of Data

It describes in details what will be done, how it will be done, what data will be needed and what data gathering devices will be used.

- **Sampling:** The action researcher may use probability and non-probability sampling technique which includes random, systematic, multi-stage, stratified, cluster sampling or quota, judgmental, incidental, situational and purposive sampling as non-probability sampling techniques.
- **Tools:** The action research proposal should explain what tools such as intelligence tests, aptitude tests, achievement tests, questionnaire, attitude scale, rating scale, check list, questionnaire, observation schedule and interview, etc. are to be used for collecting data.

f) Techniques for Analysis and Interpretation of Data

In this section, the action researcher describes how to organize, analyze and interpret to the data. The detail statistical techniques such as measures of central tendency, variability, correlation, or inferential statistics like t-test, ANOVA, ANCOVA, Chi-square, etc. and rationale for using such techniques should be described in the action research proposal.

6. Tabulation, Analysis and Interpretation of Data

At this stage the investigator has to compile and tabulate all the data obtained through administering the tools. He / she has to analyze the data which may be quantitative or qualitative in nature. In most of the action researches, application of simple statistics is needed for analysis of data. The results obtained through the analysis of data are to be interpreted with reference to the objectives and hypotheses of the study formulated earlier.

7. Drawing Conclusions and Reporting the Results

On the basis of data analysis, conclusions are drawn and reporting is made. The results of the work may be communicated to others in such a manner that everybody can understand easily.

1.6.2. Difference between Basic Research and Action Research

Followings are the major differences between Basic and Action research-

1. Objectives: The purpose of basic research is to develop and test educational theory / theories and to obtain universally applicable principles.

Knowledge obtained in action research is intended to be applied in local setting. It also provides a sort of in-service training to participating field workers.

2. Scope: The scope of fundamental / basic research is very wide. Its main objective is to lay down general theories.

The scope of action research is limited. It is mainly confined to the working of educational institution. It deals with the problems and class-room teaching, school and learning.

3. Locating the Research Problem: In basic research, the problem is broad and relates to the broad field of education and wide range of methods and vast process is used to locate the research problem. The problem is approved by the external experts.

Whereas, action research deals with narrow practical problem. It is selected and finalized by the worker or investigator himself/herself. The participating teachers identify problems which obstruct teaching-learning. In this type of research no external approval is required.

4. Training: In basic research, expert training is needed in measurement, research methodology and statistics.

In action research, only an ordinary training is needed. Action research can be done by an average teacher under the guidance of a consultant.

5. Hypotheses: In basic research, highly specific and well stated hypotheses are formulated and adopted.

In action research, usually specific statement of the problem serves as a hypothesis. The action hypotheses are formulated on the basis of the problem.

6. Review of Related Literature: In basic research, an exhaustive and thorough study of the related literature is needed to have a thorough understanding of the accumulated knowledge in the research area.

But in case of action research, there is no need for thorough and intensive study of related literature. A glance of the related study will serve the purpose of developing general understanding of the area.

7. Sampling: In basic research, workers are required to obtain a random or unbiased sample of the population being studied. The knowledge and training of sampling techniques are essential: Usually probability sampling techniques are used.

In action research pupil studying in the class or the teacher or schools are used as subjects or the sample. No parameter is used in this research.

8. Research Design: The design of basic research is rigid. It cannot be easily changed. It involves method, sample and techniques of research.

The design of the action research is flexible. It can be changed according to necessity or convenience of the worker. It includes certain steps and measuring tools.

9. Involvement: In the field of basic research, the research worker may not be personally involved in the problem he selects for research. He may not be directly connected with educational research.

In action research, the teacher is generally involved in the research problem. He is the person in job like the teachers, the headmasters, the principal, the inspector, the supervisor.

10. Data Collection: In basic research, usually the standardized tests are used for collecting data. If such types of tools are not available, the investigator has to prepare the tools and their reliability and validity are estimated.

In case of action research, observation and teacher-made tests are used for collecting data.

11. Analysis of Data: In basic research, complex analysis of data is often called for. The parametric statistical techniques are used for analyzing the data. The decision is taken about the hypothesis on the basis of data or evidences.

In action research, the data are analyzed by using simple procedures of statistics like mean, median, mode, standard deviation and graphical representations.

12. Statistical Treatment: In case of fundamental research, there is stress on befitting statistical treatment of data for the sake of objectivity.

In action research, not much stress is given on objectivity and statistical treatment. Even the subjective opinion of participating teachers is given weightage.

13. Conclusion: In basic research, the conclusions are in the form of generalization may be a new theory, new fact, new truth or new interpretation. Thus, the conclusion may be new knowledge in the field studied.

In the field of action research some conclusion are drawn about the solution of the problem. The conclusions are in the form of remedial measures for improving the current practices. It does not contribute much in the field of knowledge.

14. Finance: In basic research, the NCERT, ICSSR and different funding agencies are financing research projects of education. The UGC is also giving financial assistance to college and university teachers for their research work. The UGC is awarding JRF, SRF and PDF for fundamental research in all the subjects.

The finance for action research is met by the school or investigator himself/herself. Projects of action research are also financed by the extension department of NCERT, SCERT and MHRD. etc.

15. Evaluation: A panel of examiners is appointed for examining the report of fundamental research. It may be approved, revised or rejected. The degree of Ph.D., D.Sc. or M.Phil. is awarded for the worth of contribution in the field studied.

The investigator evaluates the action research project. No external examiner is required. Its results are in the form of improvement in the job and current practices in the educational institutions.

16. Examples: Teaching skills for different subject teachers (Mathematics, Sciences, Social Studies, Languages), behaviour patterns of effective teachers are good examples of fundamental research.

The examples of action research are the problem of poor attendance, pronunciation, spellings, assignments, truancy, copying in the examination, discipline problems, rapidly decreasing enrolment of the school etc.

17. Importance: Basic research has unique importance for answering the basic questions and contributing in the field of knowledge by solving fundamental problems of education.

But action research has unique importance for solving the problems of class-room teaching and improving the practices of the school.

Check Your Progress

1. **What is Scientific Inquiry?**
2. **What is Educational Research?**
3. **What are steps involved in Scientific Research?**
4. **Define Action Research.**
5. **What do you mean by Applied Research?**

1.7. RESEARCH ETHICS

Ethics is defined by Webster's dictionary as conformance to the standards of conducts of a given profession or group. Such standards are often defined at a disciplinary level though a professional code of conduct, and sometimes enforced by university committees called even Institutional Review Board. Even if not explicitly specified, scientists are still expected to be aware of and abide by general agreements shared by the scientific community on what constitutes acceptable and non-acceptable behaviors in the professional conduct of science. For instance, scientists should not manipulate their data collection, analysis, and interpretation procedures in a way that contradicts the principles of science or the scientific method or advances their personal agenda.

Why is research ethics important? Because, science has often been manipulated in unethical ways by people and organizations to advance their private agenda and engaging in activities that are contrary to the norms of scientific conduct. A classic example is pharmaceutical giant Merck's drug trials of Vioxx, where the company hid the fatal side-effects of the drug from the scientific community, resulting in 3468 deaths of Vioxx recipients, mostly from cardiac arrest. In 2010, the company agreed to a $4.85 billion settlement and appointed two independent committees and a chief medical officer to

monitor the safety of its drug development process. Merck's conduct was unethical and violation the scientific principles of data collection, analysis, and interpretation.

Ethics is the moral distinction between right and wrong, and what is unethical may not necessarily be illegal. If a scientist's conduct falls within the gray zone between ethics and law, she may not be culpable in the eyes of the law, but may still be ostracized in her professional community, face severe damage to professional reputation, and may even lose her job on grounds of professional misconduct. These ethical norms may vary from one society to another, and here, we refer to ethical standards as applied to scientific research in Western countries.

1.7.1. Ethical Principles in Scientific Research

Some of the expected tenets of ethical behavior that are widely accepted within the scientific community are as follows.

i. Voluntary participation and harmlessness

Subjects in a research project must be aware that their participation in the study is voluntary, that they have the freedom to withdraw from the study at any time without any unfavorable consequences, and they are not harmed as a result of their participation or non-participation in the project.

ii. Anonymity and confidentiality

To protect subjects' interests and future well-being, their identity must be protected in a scientific study. This is done using the dual principles of anonymity and confidentiality. **Anonymity** implies that the researcher or readers of the final research report or paper cannot identify a given response with a specific respondent.

iii. Disclosure

Usually, researchers have an obligation to provide some information about their study to potential subjects before data collection to help them decide whether or not they wish to participate in the study. For instance, who is conducting the study, for what purpose, what outcomes are expected, and who will benefit from the results

iv. Analysis and reporting

Researchers also have ethical obligations to the scientific community on how data is analyzed and reported in their study. Unexpected or negative findings should be fully disclosed, even if they cast some doubt on the research design or the findings. Similarly, many interesting relationships are discovered after a study is completed, by chance or data mining. It is unethical to present such findings as the product of deliberate design.

1.7.2. Professional Code of Ethics

Most professional associations of researchers have established and published formal codes of conduct describing what constitute acceptable and unacceptable professional behavior of their member researchers. As an example, the summarized code of conduct for the Association of Information Systems (AIS), the global professional association of researchers in the information systems discipline, is summarized in Table 16.1 (the complete code of conduct is available online at http://home.aisnet.org/displaycommon.cfm?an=1&subarticlenbr=15). Similar codes of ethics are also available for other disciplines.

The AIS code of conduct groups ethical violations in two categories. Category I include serious transgressions such as plagiarism and falsification of data, research procedures, or data analysis, which may lead to expulsion from the association, dismissal from employment, legal action, and fatal damage to professional reputation. Category 2 includes less serious transgression such as not respecting the rights of research subjects, misrepresenting the originality of research projects, and using data published by others without acknowledgement, which may lead to damage to professional reputation, sanctions from journals, and so forth. The code also provides guidance on good research behaviors, what to do when ethical transgressions are detected (for both the transgressor and the victim), and the process to be followed by AIS in dealing with ethical violation cases. Though codes of ethics such as this have not completely eliminated unethical behavior, they have certainly helped clarify the boundaries of ethical behavior in the scientific community and reduced instances of ethical transgressions.

Table- 1.1: Code of Ethics for the Association of Information Systems

CATEGORY ONE
Codes in this category must always be adhered to and disregard for them constitutes a serious ethical breach. Serious breaches can result in your expulsion from academic associations, dismissal from your employment, legal action against you, and potentially fatal damage to your academic reputation. 1. Do not plagiarize. 2. Do not fabricate or falsify data, research procedures, or data analysis.
CATEGORY TWO
Codes in this category are recommended ethical behavior. Flagrant disregard of these or other kinds of professional etiquette, while less serious, can result in damage to your reputation, editorial sanctions, professional embarrassment, legal action, and the ill will of your colleagues. 3. Respect the rights of research subjects, particularly their rights to information privacy, and to being informed about the nature of the research and the types of activities in which they will be asked to engage.

4. Do not make misrepresentations to editors and conference program chairs about the originality of papers you submit to them.
5. Do not abuse the authority and responsibility you have been given as an editor, reviewer or supervisor, and ensure that personal relationships do not interfere with your judgment.
6. Declare any material conflict of interest that might interfere with your ability to be objective and impartial when reviewing submissions, grant applications, software, or undertaking work from outside sources.
7. Do not take or use published data of others without acknowledgement, or unpublished data without both permission and acknowledgement.
8. Acknowledge the substantive contributions of all research participants, whether colleagues or students, according to their intellectual contribution.
9. Do not use other people's unpublished writings, information, ideas, concepts or data that you may see as a result of processes such as peer review without permission of the author.
10. Use archival material only in accordance with the rules of the archival source.

ADVICE

Some suggestions on how to protect yourself from authorship disputes, miss-steps, mistakes, and even legal action.

1. Keep the documentation and data necessary to validate your original authorship for each scholarly work with which you are connected.
2. Do not republish old ideas of your own as if they were a new intellectual contribution.
3. Settle data set ownership issues before data compilation.
4. Consult appropriate colleagues if in doubt.

1.8. PROBLEMS ENCOUNTERED BY RESEARCHERS IN INDIA

Researchers in India face many problems— particularly those who are carrying out empirical research. Some of the more significant problems are as follows:

1. The lack of scientific training in the methodology of research is a major stumbling block for researchers in India. There is a severe shortage of high quality researchers. Many researchers undertake research activities without any in-depth knowledge of research methods. Most of the work, which is carried out in the name of research, is not based on any sound method. For many researchers and also to their guides, research means a cut and paste activity without adding any thought or insight on the collated materials. The consequences of this are obvious— the results often do not reflect reality. Hence, a systematic study of research methodology is a key prerequisite. The researcher must have a strong understanding of the methodologies before taking on a research assignment. This can be achieved by providing intensive and short-duration courses.

2. Research departments at universities have very little interaction with business establishments, government departments and research institutions. A large body of non-confidential primary data remains unused by the researchers due to lack of proper contacts. Efforts need to be made to achieve interaction between all concerned parties for better and more realistic research. There is a need to develop a university-industry interaction platform so that the academics can get insight from practitioners on what aspects need to be researched, and practitioners find that the research done by the academics is relevant and can be applied.
3. Most of the businesses in India are of the opinion that the material supplied by them to researchers will be misused, and they are therefore reluctant to provide any information to researchers. The resultant need for secrecy seems to be embedded in business units, so much so that it results in a very strong barrier for the researchers. Hence, there is a requirement to create the confidence that any information provided for research will not be misused.
4. Research studies that overlap with each other are undertaken due to lack of information. The result of this is a duplication of effort and a waste of resources. This issue can be resolved through regular and updated compilation of a summary of issues and the places where research is being done. Additionally, specific attention must be given to identifying research topics across those disciplines of applied science that are of immediate concern to business and industry.
5. There is no code of conduct for researchers. Also, inter-university and interdepartmental rivalries are common. Hence, there is a requirement to develop a code of conduct for researchers which can resolve this issue.
6. Quite often, researchers in India face the issue of a lack of adequate and timely secretarial assistance—including computer support. This results in delays in the completion of research studies. A serious effort must be made to ensure that researchers have access to efficient and timely secretarial assistance. The University Grants Commission (UGC) must play a key role in resolving this issue.
7. The library management process is usually unsatisfactory. As a result, researchers spend time unproductively to trace books, journals or reports, rather than accessing the relevant content from them.
8. A number of libraries are unable to access copies of old or new Acts/ Rules, reports or government publications in time. This issue is more acute in libraries which are not situated in large cities. Therefore, efforts must be made to ensure that libraries receive regular supply of all relevant governmental publications.
9. There is a lack of availability of published data from various government and non-government agencies. Researchers also face the problem that the published data varies significantly due to differences in coverage by the concerned agencies.
10. At times, there is the problem of conceptualization as well as problems relating to the process of data collection and other related issues.

ACTIVITY

1. Meaning and application of many concepts of education have changed today.' Give an example to support the statement above, whereby a present-day law in the field of education has been altered from its original form due to research recommending the change.
2. Give a detailed account of a situation where educational psychology has benefitted from research.

DID YOU KNOW

Educational researchers have come to the consensus that educational research must be conducted in a rigorous and systematic way. The findings of educational research also need to be interpreted within the context in which they were discovered as they may not be applicable in every time or place.

1.9. SUMMARY

- Research is defined as an activity involving technical and organized search for relevant information on a particular topic. It primarily emphasizes on finding solutions of problems in a methodical way.
- A research plan plays an important role in achieving an organization's objectives.
- The main aim of research is to uncover answers to questions by applying scientific procedures. Research aims to discover hidden truths. Other objectives of research are exploratory, descriptive, diagnostic and hypothesis testing.
- One of the main objectives of conducting social research is to find out information about the behaviour of an individual and solutions to the problems related to human relations.
- The researcher uses scientific methods and techniques to provide optimum solution to problems. The scientific methods include observing and defining a problem and formulating hypothesis related to the results of the scientific methods and techniques. If the hypothesis is accepted, its results should be executed in an

organization; but if the hypothesis is not accepted, another hypothesis is formulated.

- Almost all types of research primarily follow the two basic approaches depending on the need of quality and the amount of data available. These two approaches are: (a) Quantitative approach and (b) Qualitative approach.
- Action research is 'research during action', such as observation of students in a classroom. Its findings are to be related in terms of local applicability. It means action research is generally used to solve local problems. As a result, its findings cannot be generalized beyond a particular setting. Its purpose is to improve school practices and educational outputs.
- Research design involves determining the overall structure of a research study, identifying the variables pertaining to the research, formulating the operational definitions of these variables, and finally selecting the design for analysing the data or information that is collected by the researcher.
- A good research design needs to be flexible, reliable, and efficient and aims at minimizing errors and preconceptions.
- Educational research refers to a systematic attempt to gain a better understanding of educational process, generally for the purpose of improving its efficiency. Its purpose is to solve the immediate local problems in education, to ascertain principles and develop procedures for use in the field of education and to discover new applications of principles and laws in the field of education among others.
- The field of educational research can be classified into educational psychology philosophy of education, sociology of education, educational management and administration, comparative education, curriculum development, counselling, educational technology, problems of Indian education, and inclusive education.
- The code of ethics in research provides guidance on good research behaviors, what to do when ethical transgressions are detected (for both the transgressor and the victim), and the process to be followed by AIS in dealing with ethical violation cases.

1.10. KEY TERMS

- **Applied research:** This research aims at finding solution to an immediate problem faced by a society or an industrial organization.
- **Ethnographic approach:** This is concerned with studying an entire culture and the researcher studies an integral cultural group in a natural setting over a specific period of time.

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- **Fundamental research:** This type of research is mainly concerned with identifying certain important principles in a specific field.
- **Research process:** It is a series of actions or steps that are essential to be performed in a specific order.
- **Research proposal:** It is an application that proposes to pursue or conduct a research study and aims at presenting the idea around which the research study revolves.

1.11. ANSWERS TO 'CHECK YOUR PROGRESS

1. Scientific inquiry is the search for knowledge by using recognized methods in data collection, analysis and interpretation.

2. Educational research refers to a systematic attempt to gain a better understanding of educational process generally for the purpose of improving its efficiency. It is actually an application of scientific method to study educational problems.

3. The steps involved in a scientific process are as follows:

i. Define a problem.
ii. State the hypothesis to be tested.
iii. Collect and analyse data.
iv. Interprete the results and draw conclusions about the problem.

4.Action research in education is a form of enquiry undertaken by the practitioners (teachers) in the educational situations (class-room or school) in order to improve.

a) *Their own educational practices*.
b) Their understanding of practices and
c) The situations in which the practices are carried-out.

5. This type of research work, in which the result of has direct application in the field. It is concerned with theories, principles and laws which work in the field

1.12. QUESTIONS AND EXERCISES

Short-Answer Questions

1. What are the different categories of the objectives of research?
2. What are the different types of research?
3. Why are researches in education conductedWhat is randomization principle?
4. What is the significance of educational research?
5. Differentiate between Basic research and Action research.
6. What do you mean by Ethics in research?

Long-Answer Questions

1. Elaborate on the characterstics of scientific method.
2. Discuss the characteristics of research.
3. Elaborate on the scope of educational research under the categories of educational psychology and philosophy of education.
4. Explain the significance of a research.
5. Elaborate the distinguishing features of research design with regard to quantitative and qualitative research studies.
6. Discuss the need and significance of educational research in India. Also elaborate on the problems encountered by the researchers in India.
7. Describe about the professional code of ethics in research.

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UNIT 2
RESEARCH PROCESS IN EDUCATION

Structure

2.0 INTRODUCTION

Research takes advantage of the knowledge which has accumulated in the past as a result of constant human endeavour. It can never be undertaken in isolation of the work that has already been done on the problems which are directly or indirectly related to a study proposed by a researcher. A careful review of the research journal, books, dissertations, theses and other sources of informations on the problem to be investigated is one of the important steps in the planning of any research study. A review of the related literature must precede any well planned research 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 gather as evidence to advance the hypothesized relationship between variables.

The first section of this unit describes the specific purposes which are served by the review of related literature. The unit provides a study guide to the researcher in identifying related literature, and in locating, selecting and utilizing the primary and secondary sources of information available in the library. The unit deals with procedure which the researcher should adopt for organizing the related literature in a systematic manner.

In this unit, you will also learn about the concept of hypothesis testing. For this, a hypothesis needs to be appropriate. Testing a hypothesis means verification of the hypothesis. This unit will describe the application of hypothesis testing in a variety of cases, such as comparing two related terms and testing equality of variance of two normal populations. A number of hypothesis tests, such as t-test and Z-test, facilitate the process of hypothesis testing.

2.1 UNIT OBJECTIVES

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

- Explain the significance of research process in education
- Formulate a research problem
- Know about the variables used in a research process
- Discuss the specific purposes served by the review of related literature
- Describe the procedure the researcher should adopt in organizing the related literature in a systematic manner
- Explain the concept of hypothesis
- Describe the procedure of hypothesis testing
- Describe the various types of hypothesis testing
- Explain the statistical techniques involved in hypothesis testing

2.2 RESEARCH PROCESS IN EDUCATION: GENERAL STEPS, OBJECTIVES AND FORMULATION OF PROBLEM

Educational research or research in education refers to a range of methods which helps individuals to evaluate different aspects of education. Educational researchers have accredited that the educational research must be performed in a rigorous and systematic way.

As per Creswell (2002), *"Educational research is a cyclical process of steps that typically begins with identifying a research problem or issue of study. It then involves reviewing the literature, specifying a purpose for the study, collecting and analysing data, and forming an interpretation of information. This process culminates in a report, disseminated to audiences such that it is evaluated and used in the educational community"*

2.2.1 General Steps

Accomplishing or conducting any educational research is based on exploration, description, explanation or prediction of educational phenomenon using systematic data collection and analysis procedures. All the educational research methodology follows a planning, data collection and analysis, and report writing process and consists of the following nine significant steps:

Planning: The planning process includes the following five steps, Steps 1 to 5.

Step 1: Identify the Problem or Topic: The review literature facilitates to achieve an understanding of the present state of knowledge pertaining to the research design. It helps in recognizing if the research problem or topic has already been investigated and if a revision or replication is required, how to design the research process and what data collection methods to be used.

Step 2: Review Prior Research: Researchers use the literature review to identify& the underlying principle required for the research process. Specifically, literature review can be utilized at the beginning of the research process to elucidate about the topic of research and to provide a rationale for the research process that one has planned. In addition, the literature review can also be used to facilitate the research design by providing assistance regarding appropriate) sample size or identifying proper data collection methods or mechanisms that can be used in the research process.

Step 3: Determine the Purpose, Research Questions or Hypotheses: Determining the purpose of research helps in recognizing and determining how the research should be accomplished or conducted, what research design should be used, and what the research question(s) or hypothesis(es) should be formulated for the research study. Four significant and universally used purposes to conduct any educational research are to explore, describe, predict or explain.

Step 4: Consider Research Inferences: Inferences are the realistic methods that may affect the conducted research for education field. These include the underlying goals and principles formulated for research process and the significance of research study. Inferences can be further linked to the research problem or topic, research purpose and research question(s) or hypothesis(es).

Step 5: Construct a Research Proposal: Typically, the research proposal refers to a detailed description as how the research study will be conducted. It includes the title of research and the researchers employed in the research study, statement of the research problem and research purpose, review of relevant literature, research question(s) or hypothesis(es), what information or variables are to be collected, the participants of the research study and possible benefits or risks of research under study, the design and procedure for collecting data, what data collection method(s) will be used, and how the collected data will be analysed.

Data Collection: The data collection process includes the following step, Step 6.

Step 6: Collect Data: Data collection process focuses on information accomplishment which in turn will answer the research questions and will also support the research hypotheses. Data collection process illustrates what variables will be investigated during the research process, the unit of analysis or participants of the research study (such as, population and sample), participant or subject safeguards, procedures used to select

participants, the methods and procedures used for data collection, and any reliability or validity of collection methods.

Report Writing Process: The report writing process includes the following three steps, Steps 7 to 9.

Step 7: Analyse Data: Data or statistical analysis depends on the type of data collected, i.e., whether the collected is quantitative data, qualitative data, or both. For quantitative data analysis, there are a range of statistical analysis tools that can be used to categorize statistical relationships between variables. For qualitative data analysis, the data analysis methods usually involve holistically recognizing patterns, categories and themes.

Step 8: Determine Research Findings: The research findings can be determined by analysing the data that is collected for the research. From quantitative data, the statistical information and general findings can be determined. From qualitative data, the primary details and specific findings can be determined.

Step 9: Report Conclusions, Implications and Limitations: Conclusions are statements that can be used to interpret and evaluate the results established from the research study. Ensure that the result interpretation must relate to the hypotheses or research questions of the study.

2.2.2 Objectives of Research Process

Research objectives can be defined as the systematic method of collecting data from selected sample or on the phenomenon under study and analysing the information in order to achieve the end result and to check the validity of the hypothesis that was formulated before the research was started. The research objectives are defined on the basis of either general or specific goals and by formulating the research hypothesis.

The following are some significant characteristics that provide quality in research process:

- Firmness of research process
- Trustworthiness of research process
- Reliability/Validity of research process
- Usefulness of research process, i.e., implications of research methodology for policy making and practice in educational research
- Originality of research process

Probable Aims and Objectives of Research Process

The following are the probable aims and objectives of a research process:

- Identify research aims/questions of the research problem, i.e., questions to answer-what, when, where and who
- Categorize nature/type of the research problem, i.e., scholarly review, empirical work, new or secondary analysis
- Recognize ontological position, epistemological and methodological assumptions of the research problem
- Explain the research problem, i.e., why did it happen
- Declare prediction of the research problem, i.e., what is to be expected
- Understand the research problem, i.e., how is it clutched with human experience

- Interpret the research problem, i.e., analyse the aim of research
- Identify location of the research area, date of research, sample selection and methods used in the research
- Support the conclusions appropriately by evidence
- Recommendation, i.e., proposal to the research problem to explain how ought it be
- Change and emancipation, i.e., how can it be transformed for the enhancement
- Critique and disruption, i.e., defining that what are the limitations and hidden assumptions and how can these assumptions be challenged/interrupted

2.2.3 Formulation of Research Problem

A 'Research Problem' is considered as the initial step and the most significant prerequisite in the research process. It provides the groundwork or foundation of a research study because if the research problem is well prepared then the anticipated fine research study will pursue. To solve a research problem, it is required to identify what the problem is. Basically, you have to identify the type of problem and then decide what must be done to achieve desired result.

Typically, identifying a research problem and the methodology adopted to formulate it will determine approximately every step of research that is required in the research study.

Formulation of the research problem is considered as the input into the research study while the output is referred as the quality of the contents of the research report.

The following are some significant steps that formulate a 'Research Problem' in education:

1. Identify a wide area of significance for the academic/professional field of research.
2. Analyse the wide area into sub-areas logically or by having discussion with other research colleagues, if any.
3. Select the sub-area where the research study is to be conducted following the process of elimination of other sub-areas.
4. Reverse the research questions that are to be answered through the research study. This also helps in the formulation of the hypothesis based on the research objectives.
5. Evaluate all the formulated objectives to establish the feasibility of accomplishing them precisely considering the time factor and other problem factors, such as economic factor and human resource expertise.

2.2.4 Variables in Research Problem

An important step in designing all quantitative research projects is defining or identifying the variables that will be manipulated, measured, described, or controlled. A variable is a label or name that represents a concept or characteristic that varies (e.g., gender, weight, achievement, attitudes toward inclusion, etc.).

Conceptual and Operational Definitions of Variables

Conceptual (i.e., constitutive) definition uses words or concepts to define a variable, i.e., Achievement: What one has learned from formal instruction and Aptitude: One's capability for performing a particular task or skill.

Operational definition is an indication of the meaning of a variable through the specification of the manner by which it is measured, categorized, or controlled, for example, Weschler IQ score, Income levels below and above $45,000 per year and Use of holistic or phonetic language instruction.

Types of Variables

Three variable labels defined by the context within which the variable is discussed are:

- Independent and dependent variables
- Extraneous and confounding variables
- Continuous and categorical variables Independent and Dependent (i.e., Cause and Effect)

Independent variables act as the 'cause' in that they precede influence, and predict the dependent variable whereas Dependent variables act as the 'effect' in that they change as a result of being influenced by an independent variable. For example:

- The effect of two instructional approaches (independent variable) on student achievement (dependent variable).
- The use of SAT scores (independent variable) to predict freshman grade point averages (dependent variable).

Some situations do not lend themselves to the use of the terms *independent* or *dependent* because it is difficult to discuss them in causal terms. For instance, the relationship between attitude and achievement, that is, do positive attitudes cause high achievement or does high achievement cause positive attitudes?

The relationship between creativity and critical thinking, that is, do high levels of creativity cause higher levels of critical thinking or do higher levels of critical thinking cause greater creativity?

Extraneous and Confounding Variables

Extraneous variables are those that affect the dependent variable but are not controlled adequately by the researcher.

- Not controlling for the socio-economic status of students involved in a study of the effects of instructional technologies.
- Not controlling for the key-boarding skills of students in a study of computer-assisted instruction.

Confounding variables are those that vary systematically with the independent variable and exert influence on the dependent variable.

- Not using counselors with similar levels of experience in a study comparing the effectiveness of two counseling approaches.
- Not using the same test to measure the effectiveness of two instructional approaches.

Continuous and Categorical

Continuous variables are measured on a scale that theoretically can take on an infinite number of values. For example:

- Test scores range from a low of 0 to a high of 100.

- Attitude scales that range from very negative at 0 to very positive at 5.
- Students' ages.

Categorical variables are measured and assigned to groups on the basis of specific characteristics. For example:

- Gender: Gender has two levels - male and female.
- Grade level: K- 12.
- Socio-economic status: Socio-economic status has three levels - low, middle, and high.

Here, the term level is used to discuss the groups or categories.

Continuous variables can be converted to categorical variables, but categorical variables cannot be converted to continuous variables. For instance, IQ is a continuous variable, but the researcher can choose to group students into three levels based on IQ scores - low is below a score of 84, middle is between 85 and 115 and high is above 116. Test scores are continuous, but teachers typically assign letter grades on a ten point scale (i.e., at or below 59 is an F, 60 to 69 is a D, 70 to 79 is a C, 80-89 is a B, and 90 to 100 is an A.

2.3 REVIEW OF RELATED LITERATURE

Review of the related literature; besides, allowing the researcher to acquaint himself/ herself with current knowledge in the field or area in which he/she is going to conduct his/her research, serves the following specific purposes:

1. The review of related literature enables the researcher to define the limits of his/her field. It helps the researcher to delimit and define his/her problem. To use an analogy given by D Ary *et al.*, (1972, p. 56) a researcher might say:

   The work of A, B and C has discovered this much about my question; the investigations of D have added this much to our knowledge. I propose to go beyond D's work in the following manner.

   The knowledge of related literature, brings the researcher up-to-date on the work which others have done, and thus to state the objective clearly and concisely.
2. By reviewing the related literature, the researcher can avoid unfruitful and useless problem areas. He/She can select those areas in which positive findings are very likely to result and his/her endeavours would be likely to add to the knowledge in a meaningful way.
3. Through the review of related literature, the researcher can avoid unintentional duplication of well established findings. It is no use to replicate a study when the stability and validity of its results have been clearly established.
4. The review of related literature gives the researcher an understanding of the research methodology which refers to the way the study is to be conducted. It helps the researcher to know about the tools and instruments which proved to be useful and promising in the previous studies. The advantage of the related literature is also to provide insight into the statistical methods through which validity of results is to be established.

5. The final and important specific reason for reviewing the related literature is to know about the recommendations of previous researchers listed in their studies for further research.

Identifying the Related Literature

The first step in reviewing the related literature is identifying the material that is to be read and evaluated. The identification can be made through the use of primary and secondary sources available in the library.

In the primary sources of information, the author reports his/her own work directly in the form of research articles, books, monographs, dissertations or theses. Such sources provide more information about a study than can be found elsewhere. Primary sources give the researcher a basis on which to make his/her own judgment of the study. Though consulting such sources is a time consuming process for a researcher, yet they provide a good source of information on the research methods used.

In secondary sources of information, the author compiles and summarizes the findings of the work done by others and gives interpretation of these findings. In them, the author usually attempts to cover all of the important studies in an area reported in encyclopedia of education, education indexes, abstracts, bibliographies, bibliographical references and quotation sources. Working with secondary sources is not time-consuming because of the amount of reading required. The disadvantage of the secondary sources, however, is that the reader is depending upon someone else's judgments on the importance of the study.

The decision concerning the use of primary or secondary sources depends largely on the nature of the research study proposed by the researcher. If it is a study in an area in which much research has been reported, a review of the primary sources would be a logical first step. On the other hand, if the study is in an area in which little or no research has been conducted, a check of the secondary sources is more logical. Sources of information, whether primary or secondary, are found in a library. The researcher must, therefore, develop the expertise to use resources without much loss of time and energy. To aid the researcher in locating, selecting and utilizing the resources, a study guide is provided in relation to their use in educational research.

A researcher should be familiar with the library, its facilities and services. He/She should also be acquainted with the regulations governing the use and circulation of materials. Many libraries use a printed guide that contains helpful information. The guide uses a diagram to indicate the location of the stacks, the periodicals section, reference section, reading rooms, and special collections of books, microfilm or microcard equipment, manuscripts, or pamphlets. The guide lists the periodicals to which the library subscribes and the names of special indexes, abstracts and other reference materials.

The regulations concerning the use of stacks, the use of reserve books, the procedures for securing reference materials held by the library or those that may be borrowed from another library are also included in the guide.

Research scholars and other readers are usually issued a library card giving them access to the stacks. They may take the help of library staff or may carry on the independent searching for the books and other reference materials. After using the books, it is desirable for the readers to leave them on the tables so that the library staff will return them to their proper position on the shelves.

Sometimes a reference is not available in the library. In such a situation, the reader must consult the 'union' catalog, which lists references found in other libraries. Such references may be obtained in the following ways:

(i) **By Inter-Library Loan System:** The reader requests the librarian to borrow the desired reference from other library where it is available.

(ii) **By Requesting a Photostatic Copy:** The reader may request the librarian to obtain the photostat of a page or a number of pages of a desired reference from the source.

(iii) **By Requesting an Abstract or Translation of the Portion of a Desired Reference:** Some large libraries have abstracting and translating service that provides abstracts, or copied or translated portions of needed materials at an established fee.

(iv) **Requesting Microfilm or Microfiche:** The reader may purchase a microfilm that can be projected on library microfilm equipment. A microfiche is a sheet of film that contains microimages of a printed manuscript or book. Its development has been one of the most significant contributions to library and information services by providing economy and convenience of storing and distribution of long runs of scholarly materials.

An even more significant development is the ultra-fiche. It has the capacity of 3,200 pages per fiche (Mittal, 1979, p. 10).

Various types of cameras are used to record microimage on roll film. Some of which are described below.

Planetary Camera is either 35 mm or 16 mm still camera which is mounted on a vertical column that can be moved up and down as per the requirement. At a time, it can be loaded with 100 feet of roll film. It does not cost much.

Step-And-Repeat Camera is a costly camera which is specifically used to automatically record microimages on microfiche one-by-one.

Rotary Camera, like the planetary camera, records microimages on roll film and has the capacity to change the reduction ratio as desired.

Flow Camera costs less than half of a planetary camera. Its reduction ratio is fixed unlike previously mentioned types of camera.

All these cameras make use of silver, diazo or vesicular film for recording microimages.

Generally, six types of Readers are used for reading microfilms or microfiche (Mittal, 1979, p. 13).

(i) *Cuddly Microfiche Reader* is a portable reader and can be used by keeping it in one's lap. It is very cheap and can be lent to library members for home use.

(ii) *Microfilm* and *Microfiche Readers* is a reader/printer machine that can make copies from both microfilm and microfiche.

(iii) *Universal Machines* essentially achieve by reading the description, storing it and printing it. The example is Universal Tuning Machine (UTM) or computer.

(iv) *Reader/Printer* is a push-button machine which not only helps in reading a microfilm/microfiche but is capable of producing a full-sized paper copy of the frame on the screen.

(v) *Production Printer/Enlarge Printer* is an automatic machine and can print the requisite number of copies of a microfilm or selected portions of a microfilm. It is used for mass production of full-sized copies of microfilms.

(vi) *Xerox Copy/low Machine* is a costly machine, and therefore, is beyond the reach of ordinary libraries. In can print out a microfilm into a readable size, and as such, a single copy of any requisite document can be had at low cost and in less time.

The card catalog is the index to the entire library collection. It lists the details of publications found in the library with the exception of serially published periodicals.

Generally, the card catalog contains author, title, and subject cards arranged alphabetically. A great deal of information about a book can be found on the cards. Besides the title of the book and the name of the author, the reader will find the date of birth of the author, the edition, the publication date, the number of pages, and the name and location of the publisher. Other items listed on the cards are bibliographies, maps, portraits, illustrations, tables, series (if any) in which a book appears, a brief description of the book—whether the book is a translation and who did the translation.

Library classification systems provide ingenious ways of systematizing the placement and location of books. Every system is based upon a methodology that is logical and orderly to the smallest detail. The two principal systems of library classification in the US are the 'Dewey Decimal' system and the 'Library of Congress' system.

The 'Dewey Decimal' system is a decimal plan with the numbers running from 001 to 999.99. The 'Library of Congress' system is particularly used in large libraries. It provides for 20 main classes instead of the 10 of the 'Dewey Decimal' system. The system uses letters of alphabet for the principal headings and numerals for further subgrouping.

In a library, all books have a call number or letter that appears in the upper left- hand corner of the author, subject or title card and on the back of the book. These call numbers or letters are used to arrange the books serially on the library shelves and within each classification, the books are arranged alphabetically by author's last name.

Identifying the best available sources pertaining to a problem and extracting the essential information from them is of much importance to a researcher. For this, he/she must develop some library searching techniques so as to save his/her time and effort. Van Dalen (1973, p. 88) has suggested the following valuable guidelines for a researcher:

1. Before using a library, familiarize yourself with its layout, facilities, services and regulations.
2. Learn how to use the microform (microfilm and microfitche) readers, photocopies and other mechanical aids.
3. Look in the stacks and in the periodical, reference, reserved book and rare book rooms, the materials that you will use frequently are placed.

4. Schedule your work session in a library when you will encounter the least competition for resources and services.
5. Make out call slips for all or most of the books needed in one session.
6. Copy all information that the librarian needs to obtain each reference for you, and before closing the periodical index or card catalog, recheck and rectify any errors or omissions.
7. Arrange to spend a block of time in the library that is sufficient to accomplish a specific task.
8. When little time is available, clear up questions that can be answered quickly through the help of reference books that are readily available.
9. Before initiating search for materials in a library, write down questions that cover precisely the information you wish to locate and group the questions in accordance with the areas in the library where the answers may be found.
10. Compile a list of the present and any previous names of periodicals, organizations, government agencies, research agencies, collectors of statistics, libraries and museums with special collections, and outstanding authorities in your field.
11. Keep a list of the best reference books, indexes, handbooks, historical studies, and legal references in your area of specialization.
12. Obtain copies of the best bibliographies and reprints of significant research studies for your files.
13. Note which periodicals regularly or occasionally print bibliographies, reviews of literature or such other reference material and the issues in which they appear.

There are a number of references that may he useful to a researcher in the field of education. To facilitate the search for such material, a researcher may consult the following carefully compiled volumes:

Constance M. Winchell, ed., *A Guide to Reference Books*, 8th edn. (Chicago:

American Library Association, 1967). This comprehensive work has biennial supplements to bring the up-to-date information in a number of languages. It describes and evaluates about 7,500 references and a section is devoted to education.

Albert J. Walford, *Guide to Reference Material*. This is a two-volume work which covers (I) Science and Technology (1966) and (2) Philosophy and Psychology, Religion, Social Sciences, Geography, and History (1968).

Mary N. Barton and Marion V. Bell (1962), Reference Books: *A Brief Guide for Students and Other Users of the Library*. This guide is helpful but considerably shorter.

International Guide to Educational Documentation (1955-1960), (UNESCO, 1963). This is a one-volume international guide to educational books, pamphlets periodicals, occasional papers, films and sound recordings.

Arvid Burke and Mary Burke, *Documentation in Education*. This guide provides an excellent introduction to literature in the field of education.

The Standard Periodicals Directory, (New York: Oxbridge Publishing Co., 1964-date). This is a directory of over 30,000 entries and covers every type of periodical, with

the exception of local newspapers. It is published every year and covers about 200 classifications which are arranged by subject. An alphabetical index is provided.

Christine L. Wyner, *Guide to Reference Books for School Media Centres*, (Littleton, Cob: Libraries Unlimited, 1973). This guide includes 2575 entries with evaluative comments on reference books and selection tools for use in educational institutions. It is indexed by author, subject and title.

Encyclopedias. These serve as a store house of information and usually contain well-rounded discussion and selected bibliographies that are prepared by specialists. Encyclopedias are arranged alphabetically by subject and for each field of research, they present a critical evaluation and summary of the work that has been done. In addition, these suggest the research needed in the field and also provide *a selective bibliography.*

The following list provides a sample of encyclopedias that researchers in the field of education might use:

A Cyclopedia of Education, Paul Monroe, ed., 5 vol., (New York: Macmillan, 1911-13). It is edited by Paul Monroe with the assistance of departmental editors and more than 1,000 individual contributors. It provides excellent bibliographies and is extremely useful for historical and biographical purposes.

The Encyclopedia of Education, ed., Lee C. Deighton, (New York : The Macmillan Company and The Free Press, 1971). The encyclopedia includes more than 1,000 articles. It offers a view of the institutions and people, of the processes and products, found in educational practice. The articles deal with history, theory, research, philosophy, as well as with the structure and fabric of education.

Encyclopedia of Modern Education, Henry D. Rivlin and H. Schueller, ed., (New York: Philosophical Library, 1943). This comprehensive work of about 200 authorities has been edited by Henry D. Rivlin and H. Schueller. It stresses present day problems, trends, theories, and practices. The articles are accompanied by brief bibliographies and there is a system of cross references.

Encyclopedia of Educational Research, Walter Scott Monroe, ed., rev. edn., (New York: Macmillan, 1950). Monroe's Encyclopedia of Educational Research was prepared under the auspices of the American Educational Research Association. It aims to present a critical evaluation, synthesis and interpretation of research studies in the field of education. All the articles, arranged alphabetically, are provided with bibliographies.

Encyclopedia of Educational Research, Chester Harris, ed., 3rd edn., (New York: Macmillan, 1960). Harri's Encyclopedia of Educational Research is also prepared under the auspices of the American Educational Research Association. It is not merely a revision of earlier editions, but it is completely a rewritten volume that has attempted to put into a new perspective.

Encyclopedia of Educational Research, Robert L. Ebel, ed., 4th edn., (New York: Macmillan, 1969). Ebel's Encyclopedia of Educational Research provides concise summaries of research and many references for further research. The articles deal with persistent educational problems and continual educational concerns.

Encyclopedia of Educational Research, Harold E. Mitzel, ed., 5th edn., (New York: The Free Press: A Division of Macmillan Publishing Co., Inc., 1982). The contents of

encyclopedia have been classified under 18 broad headings alphabetically ranging from 'Agencies and Institutions Related to Education, Counselling, Medical, and Psychological Services; Curriculum Areas, etc., to Teachers and Teaching'. The new concepts and topics, viz., 'Computer-Based Education', 'Drug Abuse Education', 'Equity Lssues in Education', 'Ethnography' and 'Neurosciences' are also included in this volume. These additions reflect recent events and developments in the world to which education must attend.

The International Encyclopedia of Education, Torsten Husen and T. Neville Postlethwaite, ed., (New York: Pergamon Press, 1985). This publication is the first major attempt to present an up-to-date overview on educational problems, practices and institutions all over the world. The information available in this volume provides answers to three basic questions: What is the state of the art in the various fields of education?, What scientifically sound and valid information is available? and What further research is needed in various aspects of education?

The Encyclopedia of Comparative Education and National Systems of Education, T. Neville Postlethwaite, ed., (New York: Oxford Press, 1988). This encyclopedia is in two parts: the first part presents a series of articles about comparative education; the second part provides description of 159 different systems of education in various countries.

International Encyclopedia of the Social Sciences, (New York: Macmillan Co., 1968). It was prepared under the direction of 10 learned societies. This reference work covers topics in all of the social sciences.

Encyclopedia of Child Care and Guidance, (Garden City, New York: Doubleday and Co., 1968). It is a comprehensive treatment of the nature of the problems of childhood. It also suggests the methods of dealing with such problems.

Encyclopedia of Social Work, (New York: National Association of Social Workers, 1965). This reference work presents extensive articles on all aspects of social work.

Encyclopedia of Philosophy, (New York: McGraw-Hill Book Co. 1971). This encyclopedia contains more than 7,000 articles written by more than 2,000 contributors in all areas of science and engineering.

Encyclopedia of Philosophy, (New York: Macmillan, Free Press 1967). It is an authoritative and comprehensive reference work covering both Western and Eastern thought—ancient, medieval and modern.

Encyclopedia of Indian Education, (New Delhi: NCERT, 2004). It provides a comprehensive description of various concepts, themes and systems pertaining to Indian education in ancient, medieval, pre-independence and post-independence periods.

Dictionaries. They serve as constant guides to the researcher. A few known dictionaries are detailed below:

Dictionary of Education, (New York: McGraw-Hill Book Co., 1973.). This dictionary covers 33,000 technical and professional terms. It also includes educational terms used in various countries.

Comprehensive Dictionary of Psychological and Psycho-Analytical Terms, (New York: David McKay Company). It contains more than 13,000 terms. All these are defined in non-technical terms.

Dictionary of Sociology, Totowa, N.J., (Littlefield, Adams and Co.). In this dictionary, sociological terms are defined in non-technical language.

Roget's International Thesaurus of Words and Phrases, (New York: Crowell,

Collier and Macmillan). A Thesaurus is the opposite of a dictionary. One turns to the Thesaurus when one has an idea, but does not yet have appropriate word to convey it. Thesaurus lists together the synonyms and antonyms of words. A researcher should use this reference in conjunction with a good dictionary to ensure precision of expression.

Yearbooks, Almanacs and Handbooks, A large amount of current information on educational problems, thought and practices may be found in yearbooks, almanacs and handbooks. Some yearbooks cover a new topic of current interest each year and some others give more general reviews of events. A list of some yearbooks, almanacs and handbooks is given as under:

The Handbook of Research on Teaching, N. L. Gage (ed,), (Chicago: Rand McNally & Co., 1963). This handbook presents a comprehensive research information on teaching with extensive bibliographies.

The Rand McNally Handbook of Education, Arthur W. Foshay (ed.), (Chicago: Rand McNally & Co, 1963). It is a convenient source compilation of the most important facts about education in the United States. This handbook provides a quick-reference comparison of education in England, France and Russia.

Education Yearbook, (New York: Macmillan Co., 1972-date). This is an annual publication. It includes statistical data on major educational issues and movements with a comprehensive bibliography and reference guide.

Mental Measurement Yearbook, (Highland Park, New Jersey: Grayphon Press, 1938-date). It is compiled by Oscar K. Buros and provides a comprehensive summary on psychological measurement and standardized tests and inventories. It is published every four years and includes reviews on all significant books on measurement and excerpts from book reviews appearing in professional journals.

Indian Mental Measurement Hand Book: Intelligence and Aptitude Tests, (New Delhi: National Council of Educational Research and Training (NCERT), 1991). The Handbook is one of major efforts of National Library of Educational and Psychological Tests (NLEPTs) published by NCERT to present before the researchers, a review of the standardized tests, particularly in the areas of 'Intelligence' and 'Aptitude'. It makes available the organized information on tests developed in India and the Indian adaptations or standardizations of foreign tests. The information covers not only tests which are commercially available to test users, and those available for restricted use, but also tests for which only specimen sets are available. Test reviews have been included in this Handbook in order to help the readers to evaluate the tests more critically.

The Student Psychologist's Handbook: A Guide to Sources, (Cambridge, Mass: Schenkman Publishing Co., 1969). This handbook describes the major content areas of psychology with sources of information, methods of data collection, and the use of reference materials.

Data Processing Yearbook, (Detroit: Frank H. Gille, 1952-date). This yearbook is published irregularly and includes articles on equipment, techniques, and developments

in data processing. It also provides information about institutions offering data processing and computer courses.

United Nations Statistical Yearbook, (New York: United Nations, 1949-date). This is an annual publication. It presents statistical data on population, trade, finance, communication, health and education.

World Almanac-Book of Facts, (New York: Newspaper Enterprise Association, 1968-date). This reference guide is published annually. It provides up-to-date statistics and data concerning events, progress and conditions in social, educational, political, religious, geographical, commercial, financial and economic fields.

The Standard Education Almanac. It provides a record of facts and statistics on virtually every aspect of education.

Directories and Bibliographies. Directories are used by a researcher to locate the names and addresses of persons, periodicals, publishers or organizations when he/she wants to obtain information, about financial assistance or research material and equipments. Directories may help a researcher to find people or organizations who have similar professional interests or who can answer his/her queries or help to solve his/her problems.

A few important directories in the US and the UK are as follows:

- *Guide to American Educational Directories*. It lists in one volume over 12,000 educational and allied directories. The directories are listed alphabetically and are arranged under subject headings.
- *The Education Directory*, (Washington: US Office of Education, Superintendent of Documents, 1912-date). This directory is published annually in five parts. It deals with names, educational agencies, officials, institutions and other relevant data.
- *NEA Handbook for Local, State and National Associations*, (Washington, DC: National Education Association, 1945-date). This is an annual publication and contains listings and comprehensive reports of state and national officers of affiliated associations and departments.
- *Educator's World*, (Englewood, Cob.: Fisher Publishing Co., 1972-date). This is an annual guide to more than 1,600 education associations, publications, research and foundations.
- *National Faculty Directory*, (Detroit: Gale Research Co., 1964-date). This annual publication lists alphabetically the names and addresses of more than 300,000 full-time and part-time faculty members and administrative officials of colleges and universities in the US.
- *Encyclopedia of Associations*, (Detroit: Gale Research Co., 1964-date). This directory lists alphabetically more than 14,000 national associations of the US. It includes information on membership, addresses, names of executive secretaries and statement of purpose of these associations.
- *Directory of Exceptional Children*, (Boston: Porter Sargent Publishing Co., 1962-date). This directory provides a description of schools, camps, homes, clinics, hospitals and services for the socially mal-adjusted, mentally retarded or physically handicapped in the US.

- *Mental Health Directory*, (Washington, D.C.: National Institute of Mental Health, Government Printing Office, 1964-date). This annual publication lists national, state and local mental health agencies in the US.
- *American Library Directory*, (New York: R.R. Bowker Co., 1923-date). This directory provides a biannual guide to private, state, municipal, institutional and collegiate libraries in the US and Canada. It includes information on special collections, number of holdings, staff salaries, budgets and affiliations.

Kelley, Thomas (ed.) *Select Bibliographies of Adult Education in Great Britain*, (London: National Institute of Education, 1952). Blackwell, A.M. *A List of Researches in Educational Psychology Presented for Higher Degrees in the Universities of the United Kingdom and the Irish Republic from 1918*. (London: Newnes Educational Publishing Co., 1950).

In India, a very few bibliographical guides to educational research on a national basis have appeared. *Bibliography of Doctorate Theses in Science and Arts* accepted by the Indian Universities for 1946-48 and 1948-50 was published by the Inter-University Board of India. These are listed under the respective universities with subject subheadings including education.

The Index. A periodical index serves the same purpose as the index of a book or the card file of a library. It identifies the source of the article or of the book cited by listing the titles alphabetically, under author and the readers should read all such directions before trying to locate the references.

A list of some important educational indexes is given below:

Education Index, (New York: H.W. Wilson Co., 1929-date). One valuable and work saving guide created for educators is Education Index. It is published monthly (September through June), cumulated annually and again every three years. It indexes more than 250 educational periodicals, and many yearbooks, bulletins, and monographs published in the US, Canada, and Great Britain. The material on adult education, business education, curriculum, educational administration, educational psychology, educational research, exceptional children, higher education, guidance, health and physical education, international education, religious education, secondary education and teacher education are included in this index.

Canadian Education Index, (Ottawa, Ontario: Canadian Council for Educational Research, 1965-date). This index is issued quarterly and indexes periodicals, hooks, pamphlets, and reports published in Canada.

Current Index to Journals in Education, (New York: Macmillan Information. 1969-date). This index is published monthly and cumulated six monthly and annually. It indexes about 20,000 articles each year from more than 700 education and education-related journals under author and subject headings.

ERIC Educational Documents Index, (Washington, D.C.: National Institute of Education, Government Printing Office, 1966-date). This index is published annually. It is a guide to all research documents in the 'Educational Resources Information Centre' or ERIC collection.

Index of Doctoral Dissertations International, (Ann Arbor, Mich.: Xerox University Microfilms, 1956-date). Published as the issue 13 of Dissertation Abstracts international

each year, it consolidates into one list all dissertations accepted by American, Canadian, and some European universities during the academic year, as well as those available in microfilm.

International Guide to Educational Documentation, (Paris: UNESCO). This guide is published every five years. It indexes annotated bibliographies covering major publications, bibliographies and national directories written in English, French and Spanish.

British Education Index. This index is compiled by the Librarians of Institutes of Education, and it includes references to articles of educational interest published during the period of four years. The index covers more than 50 periodicals.

Index to Selected British Educational Periodicals, (Leeds: Librarians of Institutes of Education, 1945-date). This index is issued thrice per year and it covers 41 educational periodicals excluding those on fundamental and adult education.

Information about new ideas and developments often appear in periodicals long before it appears in books. There are many periodicals in education and in other closely-related areas that are the best sources for reports on recent research studies. Such periodicals give much more up-to-date treatment to current questions in education than books possibly can. They also publish articles of temporary, local or limited interest that never appear in book form. The periodicals of proper dates are the best sources determining contemporary opinion and status, present or past.

It has been estimated that there are about 2,100 journals that are specifically related to the field of education. In all such journals, one may also find articles of interest devoted to psychology, philosophy, sociology, and other subjects.

All those engaged in educational research should become acquainted with certain educational periodicals, and they should also learn to use the indexes to them. Knowledge about the editor of a periodical, the names of its contributors, and the associations or institutions publishing it may serve as clues in judging the merit of the periodicals.

Ulrich's Periodicals Directory: A Classified Guide to a Selected List of Current Periodicals, Foreign and Domestic, (New York: Bowker), provides a comprehensive list of periodicals relating to education. In this directory, periodicals are grouped in a subject classification and are alphabetically arranged. Each entry includes title, sub-title, date of origin, frequency of publication, annual index, cumulative indexes, and item characteristics of each periodical.

In India, many periodicals are published by some associations or institutions. They provide a medium for dissemination of educational research and exchange of experience among research workers, teachers, scholars and others interested in educational research and related fields and professions.

Abstracts include brief summaries of the contents of the research study or article. They serve as one of the most useful reference guides to the researcher and keep him/her abreast of the work being done in his own field and also in the related fields.

In America, the most useful of these references are the following:

The Review of Educational Research. It gives an excellent overview of the work that has been done in the field and about the recent developments. This publication, between 1931 and 1969, reviewed about every three years each of the given 11 major

areas of education: (i) Administration; (ii) Curriculum; (iii) Educational Measurement; (iv) Educational Psychology; (v) Educational Sociology; (vi) Guidance and Counselling; (vii) Language Arts, Fine Arts, Natural Sciences, and Mathematics; (viii) Research Methods; (ix) Special Programmes; (x) Mental and Physical Development; and (xi) Teaching Personnel.

Since June 1970, the *Review of Educational Research* has pursued a policy of publishing unsolicited reviews of research topics of the contributor's choice. The role played by this publication in the past has been assumed by the *Annual Review of Educational Research*.

Research In Education (RIE): This represents the most comprehensive publication of research materials in education today. RLE is published monthly since 1966 by the Educational Resources Information Centre (ERIC) and indexed annually. Each monthly issue of RIE is divided into three sections: (1) Document Section; (2) Project Section; and (3) Accession Numbers Section.

Psychological Abstracts: This useful reference is published by the American Psychological Association since 1927. It is published bimonthly and contains abstracts of articles appearing in over 530 journals, mostly educational periodicals. The biannual issues (January-June, July-December) contain both author and subject index.

Education Abstracts: This is a publication of UNESCO, which began in 1949 and has been published monthly except in July and August. Each introductory essay devoted to a particular aspect of education is followed by abstract of books and documents selected from various countries dealing with the topic under consideration.

In addition to the above periodicals, a researcher may also consult the following publications:

(1) *Annual Review of Psychology* (1950-date)

(2) *Child Development Abstracts and Bibliography* (1927-date)

(3) *Psychological Bulletin* (1904-date)

(4) *Sociological Abstracts* (1952-date)

(5) *Educational Administration Abstracts* (1966-date)

(6) *Sociology of Education Abstracts* (1965-date)

(7) *Mental Retardation Abstracts* (1964-date)

(8) *Dissertation Abstracts International* (1952-date)

In India, National Council of Educational Research and Training (NCERT) has been publishing *Indian Educational Abstracts* to serve the cause of educational research through disseminating information about educational researches available in public domain. The information contains abstracts of the researches carried out in India and abroad relevant to Indian educational scene with bibliographic information. This biannual periodical also includes abstracts of doctoral theses, research projects, published researches in the form of books and articles in the reputed journals.

Many professional periodicals and year books, in India and abroad, include some reviews of research and technical discussions of educational problems in one or all the issues of their series. A list of some of the publications are as follows:

USA: *Journal of Educational Research, NEA Research Bulletin, Educational and Psychological Measurement, Journal of Experimental Education, Research Quarterly, Journal of Research in Music Education, American Educational Research Journal, Reading Research Quarterly, Journal of Educational Psychology, Journal of Psychology; Journal of Social Psychology, Journal of Applied Psychology, Sociology of Education, American Journal of Sociology, American Sociological Review, Sociology and Social Research, Harvard Educational Review, Journal of Teacher Education, Elementary' School Journal, History of Education Quarterly; and Educational Forum.*

UK: *British Journal of Educational Psychology.*

India: *Indian Educational Review, Journal of Psychological Researches,*

Indian Journal of Applied Psychology, Indian Journal of Experimental Psychology, Journal of Education and Psychology, The Education Quarterly; Perspectives in Education, Journal of Educational Planning and Administration, University News, Journal of Higher Education, Indian Journal of Education.

Theses and dissertations are usually preserved by the universities that award the authors their doctoral and masters degrees. Sometimes these studies are published in whole or in part in various educational periodicals or journals. Because the reports of many research studies are never published, a check of the annual list of theses and dissertations issued by various agencies is necessary for a thorough coverage of the research literature.

In the US, references of doctoral dissertations in all fields, including education, can be found in sources compiled by various agencies. For the period 1912—1938, the Library of Congress issued the annual *List of American Doctoral Dissertations* for published studies. The Association of Research Libraries published the list of *Doctoral Dissertations Accepted by American Universities* from 1933—1934 to 1954-1955. This service was continued by the Index to *American Doctoral Dissertations* 1956-1963, which became the *American Doctoral Dissertations*, 1963-64 to date. It lists all doctoral dissertations accepted by the American and Canadian universities and other educational institutions.

Dissertation Abstracts International, May 1970, abstracts dissertations in the humanities, social sciences, physical sciences and engineering. It is published monthly. For each dissertation, there is a 600 word abstract that provides the researcher enough information to satisfy his/her needs. If a researcher wants to read a complete copy of a dissertation that is presented in *Dissertation Abstracts International*, he/she can purchase a microfilm or xerox copy from the University Microfilms. The reference number for placing an order and price are provided in the abstract.

In India, only a few universities publish abstracts of dissertations and theses that have been completed at the institution.

Kurukshetra University, Kurukshetra (Haryana) published *Abstracts of M. Ed. Dissertations*, Vol.1, 1966; *Abstracts of M.Ed. Dissertations*, Vol. II, 1967; Abstracts *of M.Ed. Dissertations*, Vol. III, 1968; *Abstracts of M.Ed Dissertations*, Vol. IV, 1969; *Abstracts of M.Ed. Dissertations*, Vol. V, 1970; *Abstracts of M.Ed. Dissertations and Ph.D. Theses*, Vol. VI, 1973.

M.B. Buch (ed.) *A Survey of Research in Education*, (Centre of Advanced Study in Education, Baroda: M.S. University, 1973). This publication contains all the research

studies in education completed in Indian universities up to 1972. The break up of the studies in the said volume is 462 Ph.D. studies and 269 project research. The abstracts of all the studies have been classified into 17 meaningful areas of education. They are (i) Philosophy of Education, (ii) History of Education, (iii) Sociology of Education, (iv) Economics of Education (v) Comparative Education, (vi) Personality, Learning and Motivation, (vii) Guidance and Counselling, (viii) Tests and Measurement, (ix) Curriculum, Methods, and Textbooks, (x) Educational Technology, (xi) Correlates of Achievement, (xii) Educational Evaluation and Examination, (xiii) Teaching and Teaching Behaviour, (xiv) Teacher Education, (xv) Educational Administration, (xvi) Higher Education and (xvii) Non-Formal Education.

M.B. Buch, ed., *Second Survey of Research in Education* (1972-1978) (Baroda: Society for Educational Research and Development, 1979). This publication incorporates 839 research studies completed during the period 1972-1978 and follows the same pattern of organization of 17 research areas as *A Survey of Research in Education* (1973). The first chapter gives a broad perspective of the place and function of research for educational development including historical account of the development of educational research in India. Each subsequent chapter includes a report based on the abstracts of research studies giving the trend of research in the area, including the gaps and highlighting the research priorities as perceived by the author. The abstracts are arranged alphabetically for each area and continuously numbered throughout the volume. Each abstract contains the title of the study, the objective and/or hypotheses examined, methodology including the sample, tools of research, the statistical techniques used, and the findings. A special feature of this publication is the incorporation of a large number of studies on educational problems completed in the university departments of social sciences and humanities other than the departments of education. The trend reports are based not on the research completed during the period 1972-1978, but on the total research activities during the period 1940-1978.

M.B. Buch, ed., *Third Survey of Research in Education* (1978-1983), New Delhi: National Council of Educational Research and Training, 1987. The publication comprises 20 chapters beginning with a comprehensive review for the general trend of research in education in India based on a quantitative and qualitative analysis of the studies. The trend reports in different areas of education have been developed by eminent educationists on the basis of studies conducted during the period of four decades, from 1943 to 1983. In all, 1481 research abstracts have been presented after being classified under the 17 areas. Each research abstract reports in brief the problem, objectives of the study, research techniques adopted, and the findings and conclusions of the study. A special feature of the volume is the chapter on 'Research on Indian Education Abroad', which presents a review of 192 doctoral dissertations submitted to American and British universities, covering a period of around two decades. Another significant inclusion in the volume is the chapter on 'Priorities in Educational Research'. The volume also makes available at one place a complete list of all researches in education conducted in India till 1983.

M.B. Buch, ed., *Fourth Survey of Research in Education* (1983-1988), New Delhi: National Council of Educational Research and Training, 1991.

This publication, available in two volumes, covers researches in education till 1988. It comprises 31 chapters beginning with a comprehensive review of the general trend of

research followed by trend reports in different areas of education developed by eminent educationists on the basis of studies conducted during the period of about four- and-a-half decades— 1943 to 1988. In all, 1,652 research abstracts have been presented after classification in 29 areas. The volume makes available a complete list of all the 4,703 educational researches conducted in India since 1943. The Fourth Survey has a new dimension. There is a chapter on review of researches at the M.Phil level in Indian Universities.

Fifth Survey of Educational Research (1988-1992), New Delhi: National Council of Educational Research and Training, 1997. This publication is also available in two volumes and covers researches in education conducted during 1989—1992. It has dealt with all the areas of research which were covered in the Fourth Survey with the addition of a chapter on researches in "Distance Education and Open Learning".

Sixth Survey of Educational Research (1993-2000), New Delhi: National Council of Educational Research and Training, 2006. The first volume of this publication was released in 2006 and the second volume is still awaited. The researches in the areas of philosophy of education, teacher education, vocational education, science education, distance education and open learning, women education, guidance and counselling, physical education, health education and sports, language teaching, inclusive education, educational technology and population education conducted in India during the period 1993-2000 have been reported in the first volume.

Many articles of particular interest to a researcher may be located through pamphlets and newspapers. Current newspapers provide up-to-date information on speeches, seminars, conferences, new trends, and a number of other topics. Old newspapers, which preserve a record of past events, movements and ideas are particularly useful in historical inquiries. Some libraries catalog pamphlets and newspapers in their reference sections.

Government documents are a rich source of information. They include statistical data, research studies, official reports, laws and other material that are not always available elsewhere. These are available in national, regional, state as well as local level government offices.

Monographs are also major sources of information on ongoing research. In the US, universities and teachers' colleges publish many research studies in education in the form of monographs. A few examples of these are *Supplementary Educational Monographs, Educational Research Monographs*, and *Lincoln School Monographs*. In England too, various institutes of education publish monographs from time to time. In India, only a limited number of monographs are published by some universities and research organizations.

School Research Information Service (SRIS), Direct Access to Reference Information (DATRIX), and Psychological Abstract Search and Retrieval Service (PASAR) in the United States provide a number of computer-generated reference sources that may save a great deal of time and effort of the researcher. SRIS operated by Phi Delta Kappa (Bloomington, Indiana) provides a computer printout of abstracts for a moderate fee. DATRIX, a development of the University Microfilms (Ann Arbor, Michigan) provides computerized retrieval for *Dissertation Abstracts*, from 1928 to date. The researcher can procure information on Microfiche or Xerographic copy of the complete dissertation which he needs, from *University Microfilms*, on payment. The

PASAR furnishes printouts of abstracts of psychological journal articles, monographs, reports, and parts of books for a moderate fee.

Organizing the Related Literature

After making the comprehensive survey of the related literature, the next step for the researcher is to organize the pertinent information in a systematic manner. It should be done in such a way as to justify carrying out the study by showing what is known and what remains to be investigated in the topic of concern. According to Ary et at. (1972, p.67):

The hypotheses provide a framework for organizing the related literature. Like an explorer proposing an expedition, one maps out the known territory and points the way to the unknown territory he proposes to explore. If the study has several aspects, or is investigating more than a single hypothesis, this is done separately for each facet of the study.

One should avoid the temptation to present the literature as a series of abstracts. Rather, it should be presented in such a way as to lay a systematic foundation for the study.

The organization of the related literature involves recording the essential reference material and arranging it according to the proposed outline of the study.

Once pertinent information has been identified, the researcher should record certain essential information for locating the material on 3 x 5 inch index card to serve as a *bibliography card*. To make writing of the final report simpler, it is desirable that the information recorded in the bibliography card should appear, in content and style, exactly as it will appear in the final report.

The basic information in the bibliography card should include name of the author with last name first; title of the book or article; name of the publication (for articles); name of the publisher; date of publication; volume number, page numbers and library call number (for books). If some of this information is not available, the specified space should be left blank so that the missing information can be included immediately upon locating the references.

After recording the essential information on the bibliography cards, it is necessary to arrange the cards according to the location of the material in the library. For example, the researcher may list together all cards pertaining to the material located in the periodical section. Similarly, all the material located in the reserve section may constitute another list, and so on. Then the researcher should make a systematic review of the material located in a specific section of the library and after reviewing each reference on the list, he/she should proceed to another list.

All the information likely to be used in the final report should be recorded on 4 x 6 inch card to serve as content card. The information to be recorded on the content cards will depend on the source from which it is taken. If it is from a primary source, it may include brief bibliographic information comprising author’s last name, brief title of the report, specific page numbers on which information is located; sentence statement of the problem; brief description of the study; statements of findings or conclusions, or both; a card code as to the aspect of the research to which the material most closely relates.

The information to be recorded from the secondary source is somewhat different from the primary source. Tumey and Robb (1971, p. 55) have given the following suggestions for recording information from a secondary source:

1. Provide brief bibliographic information (as with a primary source).
2. Record on a single card only those statements that are related to the same topic (if all the information cannot be placed on one card, continue statements on another' card and staple to the first card).
3. Paraphrase, in complete statements, the most relevant ideas. Record direct quotations only if they are stated concisely and effectively, and if paraphrasing might change the meaning.
4. Place a page number and a paragraph number after each separate statement indicating its location in the reference in case you need to review it again.
5. Code the cards (probably in the upper-right hand corner) according to topic(s) to' which it most closely relates.

For the preparation of the report of the related literature, the researcher should arrange the bibliographic and content cards according to the proposed outline of the problem. This can be done with the help of card code.

The report of the related literature should begin with an introductory paragraph describing the organization of the report. After the introduction, the researcher should present the studies most relevant to each aspect of the proposed problem outline. Studies with similar and contradictory results should be reported side-by-side without using excessive space.

Test

1. What is the importance of survey of related literature in educational research? Illustrate by taking a specific research problem as to how the survey of the related literature can be helpful at various stages.
2. Describe the procedure which the researcher should adopt in identifying related literature, and in locating, selecting and utilizing the primary and secondary sources of information available in the library.
3. What library skills are required for a thorough survey of literature related to a research topic in education?
4. Name some important reference books with author's names and some important educational journals you would like to consult in connection with the problem you have selected for research.
5. Describe the procedure which the researcher should adopt in organizing the related literature in a systematic manner.

2.4 OVERVIEW OF HYPOTHESIS

A hypothesis is an approximate assumption that a researcher wants to test for its logical or empirical consequences. It can contain either a suggested explanation for a phenomenon or a proposal having deductive reasoning to suggest a possible interrelation between multiple phenomena. A deductive reasoning can be defined as a type of reasoning that can be derived from previously known facts.

2.4.1 Characteristics of Valid Hypothesis

There are several characteristics of hypothesis, which are as follows:

- **Conceptually Clear and Accurate:** The hypothesis must be conceptually clear. The concepts and variables should be clearly defined operationally. The definition should use terms which are commonly accepted and communication is not hindered. Hypothesis should be clear and accurate so as to draw a consistent conclusion.
- **Statement of Relationship between Variables:** If a hypothesis is relational, it should state the relationship between the different variables.
- **Testability:** A hypothesis should have empirical referents which mean that it should be testable through the empirical data. Hypothesis involving mystical or supernatural things are impossible to test. For example, the hypothesis '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 such as 'there is a positive relationship between the learning style and academic achievement of 8th grade students' can be tested since the variables in the hypothesis are operationally defined, and therefore can be measured.
- **Specific with Limited Scope:** A hypothesis, which is specific with limited scope, is easily testable than a hypothesis with limitless scope. Therefore, a researcher should pay more time to do research on such a kind of hypothesis.
- **Simplicity:** A hypothesis should be stated that the most simple and clear terms to make it understandable.
- **Consistency:** A hypothesis should be reliable and consistent with established and known facts.
- **Time Limit:** A hypothesis should be capable of being tested within a reasonable time. In other words, the excellence of a hypothesis is judged by the time taken to collect the data needed for the test.
- **Empirical Reference:** A hypothesis should explain or support all the sufficient facts needed to understand what the problem is all about.

A few more characteristics of a good hypothesis are as follows:

- It ensures that the sample is readily approachable.
- It maintains a very apparent distinction with what is called theory, law, facts, assumptions and postulates.
- It should have logical simplicity, a large number of consequences and be expressed in quantified form.
- It should have equal chances of confirmation and rejection.
- It permits the application of deduction reasoning.
- Tools and data should be easily available and effectively used.
- It should be based on study of previous literature and an existing theory, and should be verifiable.

As soon as a research question is formulated, it makes the hypothesis formulation imperative since a hypothesis 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 previous knowledge. Modem investigators agree that, whenever possible, 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'.

2.4.2 Need for Hypotheses Formulation

The reasons for formulating a hypothesis are as follows:

(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. They thereby extend the existing knowledge in the area to which they pertain and thus help in theory building and facilitate the extension of knowledge in an area.

(ii) The hypothesis not only indicates what to look for in an investigation but also how to select a sample, choose the 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 the problem so as to focus on specific issues and Pertinent facts. It helps the researcher to delimit his/her 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, eta!., 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/her 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 predictions about the expected outcomes and, hence the hypothesis takes on a critical role. In the case of historical or descriptive studies, however, the researcher investigates the history of an event, or life of a man, or seeks facts in order to determine the status quo of a situation and hence may not have a basis for making a prediction of the results. In studies of this nature, where fact finding itself is the objective of the study, a hypothesis may not be required.

Most historical or descriptive studies involve fact finding as well as the interpretation of facts in order 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/she cannot state facts clearly and detect relevant relationships between variables as there is no hypothesis to guide him/her.

2.5 HYPOTHESIS TESTING

Hypothesis testing means to determine whether or not the hypothesis is appropriate. This involves either accepting or rejecting a null hypothesis. The researcher has to pursue certain activities contained in the procedure of hypothesis.

In the formulation of hypothesis, the investigator looks for the statements where he/she relates one or more variables to make predictions about the relationships. The hypothesis tells the researcher what to do and why to dolt in the context of the problem.

For example, the researcher is interested to study a problem, 'Why does a gifted child become a poor achiever in school'? The researcher then moves towards finding out the causes and factors that have been responsible for his/her poor achievement. He/ She makes a conjecture that he/she might be suffering from 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/She shall go to the student's home, meet his/her parents and enquire about the student's health. All that the investigator is doing is guided by the hypothesis he/she had developed.

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

A 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. Being a specific statement of prediction, a hypothesis describes in concrete (rather than theoretical) terms what you expect will happen in your study. Not all studies have hypotheses. Sometimes a study is designed to be exploratory. In such researches, no formal hypothesis is established, and it may be the case that the actual objective of the study is to explore one or more specific areas more thoroughly in order to develop specific hypotheses or predictions that could be tested through research in the future. A single study could result in one or several hypotheses.

Some definitions of hypothesis are:

- According to Townsend, *'Hypothesis is defined as suggested answer to a problem'.*
- According to McGuigan, *'A hypothesis is a testable statement of a potential relationship between two or more variables'.*
- According to Uma Sekaran, *'A hypothesis is defined as a logical/v conjectured relationship between two or more variables in the form of testable statement. These relationships are based on theoretical framework formulated for the research problem. The hypotheses are often statements about population parameters like expected value and variance, for exam pie a hypothesis might be*

that the expected value of the lie height of 10-year-old boy's in the Scottish population is not different from that of 10-year-old girls.'

- According to Kerlinger, *'A good hypothesis is one which satisfies the following criteria:*

(i) *Hypothesis should state the relationship between variables.*

(ii) *They must cart)' clear implications for testing the stated relations.'*

This means that (a) Statements contain two or more variables which can he measured, (h) They must state clearly how the two or more variables are related and (c) It is important to note that facts and variables are not tested but relations between variables exist.

2.5.1 Sources of Hypothesis

Since the mind is led by innumerable streams and sources, it is difficult to pinpoint how a particular good idea came to the researcher. The following are some of the popularly known sources of research hypothesis:

- **Scientific Theories:** A systematic review and analysis of theories developed in the field of psychology, sociology, economics, political science and biological science may provide the researcher with potential clues for constructing a good and testable hypothesis.
- **Expert Opinions:** Discussion with the experts in the field of research may further help the researcher obtain necessary insight and skill into the problem and in formulation of a hypothesis.
- **Method of Related Difference:** When we find that two phenomena differ constantly and the other circumstances remaining the same, we suspect a causal connection. For example, when we find more uncontrolled traffic in a locality, resulting in a greater number of road accidents, we suspect a causal connection between uncontrolled traffic and road accidents. This method also suggested a hypothesis.
- **Intellectual Equipment of Researcher:** Intellectual abilities of a researcher like creative thinking and problem solving techniques are very helpful in the formulation of a good hypothesis.
- **Related Literature:** Related literature is the most important source of hypothesis formulation. A review of this literature may reveal to the researcher the variables that have been considered important in relation to his/her problem, which aspects have already been studied and which still remain to be studied, which theories have supported the relationships and which theories present a contradictory relationship. Familiarity with related literature may give the researcher a tremendous advantage in the construction of hypothesis.
- **Experience:** One's own experience may be a rich source of hypothesis generation. Personal experiences of an individual which has been gained through reading of bibliographies, autobiographies, newspaper readings or through informal talks among friends, etc., can be a potential source of generation of a hypothesis. For example, a researcher who is working on the effectiveness of guidance in teaching, can think of factors such as the teacher's polite behaviour, techniques of counselling, mastery over the subject, effective use of teaching skills, decision

making capability, perception of his/her competence, perception of student's capacity for better interaction, use of communication skills, etc.

- **Analogies:** Several hypotheses in a branch of knowledge may be made by using analogies from other sciences. Models and theories developed in a discipline may help, through extrapolation, in the formulation of hypothesis in another discipline. By comparing the two situations, analysing their similarities and differences, some rationale may emerge in the mind of the researcher which may take the form of a hypothesis for testing. For example, in a research problem like the studying the factors of unrest among college level students, the researcher insightfully thinks: 'Why was unrest found among school students? and 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/she may reason out that the new situation may also be related to Y and Z.
- **Methods of Residues:** When the greater part of a complex phenomenon is explained by some causes already known, we try to explain the residual part of phenomenon according to the known law of operation. It also provides possible hypothesis.
- **Induction by Simple Enumeration:** Sometimes scientists take common experience as a starting point of their investigation. For example, after observing a large number of scarlet flowers that are devoid of fragrance, we frame a hypothesis that all scarlet flowers are devoid of fragrance. Thus induction by simple enumeration is a source of discovery.
- **Formulation of Hypothesis:** It may also originate from the need and practice of present times.
- **Existing Empirical Uniformities:** In terms of common sense proposition, the existing empirical uniformities may form the basis for scientific examination.
- **A Study of General Culture:** It is also a good source of hypothesis.
- **Suggestions:** When given by other researchers in their reports, suggestions are quite helpful in establishment of hypothesis for future studies.

2.5.2 Procedure of Hypothesis Testing

The procedure for hypothesis testing is as follows:

(i) **Making Formal Statement:** In this step, the nature of a hypothesis is clearly stated, which could be either null hypothesis or alternate hypothesis. Stating a problem in hypothesis testing is of utmost importance, which should be done with proper care, keeping in mind the object and nature of the problem.

(ii) **Choosing a Significance Level:** In this step, a hypothesis is tested on the basis of a present significance level, which has to be adequate in terms of nature and purpose of the problem.

(iii) **Sampling Distribution:** In this step, determination of an appropriate sampling N distribution and making a choice between normal distribution and t-distribution is included.

(iv) **Selection of a Sample Randomly:** In this step, a random sample is selected from the sample data for determining an apt value.

(v) **Probability Calculation:** In this step, the probability regarding viability of the sample result is made dependent on the null hypothesis.

(vi) **Comparison:** In this step, the calculated probability and the value of alpha in case of one-tailed test and alpha in case of two-tailed test is compared.

2.5.3 Types of Hypothesis Testing

Hypothesis is tested to identify the errors occurred in the statements and concepts used in hypothesis. Hypothesis testing can be broadly divided into two types, which are as follows:

- Parametric tests or standard tests of hypothesis
- Non-parametric tests or distribution-free tests of hypothesis Parametric Tests or Standard Tests of Hypothesis

These kinds of tests assume certain properties of the population sample such as observations from a normal population, large sample size, population parameters like mean and variance. The various parametric tests of hypothesis are based on the assumption of normality. In other words, the source of data for them is normally distributed. They can be listed as follows:

- **Z-Test:** This kind of test is based on normal probability distribution. It is mostly used to judge the significance of mean as a statistical measure. This is the most frequently used test in research studies. It is generally used to compare the mean of a sample with the hypothesized mean of the population. It is also used in case the population variance is known. It is helpful in judging the significance of difference between the means of two independent large samples, to compare the sample proportion to a theoretical value of population proportion and to judge the significance of median, mode and coefficient of correlation.
- **t-Test:** This test is based on t-distribution and is aptly considered to judge the significance of a sample mean or the difference between the means of two small samples when population variance is not known.
- x^2: This test is based on a chi-square distribution and is used for comparing a sample variance to a theoretical population variance.
- **F-Test:** This test is based on F-distribution and is also used to compare the variance of two independent samples. It is also used to compare the significance of multiple correlation coefficients.

Non-Parametric Tests or Distribution-Free Tests of Hypothesis

There are situations where assumptions cannot be made. In such situations, different statistical methods are used which are known as ‘non-parametric tests’. There are various types of non-parametric tests. The important non-parametric tests are as follows:

- **Sign Test:** This is one of the easiest tests in practice based on the plus/minus sign of an observation in a sample. The sign may be one of the following two types:
  - **One-Sample Sign Test:** This is a very simple distribution-free test and is applied in case of a sample from a continuous symmetrical population, wherein the probability of a sample to be either less or more than mean is half. Here, to

test a null hypothesis, all those items which are greater than the alternate hypothesis are replaced by a plus sign and those which are less than the alternate hypothesis are replaced by a minus sign.

  - **Two-Sample Sign Test:** In case of all the problems consisting of paired data, two-sample sign test is used. Here, each pair of values can be replaced with a plus sign in the first value of the first sample with the first value of the second sample. If the first value is less, minus sign is assigned.

- **Fisher-Irwin Test:** This is applied where there is no difference between two sets of data. In other words, it is used where you can assume that two different treatments are supposedly different in terms of the results that they produce. It is applied in all those cases where result for each item in a sample can be divided into one of the two mutually exclusive categories.
- **McNamara Test:** It is applied where the data is nominal in nature, and is related to two interrelated samples. By using this test, you can judge the significance of any observed changes in the same subject.
- **Wilcoxon Matched-Pairs Test:** This test is applied in the case of a matched- pair such as output of two similar machines. Here, you can determine both the direction and the magnitude between the matched values. This test is also called Signed Rank Test.

2.6 HYPOTHESIS TESTING FOR COMPARING TWO RELATED TERMS

Researchers often use hypothesis testing for comparing two population parameters based on the corresponding statistics from each population. For instance, researchers might want to check if the two populations have the same mean, which they can test with the help of hypothesis testing.

In this method two separate scores are to be obtained for each individual sample where the data in each sample set is related in some special way. For example, a group of patient's blood pressure is measured before and after a drug therapy. In this case, the same variable is measured two times for the same set of samples. Hypothesis testing uses t-statistic for comparing two related terms, which is described in the following sections:

t-Statistic for Comparing Two Related Terms

The t-statistic for comparing two related terms is based on the 'Difference Scores' and not on the 'Raw Scores'.

What is the Difference Scores?

Suppose a sample has n = 4 participants. Each individual's blood pressure is measured before and after medication.

Let,

x_1 = The first score for each person before medication.

x_2 = The second score for each person after medication.

Then, the difference scores are obtained by subtracting the first score from the second score for each participant.

Hence, difference score (d) = $x_2 = - x_1$

The following figure illustrates the difference scores :

Subject	I	II	d
A	10	15	5
B	20	25	5
C	15	10	–5
D	25	30	5

The t-Statistic Formula for Comparing Two Related Terms

t-statistic formula for comparing two related terms is as follows:

Where,

M_d = The mean for the sample of difference scores or sample mean difference.

= The mean for the population of difference scores.

= The standard error for M_d.

Decision

If the t value obtained falls in the critical region then reject the null hypothesis, otherwise do not reject it.

- M_d can be calculated as follows:

Where, n = Sample size.

- Sample variance (S^2) of difference score (d) can be calculated as follows:

Where,

SS = It denotes sum of square of deviation.

df = It denotes degree of freedom.

Also, the formula to calculate SS is as follows:

Where, N = The size of the population.

- The sample standard deviation is then calculated as follows:

- Next, using sample variance, the estimated standard error is computed as follows:

  or

Now, from the above computations, it is clear that all the calculations are done with the d scores, which is unique for each subject.

Degrees of Freedom

If there is a sample of n scores, then there will be total of nd scores. Degrees of freedom (*df*) describe the number of scores in a sample that are independent and can vary freely. The mean for the sample of difference scores places a restriction on the value of one sample, therefore the degrees of freedom will be $n - 1$ for n scores.

Basic Assumptions for t-Statistic

1. The sample size should not exceed 30.

2. Each observation within each treatment condition should be independent.

Example 1: For the following data set from a study of examining the effect of a treatment on college students by measuring a group of $n = 6$ subjects before and after they receive the treatment, find:

(a) The difference score.

(b) The sample means difference.

(c) Variance for difference scores.

(d) Standard error for the sample means difference.

Subjects	Before Treatment	After Treatment
I	7	8
II	2	9
III	4	6
IV	5	7
V	5	6
VI	3	8

Solution: (a) Let us denote,

X_2 = The second score for each participant after treatment

X_1 = The first score for each participant before treatment

Now, the difference score for each participant is given by: $d = X_2 - X_1$

The difference scores are calculated in the table given below:

Subjects	X_1	X_2	d
I	7	8	1
II	2	9	7
III	4	6	2
IV	5	7	2
V	5	6	1
VI	3	8	5

The required difference scores are: 1, 7, 2, 2, 2, 1 and 5.

(b) The sample mean difference of the score is given by:

$= 3$

The required sample means difference is 3.

(c) First, calculate *SS* by calculating d^2, which is given in the table below:

Subjects	X_1	X_2	d	d^2
I	7	8	1	1
II	2	9	7	49
III	4	6	2	4
IV	5	7	2	4
V	5	6	1	1
VI	3	8	5	25

The formula of *SS* is given by:

$= 30$

The variance for the sample of difference scores is given by:

$= 6$

Hence, the required answer is 6.

(d) The standard error for the sample mean difference is given by:

$= 1$

Hence, the required answer is 1.

Every hypothesis test contains two opposite statements. One of the statements is null hypothesis and other is alternative hypothesis. These are the two types of hypothesis, which are described as follows:

Null Hypothesis

The null hypothesis states that the population parameter is equal to the claimed value and is denoted by H_0. It is used for comparing statistics with the help of mean, . For example, if the average time taken by the student to complete his homework is 5 hours, then, H_0 : = 5.

Alternative Hypothesis

Before conducting the hypothesis the other possible hypothesis can also be treated vice versa. It is used for comparing statistics assuming that there is a difference between the two.

If the population parameter is *not equal* to the claimed value:

H_1 : 5

If the population parameter is *greater than* the claimed value:

H_1 : > 5

If the population parameter is *less than* the claimed value:

H_1 : < 5

Example 2: Use the dataset of Example 1.1 to find whether there is any significant treatment effect. Use, = 0.05 for two tails.

Solution:

The null hypothesis is: H_0 : $_d$ = 0

The mean difference is zero as there is no difference between the treatment conditions.

Against the alternative hypothesis 7, which is:

H_0 : $_d$ 0

There is a significant mean difference. Use, = 0.05 for two tails.

With a sample of n = 6, the t statistic has df = 6 – 1 = 5.

Hence, for a two tailed test with a = 0.05 and df = 5, the critical t values are

± 2.571.

Now, compute t-value using t-statistic formula:

= 3

The value t = 3 is greater than the critical value, so reject the null hypothesis H_0. Hence, it can be concluded that there is a significant mean difference.

Confidence Intervals (CI) for *t*-Statistics

Confidence interval gives an estimate about a range of values that are centered around the sample statistic. It is calculated by using sample mean so that it can be confidently estimated that the value of the parameter lies in the interval of the known population. The sample mean difference M_d, is used to estimate the population mean difference $_d$.

Formula of CI for *t*-Statistics

For the i-test of comparing two related terms,

Where t stands fort-value and stands for standard error of mean differences. **Example 3:** Use the dataset of Example 1 to construct a 95% CI.

Solution: Confidence level = 95%

Now, = 0.05 and df = 5, the critical t values are ± 2.571.

Hence, the confidence interval is:

The required confidence interval to estimate the sample mean difference is: (0.429, 5.571).

Advantages of Hypothesis Testing for Comparing Two Related Terms

The advantage of this study is that it removes individual differences, which lowers sample variability and increases the chances of obtaining significant results.

2.6.1 Hypothesis Testing of Proportions

Many a times, crucial decisions rely on the percentage or proportion of the population that meets certain predefined criteria. For example, a state's Chief Minister might be interested in knowing the percentage of females attending school in that state in order to come up with a policy decision to enhance female literacy. An economist might be interested in the proportion of the firms in an industry that make excessive profits and hence suggest the existence of an oligopolistic market structure, which is a situation where market is controlled by few sellers. A manager of a big enterprise may want to estimate the percentage of employees with an attendance rate of more than 90 per cent. The central point is that we might want to check if the population proportion exceeds or is less than some cut off value. Stated differently, hypothesis testing would allow us to check if the population proportion is significantly different from the hypothesized proportion, which is the one that we ideally desire for our data should possess.

Let us denote the population proportion by in which we are interested in testing. Let denote the sample proportion of observations that are considered as successes according to the defined rationale. So, if *n* is the sample size and X is the number of successes, then,

Let denote the standard error of the sampling proportion. It measures the tendency for the sample proportions, to deviate from the unknown population proportion, . So,

Assuming that n is large, we can use the standard Z-test technique for hypothesis testing. Z is defined as,

Note that this variable follows a standard normal distribution since it is in the form,

Thus, we can use the standard normal tables to determine whether the calculated Z-value exceeds the Z-value at the given level of significance or not. Let us denote this critical Z-value by Z_a where a denotes the level of significance.

The general procedure for testing hypothesis can be thus outlined as follows:

- Set up the null hypothesis, that may be , where is the hypothesized value of . This is what we want to test.
- Set up the alternative hypothesis which is complimentary to the null hypothesis. So, if the null is , then the alternative is .
- Choose the appropriate level of significance ().
- Compute the relevant test statistic Z in this case.
- Find out the critical value ().

- Use the decision rule to accept or reject the null.

In this case, the decision rule is: If |Z|>|| then reject the null hypothesis, otherwise accept it.

Example 4: In a random sample of 500 people from a large population in a college, 200 are females. Is it correct to say that the sex ratio in this college is 1:1? Use level of significance as 1%.

Solution: We define success as the number of females in the sample. It is given that,

n = 500

X = 200

Since, the given ratio is 1:1, we define the null hypothesis as:

H_0: = 0.5

H_0: = 0.5, where is the proportion of females in the population.

The alterative hypothesis is therefore,

The level of significance is given to be 0.01.

We compute,

= 0.4

= 0.02191

So, the test statistic in this case is,

= – 4.564

Note that it is a two tailed test. So,

Also,

|Z| = 4.56

|| = 2.58

Thus, |Z| > ||. Hence, we reject the null hypothesis.

Therefore, we cannot claim that the sex ratio is 1:1 in the college is at level of significance 1%.

2.6.2 Hypothesis Testing for Differences between Proportions

In this method, one usually tests a claim made about two population proportions. The two estimated proportions may be different due to a difference in the populations. A hypothesis test helps in determining if there is a difference in the estimated proportions: which reflects a difference in the population proportions.

In this section, we shall consider those tests only where the hypothesized difference between proportions is zero, since this is generally the case is.

Denoting our two population proportions as and , we can write the null hypothesis as,

H_0: $p_1 - p_2 = 0$ which states that the two population proportions are equal.

Decision

lithe Z-value obtained falls in the critical region then reject the null hypothesis, otherwise accept it.

Important Notations for the Two Population Proportions

Suppose, there are two populations: Population 1 and Population 2.

p_1 = Population proportion

n_1 = Size of the sample

x_1 = Number of success in the sample

(Sample proportion)

For Population 2, the corresponding notations are: p_2, n_2, x_2, and .

Formula for Pooled Sample Proportion

The notation of pooled sample proportion is and the formula is given by:

Z-Statistic for Differences between Two Proportions

The Z-Statistic for differences between two proportions is based on the *Sample proportion* and the *Pooled sample proportion*.

The Z-Statistic formula for differences between two proportions is given by:

Where,

$p_1 - p_2$ is assumed to be 0

and

is the standard error.

P-Value

P-value is the probability of observing the sample statistic as extreme as the test statistic. Here the test statistic is a Z-statistic. The Standard Normal Distribution table is used to calculate the probability associated with the computed Z-statistic.

Basic Assumptions for Z-Statistic

1. The two samples must be independent, that is, the two samples must be drawn from two different populations, so that the samples have no effect on each other.

2. The samples must be large enough to use a normal sampling distribution and the difference of two population proportions should follow normal distribution approximately.
3. The samples must be randomly selected.
4. In both the samples, the number of successes as well as number of failures should be at least 5.

Computation of Z-Statistic Formula

Steps to calculate Z-Statistic formula are as follows:

Step 1: Calculate sample proportions: and .

Where,

and

Step 2: Calculate the difference between the two sample proportions: .

Step 3 : Calculate the pooled sample proportion :

Step 4: Calculate the standard error :

Step 5: Divide the result of Step 2 by the result from Step 4. Then, the obtained test statistic is as follows:

Example 5: Consider the following data:

	Sample 1	Sample 2
Rate	26.7%	29.0%
Total number	13200	13433

Find

Solution: Calculate in the following manner:

= 3524 (Rounded Up)

Similarly,

= 3896 (Rounded Up)

Now, calculate the pooled sample estimate as shown below:

= 0.2786

And,

1 – 0.2786

= 0.7214

Example 6: Use the dataset of Example 1 to find whether there is any significant treatment effect. Use = 0.01 for one tail.

Solution: Now, the null hypothesis H_0 is,

H_0: $p_1 = p_2$ (Original claim of equality)

The alternative hypothesis H_1 is,

$H_1 : p_1 > p_2$

The significance level is $= 0.01$.

Now, calculate the value of 'Test Statistic' as follows:

$= -4.19$

The negative standard normal table gives *P*-value that is equal to 0.0001.

The *P* value is less than the level of significance 0.01, so we reject the null hypothesis of $p_1 = p_2$.

Confidence Intervals (CI) for Z-Statistics

Confidence interval contains a range of values that are centered around the sample statistic. For this method, the confidence interval is computed to estimate the difference between two population proportions $p_1 - p_2$.

CI uses the standard deviation based on the estimated values of the population proportions, but the hypothesis testing method involves standard deviation based on the assumption that the two population proportions are equal.

Formula of CI for Z-Statistics

The margin of error is given by:

Where, is the critical value directly obtained from the standard normal table corresponding to confidence level.

The CI estimate is given by:

Example 7: Consider the following data:

	Sample 1	Sample 2
Number of samples	126	205
Total number	331	331

Construct a 95% confidence level.

Solution: With 95% confidence level, $= 1.96$ from the standard normal table.

Calculate the margin of error *E* as follows:

$= 0.0739$

Hence, $E = 0.0739$

Where,

and (Sample proportion)

p_1 = Population proportion

n_1 = Size of the sample

x_1 = Number of successes in the sample

Construct the 95% confidence Interval as follows:

$(0.3806 - 0.619) - 0.0739 < < (0.3806 - 0.619) + 0.0739$

$- 0.3123 < < - 0.1645$

2.7 HYPOTHESIS TESTING FOR COMPARING A VARIANCE

Sometimes we want to check if the variance of a population is statistically different from some hypothesized value that we have in mind. For example, we might want to test if the variance of the heights of men is significantly different from zero. An investor may want to test if the variance of a stock is statistically different and some cutoff value that may reflect his risk awareness. His decision to include such a stock in his portfolio is dependent on whether the variance of the stock calculated from available data is statistically different from his risk level. For an economist, this statistical concept holds importance because he may want to judge the variance of income for individuals in a region and thus formulate policy schemes to reduce income inequalities if the variance is statistically different from 'the acceptable' level of income inequality.

For testing the assumption about population variance, we use the test that is based on the -distribution, which is defined as follows:

Where $n - 1$ is the sample variance, n is the sample size and is the population variance that we are hypothesizing. Note that $n - 1$ is the degrees of freedom of this distribution. It is this test statistic that we shall be computing in this case.

The general procedure for testing hypothesis about population variances can be thus outlined as follows:

- Set up the null hypothesis, that may be where c is the variance of the population. This is what we want to test.
- Set up the alternative hypothesis which is complimentary to the null hypothesis. So, if the null is , then the alternative can be . It could also be or .
- Choose the appropriate level of significance .
- Compute the relevant test statistic, in this case.
- Find out the critical value; say where $n - 1$ is the degrees of freedom.
- Use the decision rule to accept or reject the null. If we are doing a two tailed test, the decision rule is, if ' then reject the null hypothesis, otherwise do not reject it. If we are doing a one tailed test, such that the alternative hypothesis is , the two conditions arise:
  - o If ' then reject the null hypothesis otherwise do not reject it.
  - o If ' then reject the null hypothesis otherwise do not reject it.

Example 8: Suppose we have a sample of 29 households from a district. The sample data suggests that the sample variance of incomes of these households is 20. Test the hypothesis that the variance of the income of all households in the district is 15. The level of significance is 5%.

Solution: We set up the null hypothesis as .

The alternative hypothesis is thus, .

It is given that,

$s^2 = 20$

$n = 29$

$= 0.05$

Next, we calculate the -statistic. Note that the distribution will have 28 (29 –1) degrees of freedom.

$= 37.33$

Since this is a two tailed test, the critical value is . Use the distribution table of to find out this value. We get:

Clearly,

So, we do not reject the null hypothesis. Hence, it can be claimed that the variance of incomes in the district is not significantly different from 15 at 5% level of significance.

2.8 TESTING THE EQUALITY OF VARIANCES OF TWO NORMAL POPULATIONS

The equality of variances of two normal populations is tested by *F*-test. *F*-test is based on *F*-distribution.

Let us draw random sample X_1, X_2, ... of size n_1 from normal population with unknown variance .

Let us draw another random sample Y_1, Y_2, ... of size n_2, from some other normal population with unknown variance .

Let us state the null hypothesis H_0 and alternative hypothesis H_1 for *F*-test as:

F statistic can be written as:

Where,

F statistic follows *F* distribution with (n_1 – 1) and (n_2 – 2) degrees of freedom under H_0.

If , then F statistic is calculated as follows:

We test with (n_1– 1), (n_2– 2).

If , then *F* statistic is calculated as follows:

We test with (n_2–1), (n_1–2).

Basic Assumptions for *F*-Test

Few assumptions for *F*-Test are as follows:

1. Samples drawn from normal population.
2. Samples are randomly drawn.
3. The observations of samples are independent.
4. Measurement error is absent.

Critical Region

For *F*-test, alternative hypothesis H_1 is two tailed, hence; the critical region lies in both the sides of the distribution as shown in the Figure 2.1.

Hence,

If or , we reject H_0 at level of significance % , otherwise we accept H_0.

We can find critical value from F-Table using degrees of freedom.

Example 9: Two independent samples of industrial process are drawn from normal population. First sample is of size 20 and consists of variance 2.8. Second sample is of size 25 and consists of variance 1.05. Find out the statistic of the *F*-Test.

Solution: Here, size of first sample, $n_1 = 20$

Variance of the first sample,

Size of second sample, $n_2 = 25$

Variance of the second sample,

$F = 2.7$

Hence, statistic of the *F*-test is 2.7.

Example 10: Given below are the two samples drawn from the normal populations of diameter of pipe in mm. For this data, apply *F*-Test to check the equality of variance of two normal populations using 5% level of significance.

X	4.8	5	5.1	4.7	4.2	4.6	5

Y	4.5	4.2	4.3	4.8	4.1	-	-

Solution: We write

and

X	X^2	Y	Y^2
4.8	23.04	4.5	20.25
5	25	4.2	17.64
5.1	26.01	4.3	18.49
4.7	22.09	4.8	23.04
4.2	17.64	4.1	16.81
4.6	21.16	-	-
5	25	-	-
$n_1 = 7$		$n_2 = 5$	
$= 4.7714$		$= 4.38$	

Hence,

And,

We calculate *F*-test as follows:

$F = 1.1349$

Hence, test statistic is $F = 1.1349$.

Critical Value

Degrees of freedom = $(n_1 - 1)$, $(n_2 - 1) = (6,4)$ and level of significance = 5%, hence, critical value is 6.1631 (from *F*-table).

Conclusion

Test statistic $F = 1.1349$ is less than critical value 6.1631, hence, we fail to reject null hypothesis H_0. The two variances for the normal populations are equal.

Hypothesis Testing of Correlation Coefficients

To test the hypothesis of correlation coefficient, we use formulae as follows:

1. Simple Correlation Coefficient

In simple correlation coefficient, we test the relation between variable in the population, i.e., variables are independent or unrelated. Simple correlation coefficient is calculated as follows:

Where,

= The correlation coefficient of random samples.

n = Pairs of observation (X_1, Y_1) drawn from Bivariate normal population.

If , we reject null hypothesis H_0 at level of significance %, otherwise we accept H_0.

2. Partial Correlation Coefficient

Suppose we have three variables X_1, X_2 and X_3 and n observations. The correlation between X_1 and X_2 with respect to X_3 on each X_1 and X_2 is called partial correlation. Formula of partial correlation coefficient is as follows:

Where,

We can compute ‘h and r23 same as .

3. Multiple Correlation Coefficient

Suppose we have three variables X_1, X_2 and X_3 has n observations. Multiple correlation coefficient is a simple correlation coefficient between X_1 and joint effect of X_2 and X_3 on X_1 . It is represented as follows:

Where,

We can compute and same as .

Example 11 : Given that and , determine and .

Solution :

= 0.73

And,

= 0.635

2.9 STATISTICAL TECHNIQUES OF HYPOTHESIS TESTING

Sometimes, we want to test the claims related to population using samples. For example, we have to test if the proportion of literacy is same or different allover India. It means we are interested in testing such claims and for that, we have already learnt the technique called hypothesis testing. Hypothesis testing involved two terms; a hypothesis

of no difference is called null hypothesis denoted by H_0 and hypothesis complimentary to null hypothesis denoted by H_1.

Let us learn hypothesis testing of means and hypothesis testing of difference of means.

2.9.1 Hypothesis Testing of Means

Here, we define different situations for hypothesis testing of means.

Testing Population Mean () Equal to Specified Value ()

For Normal, Infinite Population

Let us assume that we have a random sample X_1, X_2, ... X_n drawn from normal population with mean and known variance . Here we test if the populations mean is equal to specified mean .

Case 1: Two Tailed Test

In this case, hypothesis is as follows:

against

Test Statistic

Under H_0 test statistic follow normal distribution.

Critical Region

For level of significance %, we reject null hypothesis H_0 if and , otherwise we accept H_0.

Case 2: One Tailed Test

In this case hypothesis is as follows:

against

or

Test Statistic

Under H_0 test statistic follow normal distribution.

Critical Region

If then for level of significance %, we reject H_0 if .

If then for level of significance %, we reject H_0 if .

For Normal, Finite Population

For normal finite population test statistic is as follows:

When population is non normal and sample size is sufficiently large then by using Central Limit Theorem (CLT), the test statistic follow normal distribution.

Example 12: For industrial process 150 random sample cans of edible oil are drawn from a population. Machine is set filling with 5 kg of edible oil with standard deviation of 0.5 kg and average weight 4.9 kg. Test hypothesis using level of significance 5%.

Solution: Let us state the null hypothesis H_0

H_0 : = 5 against

Here,

n = Sample size = 150

= Sample mean = 4.9

= Standard deviation = 0.5

Test Statistic

Z = – 2.4494

Critical Value

At 5% level of significance, = 1.96.

Conclusion

Test statistic Z = – 2.4494 is more than 1.96 and less than –1.96, hence, we reject null hypothesis H_0.

Example 13: Given *N* = 1000, *n* =100, = 47, = 50, =12 test hypothesis of means with 5% level of significance.

Solution: Test Statistic

Z = – 0.00264

With level of significance 5%, critical value is 1.96.

Conclusion

Test statistic is – 0.00264 is less than 1.96 and more than –1.96 hence, we fail to reject null hypothesis H_0.

Testing Population Mean () when Variance is Unknown

For Normal, Infinite Population

Let us assume that we have a random sample X_1, X_2, ... X_3, drawn from normal population with mean and unknown variance . Here, we test population mean, which is equal to specified mean (Sample size may be small or large).

Case 1: Two Tailed Test

In this case hypothesis is as follows:

against

Test Statistic

Here, we replace by S^2 in the formula of Z for mean equal to specified value to get:

Where,

Under H_0, test statistic follows normal distribution.

Critical Region

For level of significance %, we reject null hypothesis H_0 if and , otherwise we accept H_0.

Case 2: One Tailed Test

In this case hypothesis is as follows:

against

or

Test Statistic

Where,

Under H_0 test statistic follow normal distribution.

Critical Region

If , then for level of significance %, we reject H_0 if .

If , then for level of significance % we reject H_0 if

For Normal, Finite Population

For normal finite population, test statistic is as follows:

2.9.2 Hypothesis Testing for Difference between Means

We draw two independent samples from two populations. From the first population, we select a sample of size n_1 with mean and variance . Let be the mean of first sample. Similarly, from the second population, we select a sample of size n_2 with mean and variance . Let be the mean of the second sample.

Two Tailed Test

Let us state the null hypothesis H_0 for differences between means.

against

Test Statistic

Let

Hence, the expectation of T is,

$E(T) = E$

And variance is,

$Var\ (T) = V$

Hence,

Critical Region

For a level of significance to the tune of %, we can reject the null hypothesis H_0, if

and , otherwise we can accept H_0.

One Tailed Test

Let us state the null hypothesis H_0 for differences between means.

against

Test Statistic

Let

Hence, the expectation of *T* is,

$E(T) = E$

And variance is,

$Var\ (T) = V$

Hence,

Critical Region

If , then for a level of significance %, we reject H_0 if .

If then for a level of significance %, we reject H_0 if .

If and are unknown, replace them with and .

Where,

Example 14: For the first population sample of 100 screws that are drawn for this sample the mean is 1.9 cm and the variance is 0.2 cm. Samples of 100 screws are drawn from the second population with mean 1.95 cm and variance is 0.3 cm. Using 5% level of significance, test whether the mean for the two populations are same or different.

Solution: Here, the hypothesis is,

against

It is given that:

and

The test statistic is,

$Z = -0.7071$

Critical Value

For 5% level of significance, the critical value is 1.96.

Conclusion

Test statistic Z = – 0.7071 is less than 1.96 and more than –1.96. Hence we fail to reject the null hypothesis H_0. Therefore, the mean for different populations are same.

Large Sample Drawn from the Same Population

In this situation, the test statistic changed as follows.

And when is unknown, we use pooled variance.

Where

= Combined mean of both samples.'

ACTIVITY

1. Give an example of every type of hypothesis mentioned in the unit.
2. Prepare a hypothesis keeping in mind all the characteristics of a good hypothesis.

DID YOU KNOW

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 evidence, which the researcher seeks to prove through his study.

2.10 SUMMARY

- Educational research or research in education refers to a range of methods which helps individuals to evaluate different aspects of education. Educational researchers have accredited that the educational research must be performed in a rigorous and systematic way.
- Accomplishing or conducting any educational research is based on exploration, description, explanation or prediction of educational phenomenon using systematic data collection and analysis procedures.
- Research objectives can be defined as the systematic method of collecting data from selected sample or on the phenomenon under study and analysing the information in order to achieve the end result and to check the validity of the hypothesis that was formulated before the research was started.
- A 'Research Problem' is considered as the initial step and the most significant prerequisite in the research process. It provides the groundwork or foundation of a research study because if the research problem is well prepared then the anticipated fine research study will pursue.
- Review of the related literature; besides, allowing the researcher to acquaint himself/herself with current knowledge in the field or area in which he/she is going to conduct his/her research also serves the specific purposes. The review of

related literature enables the researcher to define the limits of his/her field. It also helps the researcher to delimit and define his/her problem.

- The first step in reviewing the related literature is identifying the material that is to be read and evaluated. The identification can be made through the use of primary and secondary sources available in the library. In the primary sources of information, the author reports his/her own work directly in the form of research articles, books, monographs, dissertations or theses. In secondary sources of information, the author compiles and summarizes the findings of the work done by others and gives interpretation of these findings.
- A microfiche is a sheet of film that contains microimages of a printed manuscript or book. Its development has been one of the most significant contributions to library and information services by providing economy and convenience of storing and distribution of long runs of scholarly materials.
- The card catalog is the index to the entire library collection. It lists the details of publications found in the library, with the exception of serially published periodicals. Generally, the card catalog contains author, title and subject cards arranged alphabetically.
- Library classification systems provide ingenious ways of systematizing the placement and location of books. Every system is based upon a methodology that is logical and orderly to the smallest detail. The two principal systems of library classification in the US are the 'Dewey Decimal' system and the 'Library of Congress' system.
- Encyclopedias serve as a store house of information, and usually contain well-rounded discussion and selected bibliographies that are prepared by specialists. Encyclopedias are arranged alphabetically by subject, and for each field of research, they present a critical evaluation and summary of the work that has been done.
- Abstracts include brief summaries of the contents of the research study or article. They serve as one of the most useful reference guides to the researcher and keep him/her abreast of the work being done in his own field and also in the related fields.
- The hypotheses provide a framework for organizing the related literature. If the study has several aspects or is investigating more than a single hypothesis, this is done separately for each facet of the study.
- The organization of the related literature involves recording the essential reference material and arranging it according to the proposed outline of the study.
- The basic information in the bibliography card should include name of the author with last name first; title of the book or article; name of the publication (for articles); name of the publisher; date of publication; volume number, page numbers; and library call number (for books). If some of this information is not available, the specified space should be left blank so that the missing information can be included immediately upon locating the references.
- A hypothesis is an approximate assumption that a researcher wants to test for its logical or empirical consequences. It can contain either a suggested explanation

for a phenomenon or a proposal having deductive reasoning to suggest a possible interrelation between multiple phenomena. A deductive reasoning can be defined as a type of reasoning that can be derived from previously known facts.

- A hypothesis should be reliable and consistent with established and known facts. A hypothesis should be stated in the most simple and clear terms to make it understandable.
- 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.
- Hypothesis testing means to determine whether or not the hypothesis is appropriate. This involves either accepting or rejecting a null hypothesis. The researcher has to pursue certain activities contained in the procedure of hypothesis.
- A 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. Being a specific statement of prediction, a hypothesis describes in concrete (rather than theoretical) terms what you expect will happen in your study. Not all studies have hypotheses.
- Z-test is based on normal probability distribution. It is mostly used to judge the significance of mean as a statistical measure. This is the most frequently used test in research studies. It is generally used to compare the mean of a sample with the hypothesized mean of the population.
- T-test is based on *t*-distribution and is aptly considered to judge the significance of a sample mean or the difference between the means of two small samples when population variance is not known.
- test is based on a chi-square distribution and is used for comparing a sample variance to a theoretical population variance.
- F-test is based on F-distribution and is also used to compare the variance of two independent samples. It is also used to compare the significance of multiple correlation coefficients.
- Researchers often use hypothesis testing for comparing two population parameters based on the corresponding statistics from each population. In this method two separate scores are to be obtained for each individual sample where the data in each sample set is related in some special way.
- The null hypothesis states that the population parameter is equal to the claimed value and is denoted by H_0. It is used for comparing statistics with the help of mean, . For example, if the average time taken by the student to complete his homework is 5 hours, then, .
- Confidence interval gives an estimate about a range of values that are centered around the sample statistic. It is calculated by using sample mean so that it can be confidently estimated that the value of the parameter lies in the interval of the known population.
- The two estimated proportions may be different due to a difference in the populations. A hypothesis test helps in determining if there is a difference in the

estimated proportions: $p^1 - p^2$ which reflects a difference in the population proportions.

- *P*-value is the probability of observing the sample statistic as extreme as the test statistic. Here the test statistic is a Z-statistic. The Standard Normal Distribution table is used to calculate the probability associated with the computed Z-statistic.
- For testing the assumption about population variance, we use the test that is based on the -distribution.
- In simple correlation coefficient, we test the relation between variable in the population, i.e., variables are independent or unrelated.
- Hypothesis testing involved two terms; a hypothesis of no difference is called null hypothesis denoted by H_0 and hypothesis complimentary to null hypothesis denoted by H_1.
- Typically, the chi-square test is any statistical hypothesis test, in which the test statistics has a chi-square distribution when the null hypothesis is true. It is performed on different samples (of people) who are different enough in some characteristic or aspect of their behaviour that we can generalize from the samples selected.
- The population proportion is given by:
- The pooled sample proportion is given by:
- The formula for Z-statistic is given by:
- The estimated standard error is computed by:
- The null hypothesis specifies:
- The margin of error is given by :
- The confidence interval is computed by:

2.11 KEY TERMS

- **Review of related literature:** It enables the researcher to define the limits of his/her field and also helps the researcher to delimit and define his/her problem
- **Card catalog:** It is the index to the entire library collection and lists the details of publications found in the library, with the exception of serially published periodicals; generally it contains author, title and subject cards arranged alphabetically
- **Encyclopedias:** These serve as a store house of information and usually contain well-rounded discussion and selected bibliographies that are prepared by specialists; the Encyclopedias are arranged alphabetically by subject and for each field of research, they present a critical evaluation and summary of the work that has been done
- **Hypothesis:** It is an approximate assumption that a researcher wants to test for its logical or empirical consequences and the deductive reasoning can be defined as a type of reasoning that can be derived from previously known facts
- **Z-test:** This kind of test is based on normal probability distribution and is mostly used to judge the significance of mean as a statistical measure and to compare the mean of a sample with the hypothesized mean of the population

- **t-test:** This test is based on t-distribution and is aptly considered to judge the significance of a sample mean or the difference between the means of two small samples when population variance is not known
- **:** This test is based on a chi-square distribution and is used for comparing a sample variance to a theoretical population variance
- **F-test:** This test is based on F-distribution and is also used to compare the variance of two independent samples. It is also used to compare the significance of multiple correlation coefficients
- **Null hypothesis:** It states that the population parameter is equal to the claimed value and is denoted by H_0 and is used for comparing statistics with the help of mean,
- **P-value:** It is the probability of observing the sample statistic as extreme as the test statistic where the test statistic is a Z-statistic

2.12 ANSWERS TO 'CHECK YOUR PROGRESS'

1. The first step in reviewing the related literature is identifying the material that is to be read and evaluated. The identification can be made through the use of primary and secondary sources available in the library. In the primary sources of information, the author reports his/her own work directly in the form of research articles, books, monographs, dissertations or theses. In secondary sources of information, the author compiles and summarizes the findings of the work done by others and gives interpretation of these findings.
2. A microfiche is a sheet of film that contains microimages of a printed manuscript or book. Its development has been one of the most significant contributions to library and information services by providing economy and convenience of storing and distribution of long runs of scholarly materials.
3. The card catalog is the index to the entire library collection. It lists the details of publications found in the library, with the exception of serially published periodicals. Generally, the card catalog contains author, title and subject cards arranged alphabetically.
4. Encyclopedias serve as a store house of information, and usually contain well-rounded discussion and selected bibliographies that are prepared by specialists. Encyclopedias are arranged alphabetically by subject and for each field of research, they present a critical evaluation and summary of the work that has been done.
5. Abstracts include brief summaries of the contents of the research study or article. They serve as one of the most useful reference guides to the researcher and keep him/her abreast of the work being done in his own field and also in the related fields.
6. The organization of the related literature involves recording the essential reference material and arranging it according to the proposed outline of the study.
7. In research, a hypothesis is an approximate assumption that a researcher wants to test for its logical or empirical consequences. It can contain either a suggested explanation for a phenomenon or a proposal having deductive reasoning to suggest a possible interrelation between multiple phenomena. A deductive

reasoning can be defined as a type of reasoning that can be derived from previously known facts.

8. Hypothesis testing means to determine whether or not the hypothesis is appropriate. This involves either accepting or rejecting a null hypothesis. The researcher has to pursue certain activities contained in the procedure of hypothesis.
9. Hypothesis is tested to identify the errors occurred in the statements and concepts used in hypothesis. Hypothesis testing can be broadly divided into two types, which are parametric tests or standard tests of hypothesis and non-parametric tests or distribution-free tests of hypothesis.
10. Z-test is a kind of test that is based on normal probability distribution. It is mostly used to judge the significance of mean as a statistical measure. This is the most frequently used test in research studies. It is generally used to compare the mean of a sample with the hypothesized mean of the population.
11. Researchers often use hypothesis testing for comparing two population parameters based on the corresponding statistics from each population. For instance, researchers might want to check if the two populations have the same mean, which they can test with the help of hypothesis testing. In this method two separate scores are to be obtained for each individual sample where the data in each sample set is related in some special way.
12. The null hypothesis states that the population parameter is equal to the claimed value and is denoted by H_0. It is used for comparing statistics with the help of mean, . For example, if the average time taken by the student to complete his homework is 5 hours, then, .
13. Confidence interval gives an estimate about a range of values that are centered around the sample statistic. It is calculated by using sample mean so that it can be confidently estimated that the value of the parameter lies in the interval of the known population.
14. *P*-value is the probability of observing the sample statistic as extreme as the test statistic. Here the test statistic is a Z-Statistic. The Standard Normal Distribution table is used to calculate the probability associated with the computed Z-statistic.
15. For testing the assumption about population variance, we use the test that is based on the -distribution.
16. Hypothesis testing involved two terms; a hypothesis of no difference is called null hypothesis denoted by H_0 and hypothesis complimentary to null hypothesis denoted by H_1.

2.13 QUESTIONS AND EXERCISES

Short-Answer Questions

1. What is the importance of reviewing the related literature?
2. What are the six types of ‘Readers’ that are used for reading microfilms or microfiche?
3. What does library classification system provide?

4. Which periodicals a researcher must consult?
5. What basic information is included in the bibliography card?
6. List any three characteristics of a valid hypothesis.
7. When is hypothesis tested?
8. When is F-test used?
9. What are basic assumptions for Z-statistic?
10. Write down the definition of related sample t-test. Give two or three real life examples of this kind of study.
11. Mention two advantages as well as two disadvantages of comparing two related samples using t-test.
12. What are the basic assumptions underlying a hypothesis test with the related measures?
13. A related samples test lowers sample variability and increases the chances of obtaining significant results. Is this statement TRUE or FALSE?
15. Find out the statistic of *F*-test if (i) Sample 1 : and (ii) Sample
16. Find out the statistic of *F*-test for

    Sample

    Sample
17. Find out the critical value for F-test with 5% level of significance.

Long-Answer Questions

1. Discuss the significance of review of related literature in research specifying the purposes it serves.
2. Explain the Van Dalen's valuable guidelines for a researcher.
3. Explain the various references that are useful to a researcher in the field of education research.
4. Discuss the important directories of US and UK that are used by researchers.
5. Explain the ways in which the related literatures are organized.
6. Discuss the significance of hypothesis in research. Also discuss the characteristics of valid hypothesis and need for hypothesis formulation.
7. Discuss the significance of hypothesis formulation and its testing in a research process. Also explain the various sources of hypothesis and procedures of hypothesis testing.
8. Explain the various parametric and non-parametric tests of hypothesis giving suitable examples.
9. A sample of 36 packets is drawn from a population having average 811 gm. The population mean is 800 gm and the standard deviation is 16gm. Test the hypothesis of mean at 1% level of significance.
10. A sample of 100 tins was examined and the average volume was found to be 1.94 liter.
11. A machine is designed for filling 2 liter oil, with a standard deviation of 0.1 liter. Test the hypothesis of mean using a 5% level of significance.

12. A random sample of 400 packet of rice is drawn from the first population having mean 1225 kg with standard deviation 42kg. The second sample of 200 packet of rice is drawn from a second population having mean 1265 kg with standard deviation 60 kg. Test whether the two population have the same mean.
13. First sample has and The second sample has and Use hypothesis testing of difference between means.
14. Use one sample test concerning variance to find the Chi-square value.

    72 74 68 70 61 63 69 73 71

    Given H_0 : = 36 against H_1 :
15. Use = 0.05 , two-tailed to test whether there is a significant population proportion difference for the given data:

	Sample 1	Sample 2
Number of samples	136	215
Total number	500	555

16. Construct a 95% CI for the following data:

	Sample 1	Sample 2
Number of samples	228	229
Total number	456	500

2.14 FURTHER READING

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UNIT 3
METHODS OF EDUCATIONAL RESEARCH

Structure

3.0 INTRODUCTION

Educational research has changed dramatically since its introduction in the late 19th century. The earliest researcher on this subject was John Dewey, who worked to combine

philosophy, psychology and education. Next came Judd whose preference for quantitative data collection and analysis and his emphasis on the scientific method with a particular focus on psychology, had an influential impact on educational research during the early 20th century. Another researcher was Thorndike, who did not encourage the collection of data for census purposes but rather for the production of statistics and precise measurements that could be analyzed. Thorndike became a very influential educational scholar and his approach to educational research became popular both in the United States and abroad.

In this unit, various techniques of educational research are discussed in detail. Each technique has its advantages and limitations, and it is up to the researcher to ascertain which technique would be best suited for a specific situation.

3.1 UNIT OBJECTIVES

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

- Define qualitative and quantitative research
- Elaborate on the methods of educational research
- Identify the steps of research
- Discuss the design of experimental methods
- Explain the ethnographic method and the case study method

3.2 QUALITATIVE TECHNIQUE

Qualitative technique seeks to describe or explain psycho-social events from the point of view of people involved. It is not easy to provide explanations if there are no defined thoughts or ideas to start with. The researcher takes this into consideration and has an open mind while undertaking collection and analysis of data. In the qualitative technique, the data that is collected is usually derived from interviews that are conducted individually or in groups, participant or non-participant observations, notes in diaries and other documented studies or analysis.

The qualitative technique provides depth and detailed information for a research. Depth and detail emerge through direct questioning and careful descriptions. The extent of depth and detail will vary depending upon the nature and purpose of a particular study. The responses to open-ended questions in a questionnaires are detailed and comprehensive. These responses are neither systematic nor standardized. However, they permit the researcher to understand situations as seen and felt by him. Since the responses to open-ended questions are longer and detailed, they help the researcher to understand in depth the points of view of other people, their level of emotions, their characteristics, their attitudes and values, and their experiences.

The data gathered through participant observation or interviews are also descriptive in nature. These strategies are most comprehensive for understanding fully the complexities of a particular situation. Participant observation provides detailed first hand information to the researcher about a social event. Data gathered through participant observation generally includes: (i) description of the setting of the social situation; (ii) activities that take place in the setting; and (iii) description about people who participated in the activities and their extrinsic behaviour during the activities. The descriptions may be in the form of field notes, specifying some basic information pertaining to the place where the observation takes place, the persons present during the observation, nature of

the settings, type and nature of various types of interactions and activities during the observation. The field notes taken during observation contain direct quotations from the people who participated in the observation as well as the observer's own feelings and reactions.

It is not possible to find out what is in other individuals' minds while observing their extrinsic behaviour. Through participant observation, it is difficult for an observer to know the feelings, thoughts and intentions of others and also about the behaviours that took place in earlier situations. However, through open-ended/unstructured interviews, it is possible to find out what had happened earlier or what could not be observed during the participant observation. It provides a framework within which the researcher should be able to gather information from people conveniently and accurately. The information mostly pertains to a programme, the reaction of participants about the programme and the type of change the participants perceive in them after their involvement in the programme. The data are mostly in the form of responses to structured and unstructured questions put to the respondents by the researcher during an informal conversation. The responses are generally direct quotations from respondents in their own words and provide details about situations, events, people, experience, behaviours, values, customs, etc. The information gathered during or after an interview includes notes taken by an interviewer along with his detailed comments about what people say about their experiences, what they think and feel about the phenomena under study, and what they know about the phenomena.

Social sciences researchers use several qualitative methods by which they explore diverse issues. These are:

- ***Phenomenology:*** This is a philosophy or a method of inquiry that is used in education. Phenomenology entails the researcher trying to access individuals' 'life worlds'—their world of experiences. It is where consciousness exists.
- ***Ethnography:*** This is derived from anthropology and usually involves observation of participants and obtaining information through natural inquiry. It reveals a very comprehensive understanding of behaviours and interactions, which are set within specific social and cultural contexts.
- ***Narrative Analysis:*** This is a method that is deployed to study the structure and the content of the stories that people narrate about the important events in their lives. It helps us to understand the ways people arrive at meaning in their lives.
- ***Grounded Theory:*** This method was created to be used in sociology. It is based largely on interviews but may also rely on observation and documentary sources in order to develop new theoretical accounts of social situations and interactions. It provides a well defined approach for data analysis.

Organization of Qualitative Data

The amount of qualitative data gathered by using an open-ended questionnaire, participant observation and in-depth interviews is huge. It needs to be structured and categorized into specific patterns, types, and descriptive units to avoid any confusion. However, before any such classification, it is advisable to make some copies of all the data. Patton (1982) suggests that one should make four copies and store one complete copy in a safety deposit box as this data is priceless and unique. In case of loss of any data, it is impossible to recapture what was actually observed during participant

observation or what exact conversation took place during an open-ended in-depth interview. The second copy should be used for further treatment of the data throughout. It is essential to ensure that the field notes taken during participant observation or open-ended interview are complete. The third copy maybe used to fill the missing gaps, if any, identified during their scrutiny by the researcher. Additional notes can also be recorded in this copy. The organization of qualitative data involves a lot of cutting and pasting for which the fourth copy may be used.

Actual classification or organization can begin only after the copies are made. There are no formal or universal rules which a researcher may follow in organizing the data in various units, patterns, or categories. It requires a creative approach and a lot of perseverance to give a meaningful look to the data. The contents of field notes about the interview or observation may be read carefully by the researcher and he may note down his comments in the margins or attach small pieces of paper with his written notes using staples or tags. The next step is to arrange the data in topics for which the researcher may use abbreviations. The abbreviated topics are written either in the margins of the relevant data or on a slip of paper which may be attached with the relevant page. However, it may be noted that the researcher should read the information or data several times before it is indexed. The process of classifying or labelling various kinds of data and preparing a data index is the essential step in the organization of qualitative data. Sometimes, there are large amounts of data and it is not possible to develop a simple classification system. In such situations, the data is organized with the help of computers. Computers help in developing systematic and comprehensive classification schemes using code numbers for different categories and sub-categories. The computerized classification system permits the use of organized data by several groups of people over a long period of time. It permits easy cross-classification and cross comparison of descriptive narrations for complex analysis.

Analysis and Interpretation

Analysis of qualitative data means studying the organized material in order to discover inherent facts. These data are studied from as many angles as possible either to exploit the new facts or to reinterpret already known existing facts. Content analysis, inductive analysis and logical analysis are mostly used in analysis of qualitative material.

Content Analysis

Content analysis is concerned with the classification, organization and comparison of the content of a document or communication. In the context of communication research, Berelson (1952) remarked that content analysis is a research technique for the objective, systematic, and quantitative description of the manifest content of communication.

Cartwright (1970) used the terms ‘content analysis’ and ‘coding’ interchangeably as both the processes involve objective, systematic, and quantitative description of any symbolic behaviour. Since content analysis is concerned with the classification, evaluation and comparison of the content of communication or document, it is sometimes referred to as ‘documentary activity’ or ‘information analysis’. The communication may be in the form of responses to open-ended questionnaire, conversation as a result of interview, or description of an observed activity. It may also be in the form of official records (census, birth, accident, crime, school, institutional and personal records), judicial decisions, laws, budget and financial records, cumulative records, courses of

study, content of textbooks, reference words, newspapers periodicals or journals, prospectus of various educational institutions or universities, etc., direct quotations, and notes from an interview.

Steps in Content Analysis

The steps involved in the process along with some issues related to this operation are:

(i) **Defining the Unit of Analysis:** The material may be confined to single words, phrases, complete sentences, paragraphs, or to even larger amounts of materials such as articles or complete books. Either of these can be considered an entity whose specified characteristics can be determined and analysed. Hayman (1968) suggested that the unit should be comprehensive enough to provide meaning through some content at least, but small enough not to allow subjectivity in its use.

(ii) **Specifying Variables and Categories:** After the unit of analysis is defined, the researcher then analyses it with the purpose of creating data which is objective and can be reproduced. This can be deployed for scientific treatment as well as generalization beyond merely the actual set of symbolic material analysed. For converting this symbolic material into objective data, the 'variables' need to be explicit in terms of which descriptions are to be made. The variables are sometimes referred to as 'dimensions' or 'types of attributes'. A few examples of such variables are: number of words, percentages of personal pronouns, attitude towards privatization, attractive traits of teachers, degree of confidence in a friend, etc.

After the selection of a variable, viz., degree of confidence in a friend, there are many ways in which this variable may be broken down into categories as: (a) Unqualified confidence, (b) Qualified confidence, (c) Confidence and mistrust equally balanced, (d) Qualified mistrust, (e) Unqualified mistrust, (f) Question not asked by interviewer, (g) Question asked, but answer not classifiable in above categories. A second classification of categories of the same variable may be: (a) High, (b) Low, (c) Not classifiable in either. It may be pointed out that if two independent persons were to code the same material, one using the first set of categories and the other using the second, they would come out with different descriptions of the same material. Hence, explicit specification of the system of categories to be used with each variable is necessary for reproducible analysis.

(iii) **Frequency, Direction and Intensity:** Once the unit of analysis is defined, and the variables and their categories specified, the analysts will then classify units as well as well as the material to be analysed, according to their frequency, direction and intensity.

For frequency, the analyst merely counts the number of units which fall into each of his categories. Cartwright (1970) refers to it as an 'unit of enumeration'. The 'unit of enumeration' and 'recording unit' are not necessarily the same. But when the analyst merely counts the number of recording units which get a certain categorization, the recording unit is exactly the same as the enumeration unit. For example, in the analysis of public speech by an economist, it can be the number of times 'privatizations of higher education' may be employed as an 'argument' for a certain policy of government. In this case, an 'argument' is taken both as the recording unit and the enumeration unit. Another example would be of an analyst analysing an editorial on 'privatization of higher education' for its favourableness or unfavourableness. For purposes of quantification, he counts the number of column inches of the whole editorial. In this case, a column inch

would be the unit of enumeration, whereas the editorial as a whole would be the recording unit, and hence the two units are not identical.

In certain situations, it is useful to further classify the units according to direction and intensity. Direction refers to whether the reference was favourable, unfavourable, or neutral. It might be pleasant/unpleasant, interesting/uninteresting, and threatening/non-threatening. Intensity indicates the emotional impact of the unit analysed. Is it large or small, and in what direction? Judging direction and intensity is more subjective than merely counting for frequency.

(iv) **Contingency Analysis:** The contingency analysis takes into account the content within which the unit exists. A researcher should assess the unit in light of the entire communication so that its actual meaning is not lost.

(v) **Sampling:** One of the major and practical problems in content analysis is sampling. For the results to be generalized, the analysed unit must be representative of the total material with which the researcher is concerned. Invariably, a researcher undertakes the analysis of a specific content in order to reveal something about the universe of data than just those symbolic materials with which he deals.

(vi) **Preparation of Content Analysis Outline:** The following are six steps for arriving at a satisfactory content analysis outline:

Step 1: Specify Needed Data

In laying out a satisfactory analysis outline, a researcher should clearly specify the data that are required by him in the total research design so that he may face fewer difficulties in the long run. The specification of needed data is helpful in planning the final tables which the researcher may use at later stages of content analysis.

Step 2: Map out Plans for Tabulation

A researcher can avoid a number of problems if he makes clear plans for the tabulation of coded data. He should decide well in advance whether the coded data are to be tabulated by hand or computers.

Step 3: Lay out the Outline

The researcher should list the variables in terms of which the content is to be coded. For example, if the study pertains to analysing interviews, these variables will be used to classify not only various features of the answers to questions about the psychological make-up of the respondent but also such matters as his age, qualification, income, marital status, and other demographic and behavioural characteristics. In listing the variables to be included in the outline, the researcher should ensure that all the information needed has been entered in the computer via a Microsoft Excel spreadsheet. The outline should contain provision for coding the name of the study, the number of each enumeration unit (interview, issue of journal or newspaper, etc.), the name of coder, and any other relevant information.

Step 4: Fill in Categories for Each Variable

A researcher should use a classification which is thorough with mutually exclusive categories. Its categories are mutually exclusive if there is one and only one place to put an item within that system of categories. After defining all the categories in a structure, a manual of instructions should be prepared with operational definitions of the categories.

Step 5: Establish Procedure for Unitizing Material

It is essential for a researcher to establish a procedure for unitizing material. Specific working definitions to be used in the content analysis should be formulated in such a way that various coders can all use the same material in the same way. These definitions should he written down as part of the coding instructions.

Step 6: Try out the Analysis Outline and Unitizing Procedure

The analysis outline and unitizing procedure on a sample of material should be given a tryout in order to discover what modifications are needed. This trying out of the coding procedures is also used as training for those who are to be involved in the final coding. Coding procedures may include:

- The coder must be a sensitive person, well differentiated with respect to symbolic materials. He must be able to detect slight differences of meaning but also to neglect differences that do not have an effect on the specific purpose. In other words, he must be able to make use of the genotypic categories required by the analysis outline. In most psycho-social research, this means that the coder must be acquainted with the concepts of social psychology. If the analysis outline requires only phenotypic categories or categories defined in terms of everyday usage, the coder may well be an intelligent layman. A reasonably good level of intelligence is the minimal requirement of any content analysis.
- The successful and meaningful use of a well-developed outline depends upon the selection of efficient coders and their effective training in the outline being used under good supervision so that the proper procedures of coding are followed. If the content is large, the process of coding involves the repetitive application of the analysis outline to the material. It demands the same operational definition of categories, the same frame of reference, the same degrees of differentiation, etc. throughout the entire coding operation. In such cases, a person who is easily satisfied with repetitive work should not be selected as a coder.
- After the selection of efficient coders, it is necessary to train them in the use of analysis outline so that they have a full understanding of the objectives of the project.
- At the stage of final coding, the coder can add new categories to some of the variables of the outline if he comes across a recording unit for which there is no category. However, the merit of adding a new category should be assessed by determining whether a new category would be meaningful within the rationale of the system of categories. It is also desirable to hold periodic discussions among the coders to ensure that the same frame of reference and operational definitions of categories are maintained throughout the coding period.

Validation of Qualitative Analysis

This section is concerned with the major strategies that are helpful for validating and verifying the result of qualitative analysis.

(i) **Rival Explanations**

Once the researcher has described the patterns and their explanations, it is important to look for rival or competing themes and explanations both inductively and logically. Inductively means looking for other ways of organizing the data that might lead to a different result. Logically, it involves searching for other logical possibilities and then

finding if those possibilities can be supported by the data. However, it may be noted that when considering rival hypotheses and competing explanations, the strategy to be employed by the researcher is not one of attempting to disprove the alternatives, but to look for data that supports alternative explanations. In this strategy, the researcher should give due weightage to supporting evidence and look for the best 'fit' between data and analysis.

(ii) **Negative Cases**

The search for negative cases and instances that do not fit within the identified pattern and their understanding is also important in the verification and validation of the result.

(iii) **Triangulation: Comparing Multiple Qualitative Data Sources**

This type of triangulation involves comparing and cross-checking consistency of data derived by different means at different times using qualitative methods. It means: (a) Comparing observational data with interview data **(**b) Comparing observational data with questionnaire data (c) Comparing what participants of a programme say in public with what they say in private (d) Checking for the consistency the opinion of the participants abut a programme over a period of time, and (e) Comparing the opinions of the participants of a programme with others who were associated with the programme in one capacity or the other. The triangulation of data sources within qualitative methods will seldom lead to a single totally consistent picture. But such triangulations are helpful to study and understand when and why there are differences.

(a) **Reconciling Qualitative and Quantitative data**

This type of triangulation aims at comparing data collected through some kind of quantitative methods with data collected through same kind of qualitative methods. It is highly likely that qualitative methods and quantitative methods will eventually lead to different findings and not to a single and well integrated picture of the situation. It is because qualitative data are commonly used for 'generating hypotheses' or 'describing hypotheses' and quantitative data are used to 'analyse outcomes', or 'verify hypotheses'. However, in endorsing the notion of triangulation, Trend (1978), quoted by Patton (1980), maintains that it is useful to bring a variety of data and methods to bear on the same problem in order to reduce system basis in interpreting results of study. The findings of some studies could be strengthened by supplementing a qualitative approach with quantitative analysis.

(b) **Multiple Perspectives from Multiple Observers**

The aim of this kind of triangulation is to involve triangulating observers using several interviewers so as to reduce the potential bias or subjectivity as a result of observation by a single observer.

(iv) **Design**

The nature of research design and methodology also contribute to distortion in results. Sampling gives rise to three types of errors. These are: (a) distortion in the situations that were sampled for observation, (b) distortion introduced by the time periods during which observations took place, and (c) distortion because of selectivity in the people who were sampled either for observation or interviews. Thus, the researcher must be careful to limit

results of his study to those situations, time periods, people, and contents for which the data are applicable.

(v) **Evaluator Effects**

The presence of the researcher during the observation or interview can distort the results of the study. The distortion may be due to: (a) reactions of programme participants and others associated with it to the presence of researcher, (b) changes in the researcher during the process of observation or interview, (c) biases of researcher, and (d) incompetence of the researcher. The presence of a researcher during an observation or interview may create a halo effect, and consequently the participants of the programme are motivated to 'show off'. Their deviation from normal behaviour will lead to distorted findings. It is desirable to undertake long-term observations for minimizing the halo effect. Researchers sometimes become personally involved with programme participants and therefore lose their sensitivity to the full range of events occurring during the process of observation of interview. A record of the changes in the researcher, field notes and conversation with the people associated with the programme are helpful to overcome evaluator effects.

The basic objective of qualitative analysis is to provide useful, meaningful and objective answers to the research questions of researchers, decision-makers and information users. To be useful, answers provided must relate directly to the questions that have been asked; to be meaningful the answers must be understandable and clearly presented; to be objective the researcher must demonstrate that answers (findings) will stand the test of careful scrutiny.

3.3 QUANTITATIVE TECHNIQUE

In this technique, the data are studied from a variety of angles to explore the new facts. Analysis requires an observant, flexible and open-mind. It is worthwhile to prepare a plan of analysis before the actual collection of data. Good, Bar and Scates (1941) suggest four helpful modes to get started on analysing the gathered data:

(i) To think in terms of significant tables that the data permits.

(ii) To examine carefully the statement of the problem and earlier analysis and to study the original records of the data.

(iii) To get away from the data and to think about the problem in layman's terms, or to actually discuss that problem with others.

(iv) To attack the data by making various statistical calculations.

The exploratory modes may prove very helpful in the analysis of data of any research study and no seminaries, differences, trends and significant factors would go unnoticed by the researcher.

Statistical techniques have contributed greatly in gathering, organizing, analysing and interpreting numerical data. The processing of numerical data through statistics calls for competence in the use of statistical methods and for understanding of concepts that underline their development and their application. The researcher must know the strengths and the weaknesses of the statistical methods which he uses so that he may not mislead or he misled by such methods.

A discussion of two major areas of statistics, descriptive statistics and inferential statistics, is presented in some detail. The main purpose of such discussion is to help the

researcher develop an understanding of statistical terminology, and the concepts necessary to study with understanding the literature dealing with educational research. It also serves to help the student develop competence and know-how to conduct investigations using simple types of statistical analysis.

Organization of Quantitative Data

Organization of data includes editing, classifying and tabulating quantitative information. Editing implies checking of the gathered raw data for accuracy, usefulness and completeness. Classification refers to dividing of the data into different categories, classes, groups or heads. For this, the researcher is guided by the nature of the problem, the hypotheses to be verified, or by the responses or characteristics of the samples he has selected. If the problem or hypotheses, for example, involved the difference between attitudes of men and women teachers towards co-education at the secondary school stage, the categories male and female serving in government and private aided schools would be clearly indicated. In some situations when the group is sufficiently homogeneous, no breakdown into categories or subgroups is necessary and it is desirable to describe the group as a whole. However, in the situations where the group is sufficiently heterogeneous, it is desirable to divide the group into homogeneous sub-groups or categories that have in common some distinctive attributes significant for the purpose of analysis.

(i) **Tabulation** is the process of transferring classified data from data-gathering tools to the tabular form in which they may be systematically examined. This process maybe performed in a number of ways. In simple and less sophisticated types of research, hand-sorting and tabulating procedures are usually employed. More extensive and sophisticated investigations make use of the card-tabulating process.

- **Hand-Sorting and Hand-Tabulation:** Hand-sorting and hand-tabulation require careful planning. It includes the method of hand-sorting and recording on tabulation sheets in accurate mathematical terms by marking and counting frequency tallies for different items on which information is sought. The sorting of response sheets in case of psychological tests or scales in various categories must be done before the tabulation of responses. At times without proper planning, a researcher may waste his time and energy by tabulating the responses first before it occurs to him that it would be interesting to compare the responses of the various sub-groups comprising the sample under investigation. This process would require another handling of (he response sheets, scales or opinionnaires and would involve reticulating the responses.
- **Modern Computational Mechanical Aids:** Modern computational mechanical aids are a boon to the modern researcher. They are used to save time and effort, and to minimize error during the organizing and analysis of research data. The increasing and popular use of these computational devices has advanced educational research in terms of both quality and quantity. The computational mechanical aids commonly used are ‘calculators’ and ‘computers’.

(ii) **Calculators**

The most common computational mechanical device available to the researcher is the calculator. Its principal advantages are speed and accuracy in performing addition, subtraction, multiplication and division tasks. These operations are performed easily, merely by the pressing of the necessary keys to enter the data and another key to begin the desired operation. The calculations involving combinations of the fundamental operations can also be performed by setting their order as required in computational problem. The desk calculator provides reliable results. At times, improper input of the data or incorrect operations of the machine, or both, furnish erroneous result.

The electromechanical calculators perform the calculations by electrically operated mechanical devices. On the other hand, electronic calculators developed recently operate electronically and perform calculations without the use of mechanical counters and with greater speed. Some of these electronic calculators are capable of performing operations beyond the four basic operations of addition, subtraction, multiplication and division. These additional operations include interpolation, extraction of square roots and reciprocals.

The manufacturers of calculators usually provide instruction manuals with them for the use of their operators. These manuals provide directions even for simple operations. If they are studied carefully, the user may not face any difficulty in performing any operation.

(iii) **Computers**

A computer system operates in accordance with specific instructions. Each instruction defines an operation to be performed. It also specifies the data, device, or mechanism needed to carry out the operation. These instructions are referred to as a program. A computer is useless until a programmer writes a detailed set of instructions to be loaded into its internal storage (memory) unit. There has been a revolution in the field of information technology in recent times. Simultaneously, programming of computers has made it easy to analyse data. Statistical Programming in Social Sciences (SPSS) is used by researchers to analyse and interpreting the results. Another program is EXCEL which can analyse large volumes of data.

The researcher should keep the following factors in view while interpreting the results:

- **Influence of Unstudied Factors:** In any type of educational research, the researcher is generally guided by the factors or variables which he has studied during the research process. He totally ignores the influence or effect of unstudied factors while interpreting the results of his study. To totally ignore the unstudied factors and ascribe the findings of the research to the occurrence of studied factors alone may be misinterpreting the actual truth, for the findings in any research are conditioned not by one or two but innumerable variables. It is truer in the case of experimental or causal comparative type of research in which the researcher studied a very limited number of variables. For example, a researcher, finds that a group of eighth class students following programmed instruction material in social studies has performed better compared with another group of students of the same class taught

through lecture method. If he were to ascribe the better achievement of the first group to the method alone and ignore the other possible determining factors like high general mental ability, high achievement motivation, better study habits, interest in the subject and better socioeconomic conditions found among the higher achieving group, he will be misinterpreting the truth.

- **Selective Factors:** A researcher may hideously misrepresent the truth if he ignores the selective factors. This is more evident in the studies where a selective group is made the subject of investigation or where a particular factor is operating in the situation studied. For example, if a researcher finds that the boys of a particular tribe are mostly low in intelligence and then concludes, therefore, that the boys of all tribes have a low intelligence, is ignoring the fact that there exist outside the particular tribe, many tribal boys with average or high intelligence. Similarly, to find that in a particular secondary school, the number of the tenth class students failing in mathematics is greater than the number of students failing in other subjects and to conclude from this that mathematics is comparatively more difficult than other subjects of study is ignoring the fact that the students of mathematics did not receive good instruction in the subject.
- **Expected Results:** While interpreting the expected results, the researcher has to keep in mind that he does not go beyond his data support and that he does not forget the limitations of the study. The researcher has to be cautious in reporting all such factors which could account for the results.
- **Negative Results:** Researchers, often, on arriving at results contrary to what they had hypothesized, jump to develop a sort of defiance mechanism by exaggerating all the factors that could have possibly vitiated the results. They often list shortcomings in terms of the use of inadequate tools or sample fluctuations. These things may be true and there is no harm in reporting all such factors which come in the way of making the study precise. Nevertheless, it is not always correct to get results that confirm hypotheses. Hypotheses arise from guesswork and cannot be accepted as correct without being tested for confirmation. Only after the research is completed is the researcher in a position to declare his results with certainty. When the results contradict the original hypothesis of the study, the interpretation and discussion of results should include the researcher's reconsideration of the original hypothesis in the light of his findings. At times, researchers are reluctant to discuss results that contradict the existing known facts. This attitude is not fair and is likely to impede the progress of research. It must be noted that hypotheses are tentative and results can differ from them.
- **Results when the Null Hypothesis is Retained:** A retained null hypothesis may occur when:
  (a) There is no relationship between the variables; or the experimental variable is not more effective than the control variable.
  (b) The null-hypothesis is false, but the internal validity problems of the data contaminated the investigation so badly that the actual relationship between variables could not be established.

Table 3.1 provides a comparison between the qualitative and quantitative techniques.

Table 3.1 Comparison of the Quantitative and Qualitative Techniques of Educational Research

Qualitative Technique	Quantitative Technique
'All research ultimately has a qualitative grounding' –Donald Campbell	'There's no such thing as qualitative data. Everything is either 1 or 0' - Fred Kerlinger
The aim is to compile a comprehensive and detailed description.	The aim is to classify and count features, and then construct statistical models in order to explain the observations.
The researcher will only have a rough idea in advance of what he is looking for.	The researcher knows exactly what he is looking for in advance.
This is usually recommended for use during the early phases of research projects.	Usually recommended during later phases of research projects.
The design of the analysis gets formulated progressively as the study unfolds.	All the aspects of the study are carefully highlighted up front, before data is collected.
The researcher himself is the data gathering instrument.	The researcher uses tools like questionnaires and equipment in order to collect numerical data.
Data takes the form of words, pictures or objects.	Data is in the form of numbers and statistics
Subjective — individuals, interpretation of events is important ,e.g., uses participant observation, in-depth interviews etc.	Objective — more scientific, seeks precise measurement and analysis of target concepts, e.g., uses surveys, questionnaires etc.
Qualitative data is more 'rich', time consuming, and less able to be generalized.	Quantitative data is more efficient, able to test hypotheses, but may miss contextual detail.
Researcher tends to become subjectively immersed in the subject matter.	Researcher tends to remain objectively separated from the subject matter.

3.4 HISTORICAL RESEARCH

History is a meaningful record of past events. It is a valid integrated account of social, cultural, economic and political forces that had operated simultaneously to produce historical events. It is not simply a chronological listing of events but an integrated assessment of the relationship between people, events, times and places. It is used to understand the present on the basis of what we know about past events and developments.

Historical research attempts to establish facts so as to arrive at a conclusion concerning past events. It is a process by which a researcher is able to come to a conclusion as to the likely truth of an event in the past by studying objects available for observation in the present. Historical research is a dynamic account of the past, which seeks to interpret past events in order to identify the nuances, personalities and ideas that have had an influence on these events.

According to Kerlinger: Historical research is the critical investigation of events, developments, and experience of the past, the careful weighing of the evidence of the validity of sources of information of the past, and the interpretation of the weighed evidence.'

According to Gay (198 1): 'Historical research is the systematic collection and objective evaluation of data related to past occurrences in order to test hypotheses concerning causes, effects, or trends of those events which may help to explain present events and anticipate future events.'

Therefore, it can be concluded that true historical research is a process of reconstructing the past through systematically and objectively collecting, evaluating, verifying and synthesizing evidence relating to the past events to establish facts and defensible conclusions, often in relation to particular hypotheses (if appropriate), to arrive at a scholarly account of what happened in the past.

3.4.1 Nature and Value of Historical Research

The main aim of historical research is to obtain an exact account of the past to gain a clearer view of the present. Historical research tries to create facts to arrive at conclusions concerning past events. It is usually accompanied by an interpretation of these events at the end of their relevance to present circumstances and what might happen in the future. This knowledge enables us, at least partially, to predict and control our future existence.

- Historical research as many other types of research, includes the delimitation of a problem, formulating hypothesis or tentative generalization, gathering and analysing data, and arriving at conclusions or generalizations, based upon deductive- inductive reasoning. However, the historian faces greater difficulties than researchers in any field.
- The job of the historian becomes more complicated when he derives truth from historical evidence. The major difficulty lies in the fact that the data on which historical facts are based cannot be substantiated and is relatively inadequate.
- It may be difficult to determine the date of occurrence of a certain historical event partly because of changes brought in the system of calendar and partly due to incomplete information. The historian lacks control over both treatment and measurement of data.

Historical research has great value in the field of educational research because it is necessary to know and understand educational achievements and trends of the past in order to gain perspective on present and future direction. Knight (1943), Good, Barr and Scates (1941) have given the following analysis of the value of historical research:

Knowledge of the history of schools and other education agencies is an important part of the professional training of the teacher or school administrator.

(i) Much of the school work is traditional. The nature of work is restrictive and tends to foster prejudices in favour of familiar methods. The history of education is the 'sovereign solvent' of educational prejudices.

(ii) The history of education enables the educational worker to delete facts and drills in whatever form they appear, and it serves as a necessary preliminary to educational reforms.

(iii) Only in light of their origin and growth can the numerous educational problems of the present be viewed sympathetically and without bias by the teacher, administrator or public.

(iv) The history of education shows how the functions of social institutions shift and how the support and control of education have changed.

(v) It inspires respect for and reverence for great teachers.

The history of education serves to present the educational ideas and standards of other times, and it enables social worker to avoid mistakes of the past.

3.4.2 Types of Historical Research

- **Legal Research:** it is of immense value and interest to educational administrators. It seeks to study the legal basis of educational institutions run by different religions and castes, central and state schools, school finance, etc. But this type of researches need special training in the field of law. Anybody without this training is not competent to do this type of research.
- **Biographic Research:** It aims at determining and presenting truthfully the important facts about the life, character and achievements of famous and important educators, e.g., contributions of Dr. Radha Krishnan, Prof. B.K. Passi, Prof. L.C. Singh, etc.
- **Studying the History of Ideas:** This involves the tracing of major philosophical or scientific thoughts from their origins through their different stages of development. It aims at tracing changes in popular thought and attitudes over a given period of time.
- **Studying the History of Institutions and Organizations:** While studying such history, the same general method applies as for the study of a University. For example, one may study the history of the growth and development of National Law Universities, IIMs, etc.

3.4.3 Advantages and Disadvantages of Historical Research

The advantages of historical research are:

- The researcher is not physically involved in the situation under study.
- No danger of experimenter-subject interaction.
- Documents are located by the researcher, data is gathered, and conclusions are drawn out of sight.
- Historical method is much more synthetic and eclectic in its approach than other research methods, using concepts and conclusions from many other disciplines to explore the historical record and to test the conclusions arrived at by other methodologies.

- Perhaps more than any other research method, historical research provides librarians with a context. It helps to establish the context in which librarians carry out their work. Understanding the context can enable them to fulfil their functions in society.
- It provides evidence of ongoing trends and problems.
- It provides a comprehensive picture of historical trends.
- It uses existing information.

Historical research suffers from several limitations, some are natural due to the very nature of the subject and others extraneous to it and concerning the capabilities of the researcher.

- Good historical research is not lazy. It is slow, painstaking and exacting. An average researcher finds it difficult to cope with these requirements.
- Historical research requires a high level of know ledge, language skills and art of writing on the part of the researcher.
- Historical research requires a great commitment to methodological scholarly activity.
- Sources of data in historical researches are not available for the direct use of the researcher and historical evidence is, by and large, incomplete.
- Interpretation of data is very complex.
- Through historical research, it is difficult to predict the future.
- Scientific method cannot be applied to historical evidence.
- Modern electronic aids (like computers) have not contributed much towards historical research.
- It is not possible to construct ‘historical laws’ and ‘historical theories’.
- Man is more concerned with the present and future and has a tendency to ignore the past.
- Time-consuming.
- Resources are scarce.
- Data can be contradictory.
- The research may not be conclusive.
- Gaps in data cannot be filled as there are no additional sources of information.

A historian can generalize but not predict or anticipate, can take precautions but not control; can talk of possibilities but not probabilities.

3.4.4 Process of Historical Research

Historical research includes the delimitation of a problem, formulating hypothesis or tentative generalizations, gathering and analysing data, and arriving at conclusions or generalizations based upon deductive-inductive reasoning. However, according to Ary, *et al.,* (1972) the historian lacks control over both treatment and measurement of data. He has relatively little control over sampling and he has no opportunity for replication. As historical data is the closed class of data located along a fixed temporal locus, the historian has no choice of sampling his data. He is supposed to include every type of data that comes his way. Historical research is not based upon experimentation, but upon

reports of observation, which cannot be authenticated. The historian handles data which are mainly traces of past events in the form of various types of documents, relics, records and artefacts, which have a direct or indirect impact on the event under study.

In deriving the truth from historical evidence, the major difficulty lies in the fact that the data on which historical research is based are relatively inadequate.

It may be difficult to determine the data of occurrence of a certain historical event partly because of changes brought out in the system of calendar and partly due to incomplete information.

Historical research attempts to establish facts to arrive at a conclusion concerning the past events.

Steps in Historical Research: The steps involved in undertaking a historical research are not different from other forms of research. But the nature of the subject matter presents a researcher with some peculiar standards and techniques. In general, historical research involves the following steps:

Selection of a Problem

Formulation of
Hypothesis

Selection of Sources of
Historical Evidence

Primary Sources Secondary Sources

Collection of
Historical Evidence

External Criticism Internal Criticism

Interpretation of Data

Qualitative Quantitative

Preparation of Report

Step 1: The first step is to make sure the subject falls in the area of the history of education. One topic could be the study of the various educational systems and how they have changed with the passing of time. On the other hand, studying ‘contributions of education’ as a component of national history can be of interest to a researcher. The researcher may be interested in a historical investigation of those aspects of education

that have not been touched upon by any studies yet. Moreover, the researcher may he interested in re-examining the validity of current interpretations of certain historical problems which have already been studied.

Step 2: This necessitates that a thought is given to the various aspects of the problem and various dimensions of the problem are identified. Hypothesis also needs to be formulated. The hypothesis in historical research may not be able to be tested, they are written as explicit statements that tentatively explain the occurrence of events and conditions. While formatting a hypothesis, a researcher may formulate questions that are most appropriate for the past events he is investigating. Research is then directed towards seeking answers to these questions with the help of the evidence.

Step 3: Collection of historical evidence involves two sub-steps.

(i) Selection of sources of historical evidence

(ii) Cutting out the historical evidence from them

Historical evidence is hidden broadly in two types of historical sources and is useful the researcher in many respects. The primary sources, however, are closest to the researcher's heart and kept at the highest pedestal.

Step 4: Historical evidence collected must be truthful; hence for establishing the validity of these sources, the dual processes of external and internal criticism are used. External criticism is undertaken to establish the authenticity of the documents of source, correctness of author or builder data or period to which it belongs, etc. Internal criticism is done to judge the correctness of the contents of sources.

Step 5: Though statistical testing of hypothesis is not possible, the relationship among various facts still needs to be established, and synthesis and integration of the facts in terms of generalization needs to be done.

Three strategies are used to analyse educational concepts. These are:

(i) **Generic Analysis:** Identifies the essential meanings of a concept and isolates those elements that distinguished the concept from other words.

(ii) **Differential Analysis:** Is used when a concept means to have more than one standard meaning and the basis for differentiating between meanings is unclear.

(iii) **Conditions Analysis:** Involves identification of the context condition in which it can be safely said that the concept was present. Such conditions are rejected, revised and new conditions added.

In this type of investigation, the researcher must be very cautious while dealing with the 'cause and effect' relationship.

Step 6: The final stage of the study is the preparation of a systematic and comprehensive report. It is not just the data which is of significance in such a study. Of prime relevance are the ideas and insights of the researcher, particularly his assessment of the interaction between the data and the ideas that are used to explain the data.

3.4.5 Sources of Data in Historical Research

In this section, we discuss the three sources of data in historical research: (i) primary sources, (ii) secondary sources, and (iii) tertiary sources.

(i) **Primary Sources:** Primary sources are eye witness accounts and are the only firm basis of historical enquiry. Good, Barr and Scates (1941) have called them the 'first witness to a fact'.

Direct observation, and reporting or recording of the same, comprise primary sources of data. These provide first-hand information about events that have occurred in the past. Some of the main types of primary sources are:

- Verbal narratives written by the participants or observers. These may take various forms such as official minutes or records, biographies, letters, contracts, deeds, wills, certificates, magazines or newspaper accounts, maps, pictures, books, etc.
- Personal primary sources which are typically a person's observation of events in which he has participated.
- Physical artefacts like museum collections, artefacts in historical spots such as remains or relics, as well as various other types of institutions.
- Mechanical artefacts represent information that is observed through the medium of non-natural items like photographs, films, and audio cassettes.

(ii) **Secondary Sources:** Secondary sources of data basically refer to information that is obtained second-hand. For instance, the person from whom information is obtained neither participated nor witnessed the events. Some types of secondary sources are magazine and newspaper articles, interviews referred to in the articles, research papers, research reports, documentaries, etc.

While carrying out historical studies, primary sources of data have highest credibility when they are used to authenticate presented facts. However, second-hand information that is available, should also be considered in order to develop a more holistic view.

Advantages of Secondary Sources

(a) They may acquaint a researcher with major theoretical issues in his field and to the work that has been done in the area of study.

(b) They may suggest possible solutions of the problem and working hypotheses and may introduce the researcher to important primary sources.

Some type of data may be primary sources for some purposes and secondary sources for another. For example, a high school textbook in Indian history will be ordinarily classified as secondary source, but the book would be a primary source of data if one were making a study of the changing emphasis on national integration in high school history textbooks.

(iii) **Tertiary Sources:** These sources include bibliographies, catalogues and indexes that guide a researcher to primary and secondary sources.

3.4.6 Evaluation of Data

The main feature of historical research is the evaluation of historical data. The backbone of historiography is the authenticity of data collected through different sources. Even when the data are collected through different sources, doubts can be raised about their validity, reliability and relevance. The process of judging validity, reliability and relevance of data is carried out through two devices viz., (a) external criticism and (b) internal criticism.

(a) External Criticism

External criticism is also known as lower criticism. It involves testing the sources of data for integrity, i.e., every researcher must test the information received to ensure that any source of data is in fact what it seems to be. External criticism helps to determine whether it is what appears or claims to be and whether it reads true to the original so as to save the researcher from being the victim of fraud. On the whole, the general criteria followed for such criticism depends on:

- A good chronological sense, a versatile intellect, common sense, an intelligent understanding of human behaviour, and plenty of patience and persistence on the part of the researcher.
- Recent validation of the quality of the source.
- A good track record of the source.

This information may be found in relevant literature. Thereafter, these literary sources can be verified for genuineness of content by verifying signatures, handwriting, writing styles, language, etc. Further, material sources of information can be verified through physical and chemical tests on the ink, paint, paper, cloth, metal, wood, etc.

(b) Internal Criticism

After the integrity of the data sources are established, the actual data content is subject to verification—this process is known as the internal criticism of the data. It is also called higher criticism which is concerned with the validity, truthfulness, or worth of the content of document.

At the outset, the information obtained through a particular source is examined for internal consistency. The higher the internal consistency, the greater the accuracy. The researcher should establish the literal as well as the real meaning of the content within its historical context.

This is followed by an evaluation of the external consistency of the data. This is important because, although the authorship of a report is established, the report may comprise distorted pictures of the past. For verifying that the content is accurate, the researcher should, firstly compare the information received through two independent sources, and secondly match new information obtained with the information already on hand which has been tested for reliability. Fox (1969) suggested three major principles that need to be followed in order to establish external consistency of the data: (i) data from two independent sources to be matched for consistency, (ii) data must have been obtained from at least one independent primary source, and (iii) data should not he gathered from a source that has a track record of providing contradictory information. It is recommended that the researcher apply his professional knowledge and judgment to make a final evaluation in case it is not possible to find matching information from two comparable sources.

The following series of questions have been listed by Good, Barr and Scates (1941) to guide a researcher in the process of external and internal criticism of historical data:

- Who was the author, not merely what his name was but what his personality, character and position were like, etc.?
- What were his general qualifications as a reporter — alertness, character and bias?
- What were his special qualifications as a reporter of the matters here treated'?
- How was he interested in the events related?

- Under what circumstances was he observing the events?
- Had he the necessary general and technical knowledge for learning and reporting the events?
- How soon after the events was the document written?
- How was the document written, from memory, after consultation with others, after checking the facts, or by combining earlier trial drafts'?
- How is the document related to other documents?
- Is the document an original source—wholly or in part? If the latter, what parts are original, what borrowed? How credible are the borrowed materials'? How accurately is the borrowing done? How is the borrowed material changed and used?

Perpetually, the researcher needs answers for all these questions and, therefore, he has to depend, somewhat, upon evidence he can no longer verify. At times, he will have to rely on the inferences based upon logical deductions in order to bridge the gaps in the information.

3.4.7 Purpose of Historical Research

Historical research is carried out to serve the following purposes:

- **To discover the context of an organizational situation:** In order to explore and explain the past, a historian aims to seek the context of an organization/a movement/ the situation being studied.
- **To answer questions about the past:** There are many questions about the past to which we would like to find answers. Knowing the answers can enable us to develop an understanding of past events.
- **To study the relationship of cause and effect:** There is a cause and effect relationship between two events. A historian would like to determine such a relationship.
- **To study the relationship between the past and the present:** The past can often help us get a better perspective about current events. Thus, a researcher aims to identify the relationship between the past and the present, whereby we can get a clear perspective of the present.
- **To reorganize the past:** A historian reconstructs the past systematically and objectively, reaching conclusions that can be defended.
- **To discover unknown events:** There are some historical events that could have occurred in the past that are not known. A historian seeks to discover these unknown events.
- **To understand significance of events:** There may be significant events that could have been responsible for shaping the organization/movement/situation/ individual being studied by a historian.
- **To record and evaluate the accomplishments of individuals, institutions and other kinds of organizations:** Historians are greatly interested in recording and evaluating the accomplishments of leading individuals and different kinds of organizations including institutions and agencies as these influence historical events.

- **To provide understanding of the immediate phenomenon of concern:** A researcher may be investigating a phenomenon. Historical perspective can enable him to get a good understanding of the immediate phenomenon of concern.

The students and teachers in the discipline of education can develop the following competencies through a study of history and conducting historical research:

(i) Undertaking of dynamics of educational change

(ii) Increased undertaking of the relationship between education and the culture in which it operates

(iii) Increased understanding of contemporary educational problem

(iv) Understanding the functions and limitations of historical evidence m analysing educational problems

(v) Development of elementary ability in locating, analysing and appraising historical evidence

(vi) Development of a sense of dignity and responsibility of the teaching profess ion

3.4.8 Problems in Historical Research

- **Amount of data:** Often it is difficult to decide as to how much data is sufficient to reach meaningful conclusions.
- **Selection of data:** A historian must avoid improper or faulty selection of data which may he the result of relying too heavily on some data, ignoring other data. etc. This can result in a bias in the study.
- **Evaluation of historical data and their sources:** Inadequate evaluation of data and their sources can lead to misleading results.
- **Synthesis of data into a narrative account:** Due to the very nature of historical research, it becomes most fruitful, if a researcher is able to successfully synthesize or integrate the facts into meaningful generalizations. Thus, a failure on the part of a researcher to interpret data adequately is considered a serious setback.

There are four problems at the stage of synthesis and in report preparation as given below:

(i) The ability to establish causation from interrelated events is the first problem. It is incorrect to inter that one event caused the other just because they occurred simultaneously.

(ii) The second problem is to accurately define the keywords and terms such that ambiguity is avoided and the correct connotation is established.

(iii) Distinguishing between evidence indicating how people should behave is how they did behave is the third problem.

(iv) The fourth problem involves distinguishing between the intent and the outcome. This means that educational historians ensure that the consequences of some activity or policy were actually the intended consequences.

Historical synthesis and interpretation are considered an art, which is subjective in nature. This raises a serious problem of subjectivity. Historical synthesis is necessarily a highly subjective art. It involves the intuitive perception of patterns and relationships in the complex web of events, as well as the art of narrative writing. Explanations and

judgments may be called for, that will involve the historian's own personality, experience, assumptions, and moral values. Inevitably there are personal differences among historians in this respect, and prolonged academic disputes among historians of different schools or nationalities have arisen over practically every event. The initial reduction of complex events of the recent past to comprehensible pattern is particularly difficult and subjective...'. Since the very process of writing a narrative is a human one, therefore, total objectivity is almost impossible. As a consequence, bias and distorting of facts to fit preconceived notions or ideas are not unusual. It may also be kept in mind that historical conclusions are conditioned by place, time and the author. In order to overcome some of these inherent weaknesses, the writer must clearly indicate the underlying assumptions in his approach. In case he belongs to a particular school of thought, the same must be stated clearly.

3.5 DESCRIPTIVE SURVEY RESEARCH

One of the basic functions of research is to understand the nature of the problem and to identify various factors that contribute towards the occurrence of events. Descriptive research surveys are prominent methods of conducting exploratory research in the area of social sciences.

The terminology of descriptive survey research is designed such that it compels the researcher to obtain relevant and accurate information about the current status of the phenomena and to draw Out valid generalizations from the established facts without any interference or control over the situation. Such type of studies are not limited to fact finding and may often lead to the development of key principles of knowledge, as well as solutions for major problems that concern local, state, national and international issues.

According to Best, 'descriptive survey describes and interprets what is concerned with conditions and relationships that exist; practices that prevail; beliefs, points of view or attitudes that are held; processes that are going on, effects that are being felt, or trends that are developing'.

Descriptive surveys can tell us about what exists at present by determining the nature and degree of existing conditions. This is the most popular and most widely used research method in education.

Descriptive research, thus, is concerned with the present and attempts to determine the status of the phenomenon under investigation.

Descriptive surveys collect and provide three types of information:

- What exists, with respect to variables or conditions in a situation.
- What we want by identifying standards or norms with which to compare the present conditions or what experts consider to be desirable.
- How to achieve a goal, by exploring possible ways and means on the basis of the experience of others or opinions of experts.

In simple words, the purpose of descriptive research is to:

- identify present conditions and point to present needs
- study the immediate status of a phenomenon
- find facts
- examine the relationship of traits and characteristics (trends and patterns)

3.5.1 Characteristics of Descriptive Survey

The characteristics of descriptive survey are as follows:

- They are non-experimental, for they deal with relationships between non-manipulated variables in a natural, rather than an artificial setting.
- They may involve hypothesis formulation and testing.
- They use the logical method of indicative-deductive reasoning to arrive at generalizations.
- They are characterized by disciplined inquiry, requiring expertise, objectivity and careful execution.
- They often employ a method of randomization so that error may be estimated when inferring population characteristics from observation of samples.
- The variables and procedures are described as accurately and thoroughly as possible so that the study can be replicated by other researches.
- They use techniques of observation, description and analysis.
- Descriptive surveys ask questions about the nature, incident or distribution of educational variables.
- Descriptive surveys are a primitive type of research and do not aspire to develop an organized body of scientific laws.
- Descriptive surveys investigate phenomena in their natural setting. Their purpose is both immediate and long range.

3.5.2 Steps of Descriptive Survey

The steps of descriptive survey are as follows:

(i) **Statement of the Problem:** This statement identifies the variable to be involved in the study and specifies whether the study is merely seeking to determine the status of these variables or whether it will also investigate relationships between the variables.

(ii) **Identification of Information Needed to Solve the Problem:** The research lists the information to be collected, states whether this information is of a qualitative or a quantitative nature and identifies the form the information will take.

(iii) **Selection or Development of Instrument for Gathering Data:** Questionnaires, interviews, tests and scales of various types arc the most frequently used instruments for descriptive research. Already existing tools can be used or new tools can be devised.

(iv) **Identification of Target Population and Determination of Any Necessary Sampling Procedure:** The researches determine the group about which information is being sought—an adequate sample is selected that will adequately represent the population.

(v) **Design of the Procedure for Data Collection:** The researcher lays out the practical schedule obtaining the sample and using the instrument.

(vi) **Collection of Data:** This involves detailed planning, including getting permission from the school or persons concerned, time tabling, etc. This time table helps to collect data in an organized manner.

(vii) **Analysis of Data:** Statistical techniques to be used will have to be planned. The researcher should be familiar with the different categories of measurement scales and use the most suitable so the appropriate tests can be carried out.

(viii) **Preparation of the Report:** The researcher decides the final format of his descriptive study.

Data in Descriptive Research

Descriptive research is designed to obtain pertinent and precise information concerning the current status of phenomena, and wherever possible to draw valid general conclusions from the facts discovered. They may often result in the formulation of important principles of knowledge and solution of significant problems concerning local, state, national, and international issues. They involve measurement, classification, analysis, comparison and interpretation. They collect and provide three types of data:

- What exists with respect to variables or conditions in a situation.
- What we want by identifying standards or norms with which to compare the present conditions or what experts consider desirable.
- How to achieve gaps by exploring possible ways and means on the bases of the experience of others or the opinion of experts.

3.5.3 Values of Descriptive Research in Education

Due to the following reasons, the descriptive method has been the most popular and widely used research method in education.

- **Description in Present:** It helps to explain educational phenomena in terms of the conditions or relationships that exists, opinions that are held by the students, teachers, parents and experts processors that are going on , effects that are evident or trends that are developing.
- **Easy and Direct:** Due to the apparent simplicity and directness of the method, a researcher can gather information in terms of individual's opinion about some issue, by a simple questionnaire.
- **Only Means:** At times, descriptive surveys are the only means through which opinions, attitudes, suggestions for important educational practices and instruction, and other data can be obtained.
- **Problem Solving:** They are of immense value in solving problems about children, school organizations, supervision and administration, curriculum, teaching methods and evaluation.
- **Keeping Abreast with Changes:** The problems in education directly involve people and the situations precipitating these problems are constantly in a state of change. To keep abreast of changes, descriptive surveys conducted at different intervals with representative groups of people will be immensely helpful.
- **Development of Data Gathering Tools:** Descriptive research is useful in development of data gathering instruments and tools like checklists, schedules, score questionnaires and rating scales.
- **Provision of Ideas and Data:** It provides the background ideas and data from which many more refined or controlled studies of causal relations are made.

3.5.4 Types of Surveys

These include census surveys, sample surveys, longitudinal surveys, cross sectional surveys, comparative surveys, evaluation surveys and documentary surveys.

- **Census Survey:** Census survey means gathering pertinent information about all the units of population viz., people, institutions, householders, etc. As you know, population may consist of persons, institutions, objects, attributes, qualities, families, etc. A population is a well defined group of many of these. For instance, the Census Survey of India, which takes place once in ten years, gathers benchmark data about each and every household of India. Since it concentrates on each and every household, it restricts its scope to certain surface level demographic data like age, sex, income, education, lands possessed, cattle, nature of house, domestic facilities available, etc. The studies are conducted through a quick survey in a stipulated period. However, coverage of units is very exhaustive. The census survey as a method of research in education can be employed to understand educational problems and make policy decisions.

  Strength of Census Survey: The strength of the census survey is associated with generalized characteristics of data. Description of population data acts as a major source of identifying several pertinent issues and questions for research. It is very useful in making a trend analysis of different events. Moreover, hard database system of the entire population is very useful in development of strategic planning and policy-making of education at the micro level as well as at the macro level.

  Limitations of Census Survey: As discussed, each and every unit of population is covered under census survey. However, data is gathered only under limited headings. Also, this data is only surface level information. Through a census survey one can gather nominal data. Thus the researcher cannot ask questions in depth.

  Many times such data is gathered mechanically where the investigators are not well trained about cross examining the evidence at the field level. In such cases, the probability of getting valid data is also minimized. Census surveys involve employment of huge manpower and monetary resources. This method is also time consuming. Getting each respondent to cooperate for data collection is very difficult. Hence, the feasibility of conducting census studies is very limited. Moreover, because of sample surveys many questions can be well answered by saving time, money and human resources hence, one may look for census studies with limited focus of research.

- **Sample Survey:** Sample survey means gathering relevant information about a smaller representation of the population under study. The data gathered through sample surveys are generalized to the population of the study. For example, the opinion of a sample of distance learners drawn from a particular district towards usefulness of media in open and distance education can be generalized as the opinion of all distance learners of that district. Educational research invariably makes use of sample surveys.

  Reasons for Conducting Sample Surveys: Sample surveys are preferred over census surveys on the following grounds:

(a) **Greater Range:** Unlike census studies where limited information is gathered from the whole population, sample surveys cover a wide range of data on different dimensions of the study.

(b) **Greater Correctness:** With reduced volume of work using expert and trained personnel, and application of appropriate monitoring mechanism of data collection and analysis, there is a greater chance of gathering valid data and its appropriate processing. Moreover, sampling is particularly more important in obtaining accurate results about phenomena which are undergoing rapid changes such as opinions about political and social issues and their impact on education.

(c) **Reduced Expenditure:** Data collected from a small fraction of population involves lesser expense than that of a census survey.

(d) **Greater Pace:** Since the size of respondents is smaller than the whole population, the volume of data is smaller. Hence, it is economical in terms of gathering evidence, tabulating them and processing them quickly.

Characteristics of Sample Surveys: Sample surveys have specific characteristics, viz., application of appropriate sampling techniques with a view to ascertaining representativeness of units under investigation; use of appropriate data gathering tools, mainly, questionnaires, interview schedules, observation schedules and checklists for record surveys; and use of appropriate techniques of data analysis for drawing inferences about population.

Examples

(i) Attitude of parents towards *Ladli* scheme in Delhi schools.

(ii) Causes of dropouts among distance learners as perceived by teachers of IGNOU.

(iii) Attitude of university students towards Information and Communication Technology based education.

(iv) Teaching competencies of primary school teachers.

(v) Physical facilities of primary schools in backward districts of a state.

- **Cross-Sectional Survey:** Cross-sectional survey can be understood as a kind of sample survey where standardized information is gathered from a sample drawn from a cross section of pre-determined population at one point of tune. Hence, the sample respondents must represent different distinct segments of population or stages of development of events. The segments may indicate different stages of school education like primary, secondary and higher or different modes of education like face-to-face mode and distance mode. It may include the schools covered under a specific scheme like mid-day meals and the schools yet to be covered under the scheme. It may cover a sample of trained teachers and in-service teachers yet to be trained. The sampling techniques like random, stratified and cluster sampling are used in identifying cross-sectional representation of population of the study. Hence the basic feature of cross sectional survey is associated with varieties of respondents covering different stages/status in the study. Another main feature of cross-sectional study is that the information is collected at one point of time. Here, one point of time refers to single slot of data collection stretching over a few days or months or more.

Types of Cross-Sectional Surveys: Cross-sectional surveys are classified into two types. These are:

(i) Description of status of single variables.

(ii) Exploring relationships between two or more variables.

(i) **Single Variable Study:** In such kind of studies, the researcher is interested in describing the status of any one variable as explored through investigation of sample respondents. For example, in an academic assessment study, the researcher explores needs of secondary and higher secondary students towards pursuing various kinds of academic programmes. Data may be gathered through questionnaires or interview techniques, and analysed descriptively highlighting the degree of different academic needs of students' background-wise at the secondary and higher levels. Such kinds of studies are conducted to describe the characteristics of a cross section of a population. It may include the opinion of people, attitude of students, teacher competencies, etc. The analysis of data in such a kind of study will indicate how characteristics of one sample group are different from that of another sample group.

(i) ***Many Variables Study:*** In such studies, at least two variables are picked up for investigation. It may also be more than two variables. For example, you may be interested in exploring the relationship between achievement and academic interest of students at different stages of education. Hence, you go one step ahead by describing the achievement level of a group of students and academic interest of the same group of students respectively. In exploring relationships of two variables, you are to plot two sets of data, i.e., achievement scores and academic interest scores of the same group of sample respondents. Then you will have to use appropriate statistical techniques for measuring the level of relationships or coefficient of correlation, multiple correlation, etc.

- **Longitudinal Survey:** Through longitudinal surveys, one explores the status of variables as investigated at different points in time. Through such studies, the changes in the status of the variables over a period of time are explored. Time-ordered associations of one variable's status at different periods of time are also studied. Unlike a cross-sectional study where past data is recollected by the respondents at one point in time, the longitudinal study deals with gathering actual evidences at different points in time. Hence, it is assumed that the accuracy of data is a higher in longitudinal studies than in that of cross sectional time-ordered studies. There are three kinds of longitudinal surveys:

  (i) **Trend Studies:** In such kinds of studies, data collection takes place at different phases. Different groups of sample respondents drawn from the general population are contacted for different phases of data collection. For instance, in the case of the impact study of the mid-day meal scheme at the primary stage, the researcher may collect evidence from a fresh batch of primary school students on an annual basis for a few years. The researcher identifies the trend of response patterns of each batch of fresh students over a period of time.

  (ii) **Panel Studies:** In such studies, the same group of sample respondents is studied over a period of time. For example, the attitude of a particular group

of students towards school education is studied over a period of time. In another case, the attendance rate and the achievement level of students enrolled in class I can be studied longitudinally till the same group of students clear the class V examination in a school. The problem of retention of sample respondents is associated with absenteeism or non-availability/noncooperation of the same group of sample respondents in different phases of data collection.

(iii) **Cohort Studies:** In the cohort study method, a specific population is taken for study over a period of time. Different samples are drawn from a specific population over different phases of data collection corresponding to different phases/stages of development of events. For example, in a district, prior to the introduction of decentralized management system of primary education, the teachers' attitude towards management of the school system was studied. In the second phase, immediately after introduction of the new management system, the attitude of teachers was studied. In the third phase, the attitude of the teachers was studied after completion of five years of introduction of the new management system. In this case, the teacher population was restricted to all the primary schools of a district covered under District Primary Education Project (DPEP). Even though the population of the study was specific, the sample respondents representing the population varied from one phase of study to another.

- **Comparative Survey:** In comparative surveys, the purpose is to compare the status of two or more number of variables, institutions, strategies adopted or groups of respondents, etc. In other words, one may be interested in comparing the achievement level of students enrolled in two different institutions assuming that the students of the two different institutions belong to the same population. In another study, you may like to compare the reaction of teachers serving in government and private management schools towards the leadership behaviour of their principals. Moreover, you may he interested to determine the superior nature of an innovative teaching—learning strategy adopted in certain schools with a traditional approach of teaching adopted in the same institutions in terms of achievement of learners. Though comparative survey studies have many limitations, and they often do not produce the precise and reliable knowledge that can he gained through rigorous experimental studies, they provide means of tackling problems that cannot he probed in laboratory situations. Furthermore, such studies yield valuable information and clues concerning the nature of the phenomena and are admirably suited to many types of field studies seeking to establish causal relationships.
- **Evaluative Survey:** Evaluative survey is conducted with the purpose of evaluating a programme, a curriculum, a policy, etc. When one intends to conduct empirical studies on identifying the effectiveness to any programme functioning or programme output, one may undertake an evaluative survey. Evaluation studies lead towards arriving at a value judgment about a programme or policy or institution being worthwhile. Two purposes can be served in the evaluation of programmes through surveys: (a) judging the effectiveness of the programme and (b) taking a decision for the future course of action. On the basis of such a study,

policy makers or decision—making bodies may identify the strength and loopholes of a programme and take an appropriate decision to improve the situation.

- **Documentary Survey:** Various research questions need to he answered through analysis of data already available in the form of printed text viz., books, official records, research reports, review articles, research papers, information bulletins, handouts, prospectus, annual reports, periodicals, progress reports, experience of individuals, news items, etc. For instance, the researcher is interested in comparing the existing status of teacher education programmes in Asian countries. The researcher makes an analysis of available literature on teacher education programmes countries under investigation like policy documents on education in general, and teacher education in specific curriculum frameworks of teacher education, role and functions of quality control bodies on education, planning documents on teacher education researches conducted on existing practices of teacher education, evaluation reports on teacher education programmes, committee reports, minutes of meetings, recommendations of education commissions, guidelines and norms prescribed by statutory bodies in education, recommendations of professional organizations and forums, seminar reports and proceedings on teacher education, etc. There can be innumerable sources of obtaining documentary evidences and conducting relevant studies.

  Difference between Documentary Survey and Historical Survey: The difference is simple and is seen in the context of time of occurrence of events under investigation. As a documentary surveyor one would be interested in analysing present, events from available records, whereas as a historical researcher you may analyse past records to explore the incidences which occurred in the distant past. The similarity of both the approaches exists in the context of analysis procedure adopted in historical documents and present documents. For instance, the surveyor as well as the historian follows similar approaches of identifying relevant records for investigation, judging authenticity of documents, doing content analysis of evidence, codifying and organizing contents/information, reviewing the content, making interpretations, etc.

  Purpose of Documentary Studies: The documentary surveys serve different purposes which have a lot of significance for educational research.

(i) ***To describe the existing structure amid functions of educational system or conditions that exists in the educational field:*** For example, the existing practices of primary education in view of achieving the goals of universalization of elementary education or the status of distance education programme in teacher preparation can be included in such a category of documentary surveys.

(ii) ***To discover the relative importance of certain problems and identifying future trends of different developments in the field of education:*** The trend analysis of growing demand for certain areas of education, and analysing the corresponding need for expansion of education can best fit in with such a kind of documentary study.

Another example is Survey of Research in Education. We will come across different Surveys of Research in Education conducted chronologically by the late

Professor M.B. Buch and NCERT. In such surveys, researches conducted in different areas of education have been presented in the form of abstracts. Such studies have been analysed by experts. Projections have been made about the future. Developments and priorities of research have also been analysed area-wise. In a closer sense, review of research studies conducted by a research student in identifying his problem of investigation also comes under the category of documentary survey study.

(iii) ***To analyse curriculum of different stages of education or to compare curriculum of different states or countries:*** For example, we may he interested in analysing the curriculum of B.Ed education adopted B.Ed colleges and universities vis-a-vis NCTE. Similarly, we maybe interested in pointing out the logical flow of curriculum of DIET, SCERT, and higher education of a particular state or country.

(iv) ***To analyse and review study materials/evaluation items:*** Analysis, review and evaluation of textbooks, study materials, reference books, examination question papers, assessment of assignments, internal assessment of students performance, evaluation of answer books, etc., fall under this category of research. We will come across a number of studies where the researcher may be interested in content analysis and evaluation of self study materials of an open university, examination papers of a board of secondary education, nature of assignments of distance education programme, nature of feedback given by tutors, marking procedure of assignments, etc. Such kinds of analysis depend on the availability of original documents, adoption of standard parameter of evaluation and the researcher's judgment capacity. On many occasions such kinds of evaluation studies are treated as part of formative research which have major potentials for programme development.

(v) **To analyse the literacy style, concepts, beliefs and ideology of a writer:** In the case of research in the field of literature and social science, such analysis is given importance. Moreover, in the area of philosophy of education, analysis of original text prepared by an author and ideas/comments of others about the author are analysed for drawing inferences which have significance for education.

Limitations of documentary survey studies: While conducting documentary analysis, you may find certain limitations inherent in the method itself.

(a) First, our analysis exclusively depends on documentary evidence. Conclusions drawn on the basis of documentary data may not give a complete picture of the phenomenon under investigation. For example, while analysing curriculum we may depend on text materials. However, the curricular practices as presented in textual form may not reveal the complete picture of the process dimensions. The investigation remains incomplete without incorporating observation based evidence.

(b) Second, data presented in the form of records or publications may not be available in a particular order. It may be available in an incomplete form. Moreover, evidence gathered through available documents may not represent the population of the study. The views, opinions or reactions of people already

available in published documents may not be representative in nature. A particular segment of the population who maybe expressing their views on certain incidents may not be a true sample of the population under study. Hence, generalizations of documentary evidences have major limitations.

(c) Third, we may doubt the authenticity of data available in printed text. We may cross-examine the information available through one source with that of the other. Moreover, we will have to be careful about the trustworthiness of sources of data. Unless we become careful about the objectives of our study and try to trace necessary documentary evidence, many a time documentary evidence creates confusion and leads to complicating the process of investigation. Different records may use different parameters of present data. Unless we trace these parameters of classification of such data, we will find it difficult to find a meaningful base of data analysis. For example, the boundary of some units of analysis, e.g., school districts, age associates, dropout ratio, etc., can differ from document to document. Different records pertaining to these data may not have used a common parameter of classifications or definition of terms. Hence, it is always advisable to be cautious while adopting documentary analysis with caution of internal and external criticism of data, meaningfulness of information and correlating documentary data with other methods of data collection procedures with a view to getting the total picture of the reality.

3.6 EXPERIMENTAL RESEARCH

Experimental research refers to the research activity wherein the manipulation of variables takes place, and the resultant effect on other variables is studied. It provides a logical and structured basis for answering questions. The experimental researchers manipulate the environment, stimuli or applications and observe the impact of this manipulation on the condition or behaviour of the subject. The manipulation that they undertake is deliberate and systematic.

Experimentation is the testing of hypotheses. Once the experimenters have defined a situation or issue, they formulate a preliminary solution or hypothesis. They then apply their observations of the controlled variable relationships in order to test, and then confirm or reject the hypothesis.

Experimentation is the classic method of experimenting in a science laboratory where elements are manipulated and effects observed can be controlled. It is the most sophisticated, exacting and powerful method for discovering and developing an organized body of knowledge.

According to J.W. Best, ‘Experimental research is the description and analysis of what will be or what will occur under carefully controlled condition’.

3.6.1 Characteristics of Experimental Research

Experimental research is based on highly rigorous procedures and aims at producing reliable and valid conclusions. By looking at the various designs and procedures used, one can formulate some essential characteristics of experimental research which distinguish it from other types of research methods like survey and historical.

- **Pre-Experimental Statistical Equivalence of Subjects in Different Groups:** This pre-condition is achieved by random selection and assignment of subjects to

different groups. This procedure is essential to meet the threat of selection differences to the internal validity of the results.

- **Use of At Least Two Groups or Conditions that can be Compared:** An experiment cannot be conducted with one group of subjects or one condition at a time. The intent of the experimenter is to compare the effect of one condition on one group with the effect of a different condition on another equivalent group. An experiment may take the shape of a comparison of the effect of one condition on a group of subjects and the effect of another condition on the same group.
- **Manipulation of the Independent Variable:** It is perhaps the most distinct feature of experimental research. Manipulation stands for the process of assignment of different values or magnitudes or conditions or levels of the independent variable to different groups.
- **Measurement of Dependent Variable in Quantifiable Form:** This distinguishes experimental research from descriptive, qualitative or analytical research.
- **Use of Inferential Statistics:** This is done to make probability statements about the results, and thus meet the requirements of imperfect measurements on which the behavioural sciences base their generalization.
- **Control of Extraneous Variables:** Though applicable to any other type of research, control of extraneous variables is the sine qua non of true experimental designs and the experimenter makes a determined effort to achieve it. It helps the experimenter to eliminate the possibility of any other plausible rival hypothesis claiming to explain the result.

3.6.2 Steps in Experimental Research

The steps in experimental research are as follows:

(i) **Survey of the Literature Relating to the Problem:** In experimentation, the researcher needs to acquire up-to-date information relating to the problem.

(ii) **Selection and Definition of the Problem:** It needs a rigorous logical analysis and definition of the problem in precise terms. The variables to be studied are I defined in operational terms clearly and unambiguously. It helps the researcher to convert the problem into a hypothesis that can be verified or refuted by the experimental data.

(iii) **Statement of Hypotheses:** Hypotheses are the heart of experimental research. They suggest that an antecedent condition or phenomenon is related to the occurrence of another condition, phenomenon, event or effect. To test a hypothesis, the researcher attempts to control all the conditions except the independent variable. Therefore, he should give sufficient attention to the formulation of hypotheses. The experimental plant and statistical procedures help him in the testing of hypotheses and contribute little in the development of theories or advancement of knowledge. However, the hypotheses developed or derived from existing theories contribute to the development of new theories and knowledge.

(iv) **Construction of Experimental Plan:** Experimental plan refers to the conceptual framework within which the experiment is to be conducted.

According to Van Dalen, an experimental plan represents all elements, conditions, phenomena, and relations of consequences so as to:

- Identify the non-experimental variables.
- Identify the most appropriate research design.
- Identify a sample of subjects that will suitably represent the target population, form groups of these subjects and decide on the experiments which will be conducted on each group.
- Choose or develop an instrument that can be deployed to measure the results of the experiment.
- Lay out the data collection process and conduct a pilot study to test the instrument and the research design and state the hypotheses.

3.6.3 Variables

A variable is any feature or aspect of an event, function or process that, with its presence and nature, affects some other event or process which is being studied. According to Kerlinger, 'variable is a property that takes on different value'.

Types of Variables

- ***Independent Variables*:** These are conditions or characteristics that are manipulated by the researcher in order to identify their relationship to observed phenomena. In the field of educational research, for instance, a specific teaching method or a variety, of teaching material are types of independent variables. The two kinds of independent variables are:
  (i) *Treatment Variables*: These are variables which can be manipulated by the researcher and to which he assigns subjects.
  (ii) *Organism or Attribute Variables*: These are factors such as age, sex, race, religion etc., which cannot be manipulated.
- ***Dependent Variables:*** Dependent variables represent characteristics that alter, appear or vanish as a consequence of introduction, change or removal of independent variables. The dependent variable maybe a test score or achievement of a student in a test, the number of errors or measured speed in performing a task.
- ***Confounding Variables***: A confounding variable is one which is not the subject of the study hut is statistically related with the independent variable. Hence, changes in the confounding variable track the changes in the independent variable. This creates a situation wherein subjects in a particular condition differ unintentionally from subjects in another condition. This is not a good result for the experiment which is attempting to create a situation wherein there is no difference between conditions other than the difference in the independent variable. This phenomenon enables us to conclude that the manipulation undertaken directly causes differences in the dependent variable. However, if there is another variable besides the independent variable that is also changing, then the confounding variable is the likely cause of the difference. An example of a common confounding variable is that when the researcher has not randomly assigned participants to groups, and some individual difference such as ability, confidence, shyness, height, looks, etc., acts as a confounding variable. For instance, any experiment that involves both men and women is naturally afflicted with confounding variables, one of the most

apparent being that males and females operate under diverse social environments. This should not be confused to mean that gender comparison studies have no value, or that other studies in which random assignment is not employed have no value; it only means that the researcher must apply more caution in interpreting the results and drawing conclusions.

Let us consider an instance wherein an educational psychologist is keen to measure how effective is a new learning strategy that he has developed. He assigns students randomly to two groups and each of the students study materials on a specific topic for a defined time period. One group deploys the new strategy that the psychologist has developed, while the other uses any strategy that they prefer. Subsequently, each participant takes a test on the materials. One of the obvious confounding variables in this study would be advance knowledge of the topic of the study. This variable will affect the test results, no matter which strategy is used. Because of an extraneous variable of this nature, there will be a level of inconsistency within and between the groups. It would obviously be the preferred situation if all students had the exact same level of pre-knowledge. In any event, the experimenter, by randomly assigning the groups, has already taken an important step to ensure the likelihood that the extraneous variable will equivalently affect the two groups.

Let us imagine an experiment being undertaken to measure the effect that noise has on concentration. Assume that there are 50 subjects each in quiet and noisy environments. Table 3.2 below illustrates the ideal or perfect version of this experiment. 'IV' and 'EV' represent the independent variable and external variables respectively. Note that (as shown in the table), the only difference between the two conditions is the IV, which indicates that the noise level varies from low to high in the two conditions. All the other variables are controlled and are exactly the same for the two conditions. Therefore, any difference in the concentration levels of subjects between the two conditions must have been caused by the independent variable.

Table 3.2 Determining the impact of Internal and External Variables

Variables	**Quiet Condition N = 50**	**Noisy Condition N = 50**
Noise Level (IV)	Low	High
IQ (EV)	Average	Average
Room temperature (EV)	68 degrees	68 degrees
Sex of subjects (EV)	60 per cent F	60 per cent F
Task difficulty (EV)	Moderate	Moderate
Time of day (EV)	All different times between 9-5	All different times between 9-5
Etc. (EV)	Same as noisy environ	Same as quiet environ
Etc. (EV)	Same as noisy environ	Same as quiet environ.

An Ideal Experiment

Now consider another version of this experiment wherein some of the other variables differ across conditions. These are confounding variables (highlighted below) and the experiment being conducted is not ideal. In this experiment, if the concentration levels of

subjects vary between the two conditions this may have been caused by the independent variable, but it could also have been caused by one or more of the confounding variables. For instance, if the subjects in the noisy environment have lower concentration levels, is it because it was louder, too hot or because they were tested in the afternoon? It is not possible to tell and therefore, this is less than ideal.

Variables	Quiet Condition	Noisy Condition
Noise Level (IV)	Low	High
IQ (EV)	Average	Average
Room temperature (EV)	68 degrees	82 degrees
Sex of subjects (EV)	60 per cent F	60 per cent F
Task difficulty (EV)	Moderate	Moderate
Time of day (EV)	Morning	Afternoon
Etc. (EV)	Same as noisy environment	Same as quiet environ.
Etc. (EV)	Same as noisy environment	Same as quiet environ.

A Non-Ideal Experiment

Controlling the Confounding Variables

There are ways by which the extraneous variables may be controlled to ensure that they do not become confounding variables. All people-related variables can be controlled through the process of random assignment which will most likely ensure that the subjects will be equally intelligent, outgoing, committed, etc. Random assignment does not necessarily ensure that this is the case for every extraneous variable in every experiment. However, when a sample is large, it works very well and the researcher's motives for using this method will never be questioned.

One of the way in which situation variables or task variables can be controlled is basically by keeping them constant. For instance, in the noise-concentration experiment above, we could adjust the thermostat and thereby keep the room temperature constant and test all the subjects in the same room. We would, of course, hold the difficulty of the tasks constant by giving all subjects in both environments the same task. It is common practice for instructions to be written or recorded and presented to each subject in exactly the same way.

At time, the researcher cannot hold a situation or task variable constant. In these situations too, random assignment can be of great help. Consider a situation where the same room is not available for testing the two groups and, in fact, one group is tested on a Monday in Room I and the other group on a Tuesday in Room 2. In this situation, we can use random assignment which can result in half the Monday subjects in Condition A and the rest in Condition B, and the same for the Tuesday subjects. Hence both conditions will have roughly the same percentage of subjects tested in Room 1 and 2. On the other hand, consider what would happen if we did not use random assignment and instead tested the Monday subjects in Condition A and the Tuesday subjects in Condition B. In this situation, we have two confounding variables. Subjects in Condition A were tested on different days of the week and in different rooms from those in Condition B. Any difference in the results could have been caused by one or more of the independent variable, the day of the week, or the room.

In other words, confounding variables are those aspects of a study or sample that might influence the dependent variable and whose effect may be confused with the effects of the independent variable. Confounding variables are of two types:

(a) ***Intervening Variables:*** In many types of behavioural research, the relationship between independent and dependent variables is not a simple one of stimulus to response. Certain variables that cannot be controlled or measured directly may have an important effect on the outcome. These modifying variables intervene between the cause and the effect. For example, in a classroom language experiment, a researcher is interested in determining the effect of immediate reinforcement on learning the parts of speech. He suspects that certain factors or variables other than the one being studied may be influencing the result, even though they cannot be observed directly. These factors may be anxiety, fatigue or motivation. These factors cannot be ignored. Rather they must be controlled as much as possible through the use of appropriate design. For example, a variable (as memory) whose effect occurs between the treatment in a psychological experiment (as the presentation of a stimulus) and the outcome (as a response) is difficult to anticipate or is unanticipated, and may confuse the results.

(b) **Extraneous Variables:** These are variables that are not the subject of an experiment but may have an impact on the results. Hence, extraneous variables are uncontrolled and could significantly influence the results of a study. Often we find that research conclusions need to be questioned further because of the influence of extraneous variables. For instance, a popular study was conducted to compare, the effectiveness of three methods of social science teaching. Ongoing, regular classes were used, and the researchers were not able to randomize or control the key variables as teacher quality, enthusiasm or experience. Hence, the influence of these variables could be mistaken for that of an independent variable.

For instance, in a study which attempts to measure the effect of temperature in a classroom on students' concentration levels, noise coming into the class through doors or windows can influence the results and is therefore an extraneous variable. This may be controlled by soundproofing the room, which illustrates how the extraneous variable may be controlled in order to eliminate its influence on the results of the test.

The following are the types of extraneous variables:

- Subject variables pertain specifically to the people being studied. These people's characteristics such as age, gender, health status, mood, background, etc., are likely to affect their actions.
- Experimental variables pertain to the persons conducting the experiment. Factors such as gender, racial bias, or language influence how a person behaves.
- Situational variables represent the environment factors which were prevalent at the time when the study or research was conducted. These include the temperature, humidity, lighting, and the time of day, and could have a bearing on the outcome of the experiment.
- Continuous variable is one wherein, any value is possible within the range of the limits of the variable. For instance, the variable 'time taken to run the marathon' is continuous since it could take 2 hours 30 minutes or 3 hours 15 minutes to run the

marathon. On the other hand, the variable 'number of days in a month that a worker came to office' is not a continuous variable since it is not possible to come to office on 14.32 days.

- Discrete variable is one that does not take on all values within the limits of the variable. For instance, the response to a five-point rating scale must only have the specific values of 1, 2, 3, 4, or 5. It cannot have a decimal value such as 3.6. Similarly this variable cannot be in the form of 1.3 persons.
- Quantitative variable is any variable that can be measured numerically or on a quantitative scale, at an ordinal, interval or ratio scale. For example, a person's wages, the speed of a car, or the person's waist size are all quantitative variables.
- Qualitative variables are also known as categorical variables. These variables vary with no natural sense of ordering. They are therefore measured on the quality or characteristic. For example, eye colour (black, brown, or blue) is a qualitative variable, as are a person's looks (pretty, handsome, ugly, etc.). Qualitative variables maybe converted to appear numeric, hut this conversion is meaningless and of no real value (as in male = 1, female = 2).

3.6.4 Experimental Designs

The various experimental designs have been discussed in this section.

(a) **Single Group Design:** In this design study is carried out on a single group. Experiments can be conducted in the following ways:

(i) ***The One-Shot Case Study:*** This is a single group studied only once. A group is introduced to a treatment or condition and then observed for changes which are attributed to the treatment. This is like an ex-post facto method in which on the basis of a dependent variable, an independent variable is looked for.

(ii) ***One Group Before after Design:*** This design entails the inclusion of a pre-test in order to establish base level scores. For instance, to use this design in a study of college performance, we could compare college grades prior to gaining the experience to the grades after completing a semester of work experience. In this design, we subtract the score of pre-test from post-test and see the differences. This difference is seen using a 't' test.

(iii) ***Time Series Designs:*** Time series designs refer to the pre-testing and post-testing of one group of subjects at different intervals. In this design, continuous observation is carried out till a clear result is not seen. The purpose is to establish the long-term effects of treatment and can often lead to the number of pre- and post-tests varying from just one each, to many. At times, there is a period of interruption between tests so as to assess the strength of the treatment over a long time frame.

(iv) ***Counterbalanced Design:*** Experiments that use counterbalanced design are effective ways to avoid the pitfalls of repeated measures, where the subjects are exposed to treatments one after the other.

Typically in an experiment, the order in which the treatments are administered can affect the behaviour of the subjects. It may also elicit a false response due to fatigue or any other external factors which may have a bearing on the behaviour of the subjects. To

control or neutralize this, researchers use a counterbalanced design, which helps to reduce the adverse effects of the order of treatment or other factors on the results.

Counterbalancing helps to avoid confounding among variables. Take for example an experiment in which subjects are tested on both, auditory reaction time task and visual reaction time task. If each and every subject were first tested on the auditory reaction time task and then on the visual reaction time task, the type of task and the order of presentation would be confounded. If the visual reaction time was lower, we would not be sure whether reaction time to a visual stimulus is 'really' faster to an auditory stimulus, as it is quite likely that the subjects would have learned something while performing the auditory task which led to an improvement of their performance on the visual task.

(b) **Two Equivalent Group Design**

(i) ***Static Group Comparison Study:*** This design attempts to make up for the lack of a control group but falls short in relation to showing if a change has occurred. In this group, no treatment is given but only observation is carried out in a natural way of two groups, e.g., observation of the monkeys living in a city and observation of other monkeys living in the jungle. It is fair to mention here that in these groups nothing is manipulated as this design does not include any pre-testing and therefore any difference between the two groups prior to the study is unknown.

(ii) ***Post-Test Equivalent Groups Design:*** Randomization as well as the comparison of both the control and experimental group, are used in studies of this nature. Each group is chosen and assigned randomly and presented with either the treatment, or a type of control. Post-tests are subsequently administered to each subject to establish whether or not a difference exists between the two groups. While this is close to being the best possible method, it falls short on account of its lack of a pre-test measure. It is not possible to establish if the difference that seems to exist at the end of the study actually represents a change from the difference at the beginning of the study. Hence, while randomization mixes the subjects well, it does not necessarily create an equivalency between the two groups.

(iii) ***Pre- Test Post- Test Equivalent Groups Design:*** This is the most effective as well as the most difficult method in terms of demonstrating cause and effect. The pre-test post-test equivalent groups design ensures the presence of a control group as well as a measure of change. Importantly, it also adds a pre-test thereby assessing any differences that existed between the groups prior to the study taking place. In order to apply this method, we select students at random and then segregate them into one of two groups. We would subsequently evaluate the previous semester's grades for each group in order to arrive at a mean grade point average. The treatment (work experience) would be applied to one group, whereas a control would be applied to the other.

It is critical that the two groups be treated similarly in order to control for variables such as socialization, so the control group may participate in an activity such as a softball league while the other group participates in the

work experience programme. The experiment ends at the end of the semester, and the semester's grades are compared. If it is found that the grade change for the experimental group was significantly different from the grade change of the control group, one could conclude that a semester of work experience results in a significant difference in grades when compared to a semester of non-work related activity, programme.

(iv) ***Counterbalanced Randomized Two Groups Design:*** In this design, the group is divided in two parts on a random basis. This design is also called 'rotation design'.

The simplest type of counterbalanced measure design is used when there are two possible conditions, A and B. As with the standard repeated measures design, the researchers want to test every subject for both conditions. They divide the subjects into two groups — one group is treated with condition A, followed by condition B, and the other is tested with condition B followed by condition A as shown in Figure 3.1.

Group 1 Treatment A Treatment B Post-test

Group 2 Treatment B Treatment A Post-test

Fig. 3.1 Experiment to Show Counterbalanced Measure Design

(c) ***Solomon Four Group Design:*** The sample is randomly divided into four groups. Two of the groups are experimental samples, whereas the other two groups experience no experimental manipulation of variables. Two groups receive a pretest and a post-test. Two groups receive only a post-test. Table 3.3 shows the effect of a particular teaching method on the following groups.

Table 3.3 Solomon Four Group Design

Group		**Pre-test**	**Treatment**	**Post-test**
a)	R	No	No	No
b)	R	No	Yes	No
c)	R	Yes	No	No
d)	R	Yes	Yes	No

Table 3.4 shows a teaching experiment using the Solomon design where testing before and without treatment have similar results, whilst results after teaching are significantly improved. This indicates that the treatment is effective and not subject to priming or learning effects.

Table 3.4 Pre-and Post-Testing

Group		**Pre-test**	**Treatment**	**Post-test**	**Pre-result**	**Post-result**
a)	R	No	No	No	3	10
b)	R	No	Yes	No	4	5
c)	R	Yes	No	No		9
d)	R	Yes	Yes	No		3

3.6.5 Internal and External Validity 'in Experimental Research

Internal Validity

Internal validity is considered as a property of scientific studies which indicates the extent to which an underlying conclusion based on a study is warranted. This type of warrant is constituted by the extent to which a study minimizes systematic error or 'bias'. If a causal relation between two variables is properly demonstrated then the inferences are said to possess internal validity. A fundamental inference may be based on a relation when the following three criteria are satisfied:

1. The 'cause' precedes the 'effect' in time (temporal precedence).
2. The 'cause' and the 'effect' are related (covariation).
3. There are no plausible alternative explanations for the observed covariation (non-spuriousness).

Internal validity refers to the ability of a research design for providing an adequate test of an hypothesis and the ability to rule out all plausible explanations for the results but the explanation being tested. For example, let us consider that a researcher decides that a particular medication prevents the development of heart disease because he found that research participants who took the medication developed lower rates of heart disease than those who never took the medication. This interpretation of the study's results is likely to be correct, however, only if the study has high internal validity. In order to have high internal validity, the research design must have controlled the directionality and third-variable problems, as well as for the effects of other extraneous variables. In short, the researcher would have needed to perform an experimental study in which:

- Participants were randomly assigned to the experimental and control groups.
- Participants did not know whether they were taking the medication.

The most internally valid studies are experimental studies because they are better than correlational and case studies at controlling for the directionality and third-variable problems, as well as for the effects of other extraneous variables.

Threats to Internal Validity

The following are the various threats to internal validity:

Ambiguous Temporal Precedence: Lack of precision about the occurrence of variable, i.e:, which variable occurred first, may yield confusion that which variable is the cause and which is the effect.

Confounding: Confounding is a major threat to the validity of fundamental inferences. Changes in the dependent variable may rather be attributed to the existence or variations in the degree of a third variable which is related to the manipulated variable. Rival hypotheses to the original fundamental inference hypothesis of the researcher may be developed where spurious relationships cannot be ruled out.

Selection Bias: It refers to the problem that, at pre-test, differences between existing groups that may interact with the independent variable and thus be 'responsible' for the observed outcome. Researchers and participants bring to the experiment a myriad of characteristics, some learned and others inherent. For example, sex, weight, hair, eye, and skin color, personality, mental capabilities and physical abilities, etc. Attitudes like motivation or willingness to participate can also be involved. If an unequal number of test subjects have similar subject-related variables during the selection step of the research study, then there is a threat to the internal validity.

Repeated Testing: It is also referred to as testing effects. Repeatedly measuring or testing the participants may lead to bias. Participants of the testing may remember correct answers or may be conditioned to know that they are being tested. Repeatedly performing the same or similar intelligence tests usually leads to score gains instead of concluding that the underlying skills have changed for good. This type of threat to internal validity provides good rival hypotheses.

Regression toward the Mean: When subjects are selected on the basis of extreme scores (one far away from the mean) during a test then this type of threat occurs. For example, in a testing when children with the had reading scores are selected for participating in a reading course, improvements in the reading at the end of the course might he due to regression toward the mean and not the course's effectiveness actually. If the children had been tested again before the course started, they would likely have obtained better scores anyway.

External Validity

External Validity is considered as the validity of generalized (causal or fundamental inferences in scientific studies. It is typically based on experiments as experimental validity. In other words, it is the degree to which the outcomes of a study can be generalized to other situations and people.

If inferences about cause and effect relationships which are based on a particular scientific study may be generalized from the unique and characteristics settings, procedures and participants to other populations and conditions then they are said to possess external validity. Causal inferences possessing high degrees of external validity can reasonably be expected to apply:

- To the target population of the study, i.e., from which the sample was drawn. It is also referred to as population validity.
- To the universe of other populations, i.e., across time and space.

An experiment using human participants often employ small samples which are obtained from a single geographic location or with characteristics features is considered as the most common threat to external validity. Due to this reason, one cannot be certain that the conclusions drawn about cause and effect relationships do actually apply to people in other geographic locations or without these particular features.

External validity refers to the ability of a research design for providing outcomes that can be generalized to other situations, especially to real-life situations. For instance, if the researcher in the hypothetical heart disease medication study found that the medication, under controlled conditions, prevented the development of heart disease in research participants, he would want to generalize these findings to state that the medication will prevent heart disease in the general population. However, let us consider that the research design required the elimination of many potential participants, such as people who abuse alcohol or other drugs, suffer from diabetes, weigh more than average for their height, and have never suffered from a mood or anxiety disorder. These are common risk factors for heart disease and, by eliminating these factors; the outcomes of the study would provide little evidence that the medication will be effective for people with these risk factors. In other words, the study would have low external validity and, hence, its outcomes to the general population could not be generalized.

This commonly happens in tests of antidepressant medications. Because researchers want to make sure that the antidepressant effects of the medications being tested are not hidden by the effects of extraneous variables, they often have excluded potential participants with one or more of the following characteristics:

- People who are addicted to alcohol or illicit drugs.
- People who take various medications.
- People who have anxiety disorders (such as, phobic disorders).
- People who suffer from depression with psychosis.
- People with mild depression (because they would show only a small response to the medication).

If a study excluded people with these characteristic features, then most of the participants suffering from depression would be excluded from the final pool of participants. The outcomes of the study, therefore, would provide little information about how most depressed people will respond to the medication.

Threats to External Validity

A threat to external validity is an explanation of how you might be wrong in making a generalization. Usually, generalization is limited when the cause, i.e., independent variable depends on other factors; therefore, all threats to external validity interact with the dependent variable.

- **Aptitude-Treatment Interaction:** The sample may have specific characteristic features that may interact with the independent variable, limiting generalization. For example, inferences based on comparative psychotherapy studies often employ specific samples (e.g. volunteers, highly depressed, no comorbidity). If psychotherapy is found effective for these sample patients, will it also be effective for non-volunteers or the mildly depressed or patients with concurrent other disorders?
- **Situation:** All situational features, such as treatment conditions, time, location, lighting, noise, treatment administration, investigator, timing, scope and extent of measurement, etc. of a study potentially limit generalization.
- **Pre-Test Effects:** If cause and effect relationships can only be found when pretests are carried out, then this also limits the generality of the findings.
- **Post-Test Effects:** If cause and effect relationships can only be found when post-tests are carried out, then this also limits the generality of the findings.
- **Reactivity (Placebo, Novelty and Hawthorne Effects):** If cause and effect relationships are found they might not be generalized to other situations if the effects found only occurred as an effect of studying the situation.
- **Rosenthal Effects:** Inferences about cause-consequence relationships may not be able to generalize to other investigators or researchers.

3.7 QUALITATIVE RESEARCH

Qualitative research is a specific method of inquiry used in various different educational disciplines. Qualitative researchers aim to collect an in-depth perceptive of human activities and the reasons that govern such activities. Typically, the qualitative method exceptionally investigates the ‘why’ and ‘how’ of decision-making along with ‘what’,

‘where’ and ‘when’. Consequently, the researchers use the smaller but focused samples rather than large samples.

Qualitative researchers have several alternatives related to data collection, such as qualitative research interview, grounded theory practice, narratology, story telling, classical ethnography or shadowing. Besides, the qualitative researchers categorize the data into specific modules for organizing and analysing results. Typically, the qualitative researchers rely on the following methods for collecting required information:

- Participant Observation
- Non-Participant Observation
- Field Notes
- Reflexive Journals
- Structured Interview
- Semi-Structured Interview
- Unstructured interview
- Analysis of Documents and Materials

The techniques of participating and observing may differ from situation to situation. Some of the distinctive qualitative methods include the use of focus groups and key informant interviews. One of the traditional and specialized forms of qualitative research is termed as cognitive testing or pilot testing which is specifically used to develop quantitative survey objects. Survey objects are piloted on study participants to test the reliability and validity of the objects.

The qualitative researchers use various different research approaches or research designs in the educational researches. Some of the most commonly used qualitative research approaches are as follows:

- Basic/Generic/Pragmatic Qualitative Research
- Ethnographic Research
- Grounded Theory
- Phenomenological Research
- Philosophical Research
- Critical Social Research
- Ethical inquiry
- Foundational Research
- Historical Research

Qualitative research is thus a generic term specifically used for investigative methodologies. It emphasizes the use of the significant variables in their natural surroundings.

3.7.1 Phenomenological Research

Applied to research, phenomenology is the study of phenomena: their nature and meanings, i.e., the descriptive study of how individuals experience a phenomenon. The phenomenological research describes the ‘subjective reality’ of an event as perceived by the population under study; thus it is the study of a phenomenon. The underlying principle of the phenomenological approach is to elucidate and identify the phenomena

through how they are perceived by the actors/samples in a situation. In case of human samples, this usually involves collecting 'in-depth' information and perceptions through inductive, qualitative methods, such as interviews, discussions and participant observation, and then representing it from the perspective of the research participant(s).

Phenomenology is typically concerned with the study of experience from the perspective of the individual, 'bracketing' taken-for-granted assumptions and standard techniques of perceiving. Epistemologically, phenomenological approaches are exclusively based in a paradigm of individual knowledge and subjectivity, and emphasize the significance of personal perspective and interpretation. As such these are considered as powerful tools that help to understand subjective experience, gain insights into people's motivations and actions, and evaluate taken-for-granted assumptions and conventional wisdom.

Phenomenological approaches can be characteristically applied to single cases or to serendipitous or intentionally selected samples. Several methods can be used in phenomenological based research, including interviews, conversations, participant observation, action research, focus meetings and analysis of personal details.

The objective of qualitative phenomenological research is to describe a 'lived experience' of a phenomenon. Since this is a qualitative analysis of narrative data, hence methods used to analyse the data must also be quite different as compared to traditional or quantitative methods of research.

Data Collection

To collect data for processing meaningful information in a phenomenological study, the participant can depict their own live phenomenal experience. The research tools used can be an interview to collect the participants' explanations of their own experience or the participants written or oral self-report, or even their aesthetic expressions, such as, art, poetry, narratives, etc. The researcher should attempt to be non-directive as much as possible in giving the instructions. Encourage the participant to provide a full description of their own experience which may include their thoughts, feelings, images, sensations, memories along with a description of the circumstances in which the experience actually happened.

Data Analysis

The data analysis is also very significant aspect of any research because if the data is not analysed logically and accurately then the purpose of the research conducted will be unsuccessful. The most important principle of analysis of phenomenological data is to utilize an emergent policy that will support the technique of analysis to pursue the data analysis process in such a way that the original nature of the data remains intact. For example, the approach used for analysing artistic depictions of experience must be different from narratives or interview data. Though in all types of cases under analysis, the focus should be on to evidently understand the significance and meaning of the description.

Foundational Concepts for Research

The phenomenological researcher aims to provide affluent textured description of live experiences. The term live experience typically refers to a key perception and the focus of investigation for phenomenological study.

The live experiences include the world of objects that are around us as we perceive them and our own live experience about our self, body and relationships. Characteristically, it is the ***"Locus of interaction between ourselves and our perceptual environments and the world of experienced horizons within which we meaningfully dwell together."*** It can be described as the world that is lived and experienced, i.e., a world that emerges significantly to consciousness in its qualitative approach. This lived world is considered pre-reflective as it automatically occurs before a person think about it or put it into narrative language. Typically, the lived world includes the day-to-day world that is completely filled with multifaceted meanings which structure the background of everyday actions and interactions.

Phenomenology inquires, "What is this kind of experience like?", "What does the experience mean". "How does the lived world present itself to anyone general or to any participant under study?" The phenomenological researchers face the following two challenges:

- How to help participants express their world as directly as possible?
- How to explicate these dimensions such that the lived world is revealed?

Implications revealed by the researcher essentially depend on the researcher's attitude and the approach the researcher poses questions. Especially, the researcher intends to **'bracket'** or suspend earlier assumptions or realizations to understand and analyse the phenomenon as it appears.

3.7.2 Ethnographic Research

Ethnography is a qualitative research method that is used by anthropologists to describe a culture of a group, e.g., what are the characteristics of a particular group.

Culture is defined in many ways but usually comprises origins, values, roles, as well as material items linked to a particular group of people. Ethnography research, therefore, seeks to comprehensively describe a large number of aspects of a cultural group in order to enhance the understanding of the subjects of the study.

Ethnographic research focuses on local as well as foreign cultures and seeks to understand native people — those who are isolated from modern civilization. One of the famous anthropologists, who undertook research of this nature, was Margaret Mead. Her renowned study of three New Guinea cultures explored the gender characteristics and roles of these cultures. By examining a large number of cultural norms, gender characteristics and roles, this type of research enables scientists to categorize key characteristics of each gender. Several ethnographic studies have provided significant detail of cultural roles that challenge the Western perspectives of gender characteristics.

The orientation or mindset of the researcher undertaking ethnographic studies is termed 'ethic' or 'emic'. The ethic orientation refers to the view from the perspective of an outsider.

Assumptions

Research that follows the *critical approach* differs from research that follows the *descriptive* or *interpretive* approaches. The latter have historically adopted a more detached, objective and value-free assessment of knowledge, although there is some degree of convergence between the critical and descriptive approaches in contemporary ethnography. Critical approaches are aligned with the post-enlightenment philosophical

tradition which believes in situating research within its social context. This enables the researcher to consider how knowledge is influenced by the values of human beings and communities, implicated where there are power struggles, and critical in the process of democratizing relationships as well as institutions. The critical approach questions dichotomies such as the separations of theory and method, interpretation and data, subjective and objective, and ethics and science. The method also specifically questions the treatment of the second term in each pair as constituting valid research. Critical ethnography views these binary constructs as being interconnected and making mutual contributions to the body of knowledge.

Ethnography accepts a complicated theoretical orientation toward culture. Culture, expressed by collections of humans of varying characteristics and magnitude such as educational institutions, student bodies or classes, or activity groups, is treated as heterogeneous, conflicted, negotiated, and evolving, as opposed to unified, cohesive, fixed and static. It should also be noted that while cultures carry the 'different-but-equal' view, critical ethnographv openly assumes that cultures are not positioned equally in power relations. Further critical ethnography assumes that the descriptions of culture are shaped by the biases of the researcher, the project sponsors, the audience, or the dominant communities. Hence, cultural representations are deemed to be partial and partisan. Studies that adopt the ethnographic approach should be conducted against the backdrop of the theoretical assumptions behind this research initiative.

Data

- Provides evidence of cohabitating or spending considerable time with people who are in the study setting, by observing and recording their activities as they unfolded through notes or journals, (Emerson, Fretz and Shaw, 1995), audio and video recordings, or both. One of' the trademarks of ethnography is the extended and first-hand participant observations of their interactions with participants in the study setting.
- Records participants' beliefs as well as their attitudes through typical means such as notes or transcriptions of informal conversation and interviews, as well as participant journals (Salzman, 2001).
- Includes multiple sources of data. Besides observation and interactions with participants, these sources can include life histories (Darnell, 2001) or narrations (Cortazzi, 2001), photography, audio or video recordings (Nastasi, 1999), written documents (Brewer 2000), data that describes historical trends, as well as questionnaires and surveys (Salzman, 2001).
- Often called for in critical ethnography (and also in several cases of descriptive or interpretive ethnography), to use additional sources of data and reflection including:
    (i) Evidence to show how the differences in power between you and the informants or subjects were addressed. It is idealistic to assume that differences in power may be totally eliminated, and hence what must be addressed is how these differences were managed, amended, or moved and also the influence that they had on the data gathered.

(ii) The attitudes as well as biases towards the community and its culture. There needs to be a record of how perspectives got modified as the research progressed and how these modifications impacted the data that was collected.

(iii) The impact that your behaviour and activities have had on the community. One must state if one was personally involved in the ethical, social, or political challenges faced by the community. The data should also contain the manner in which this involvement could have provided deeper insights or impacted the research (and also the manner in which the tensions were addressed).

(iv) Expose the contradictions in the statements made by the insiders or informants. Rather than opting for a particular data set over another, or attempting to tie up all the loose ends in order to arrive at generalizations, one should wade through the diverse insider perspectives in order to more accurately represent the complex nature of the culture.

(v) A wider insight and understanding of the context within which the culture prevails. Context creation is a continuous activity taking place even as the informants are interacting with the researcher. However, the data must expose the manner in which external forces outside the community shape culture. A study of the manner in which local culture is shaped by social and political institutions and also obtains pre- and post-research data on the status of the culture.

Analysis and Interpretation of Data

The *emic* perspective addresses the attitudes, beliefs, behaviours, and practices of the participants. This assists in achieving the objective of ethnography which is to develop a comprehensive understanding of how people embedded in specific contexts experience and react to their social and cultural worlds.

- **Ethic perspective** refers to situations in which the researcher approaches outsiders to analyse various behaviours or phenomena related with the culture under study.
- **Symbols** refer to any material such as architecture technology as a source of information. Ethnographic researcher uses these symbols in understanding the participant's behaviour.
- **Tacit knowledge** refers to deep and hidden information about cultural beliefs and assumptions, but this knowledge is never formally or informally discussed with the participants. Researchers use this knowledge individually.
- **Practice reflexivity** is an introspective process of self-examination and self-disclosure of one's own background, identity or subjectivity, as well as assumptions that are made and which may determine biases in data collection and in its interpretation.
- **Approach** the data discovery and analysis in a manner that is inductive and recursive. Be aware that patterns, categories and themes will evolve as data collection progresses and be cautious not to impose these up front.
- **Evidence of triangulation should be depicted in the report**. It is the systematic process of scanning multiple data sources of information and deriving conclusions so as to confirm or disregard evidence.

- **Specific context and particular time period are important features of ethnographic knowledge:** This is because of its first-hand and experiential nature. However, most modern ethnographers acknowledge that the cultures being studied are unstable and ever-evolving. They pay attention to exploring how embedded and interdependent they are with broader socio-cultural contexts.
- It must be noted that a large number of ethnographers accept and expose heterogeneity and diversity within the cultures being studied. This is despite the fact that ethnographic reports often present abstractions and generalizations about attitudes, behaviours, and beliefs of these cultures.
- It thus provide evidence of how the tensions embedded in the research have been interpreted with openness while taking into account their complexity as follows:
  (i) Between the standpoint of the insider (emic) and outsider (ethic). We usually bring a relative outsider status and generalized ethic perspectives and can therefore offer certain interpretations which are not available to the insiders.
  (ii) Between the macro and micro perspectives on the culture. The strength of ethnography is its localized, detailed and grounded perspective. However, local culture is greatly impacted by global forces which emerge from ideological, economic, and geopolitical structures. Sensitivity to and understanding of the macrolevel impact on local culture provides important insights into the prospects for community empowerment.
  (iii) Between the structural and the temporal. While descriptive ethnography has always placed a value on capturing the historical present (i.e., culture understood as an independent and well-constructed static system), critical ethnography believes that culture is exposed to historical influences and also itself shapes history, even though it is considered autonomous from other social institutions.
  (iv) Between interpreting and explaining. Critical ethnography takes into account that culture, if regarded as ideology, may result in misinterpretation of social life. In the same way, a culture that is simply accepted and lived out is not always flexible for the insiders to experience relevant reflection. If one displays adequate respect and sensitivity to the community, one may be in a position to explain some of the questions and contradictions that are unresolved following the informant's interpretation.
  (v) Between the parts and the whole of the culture. By explaining the tensions in a culture, one achieves a consistency and uniformity about the entire community that basically serves to stereotype, essentialize, and generalize its culture. Hence, a critical interpretation must not oversimplify but, on the other hand, should represent all the complexity, instability and diversity of the culture.

Between the different subject positions of the researcher. The researcher should be flexible and have a reflexive approach; should understand and interpret personal biases, backgrounds, and identities (such as race, religion, ethnicity, class, gender, region) both within the field and outside; and acknowledge the ways that these can affect the research and cultural representation.

3.8 CASE STUDY

Case study leads to very novel idea and is no longer limited to the particular individual. In a case study, an investigator tries to collect bits of information in support of a proposition. Case study methodology is not longitudinal study but depends on the methods of information about the individual as far as possible. It is the intensive study of a phenomenon, but it gives subjective information rather than objective.

The credit of introducing case study method in social research goes to Fredric Le Play (1806-l882) who used this method in studying family budgets. Thereafter, Herbert Spencer used this method in his ethnographic studies. But Burgess is of the view that, 'Spencer was notoriously guilty of amassing all favourable cases to prove a point, in utter disregard of negative cases'. Dr. William Healy, a psychiatrist was among the first to adopt this case study method in his work with delinquents. Among the historians who used this method, mention maybe made of Arther S. Urik, George E. Mowry and John Gunther. Some of the anthropologists and ethnologists have utilized this method for their detailed description of primitive and modern cultures.

According to P.V. Young, 'case study is a method of exploring and analysing life of a social unit'. Charles Horton Cool says that, 'case study depends on our perception and gives us clearer insight into life'.

According to H. Odum, 'the case study method is technique by which an individual factor whether it be an institution or just an episode in the life of an individual or a group is analysed in its relationship of any other in the group'.

3.8.1 Characteristics of Case Study

Like every other method in social research, the case study method has some important characteristics which are briefly discussed below:

(i) First important characteristic of this method is that the social unit which is picked up for study is comprehensively studied in its entirety. All aspects are deeply and thoroughly studied. Various factors which act or interact on that unit are carefully studied. In this study, both qualitative and quantitative aspects are given full weight and consideration is given to family, group and community life of the individual, group or even of the community as a whole.

(ii) In this method, the approach of study is direct and neither abstract nor indirect.

(iii) Another characteristic of this method is that it studies both 'what and why'. In the first instance, the researcher investigator tries to describe complex behaviour patterns of a unit. After that has been done, his next attempt is to discover such factors which will rationally account for them. In other words, it can be said that he aims to describe as well as explain the units which are studied. Not only this, he also tries to explain the behaviour of the unit in social surroundings and set-up.

(iv) In this method, the whole approach is not quantitative but qualitative. The idea is not merely to collect information but to go in depth into the life of the person concerned.

(v) In this method the researcher can pick up for his study only one social unit. While studying, effort is made to know the mutual inter-relationship of several factors.

This method tries to integrate the individual units in a manner that its integrity and wholesomeness can be preserved. In this, all unifying bonds are created so that diverse elements are brought together in a well knit unit system. In this system, the individual, family, institution or group is considered as a unified whole.

The six types of case studies are:

(i) A group or a community case study.

(ii) Casual comparative studies.

(iii) Activity analysis.

(iv) Content or document analysis.

(v) A follow-up study.

(vi) Trend studies.

Criteria for a Good Case Study

The essential characteristics of a satisfactory case study are as follows:

- **Continuity:** There should be desirable continuity of information provided by two successive psychological examinations and by an elementary school record in relation to performance in high school.
- **Completeness of data:** In so far as possible, the potential range of data or information includes symptoms, examination results and history.
- **Validity of data:** A doubtful birth date may be verified through the bureau of vital statistics and employment record by referring to employers.
- **Confidential recording:** Educational workers have something to learn from medicine with respect to the confidential nature of professional records, the difficulties of individual teachers or pupil in relation to discipline, failure, achievement should be recorded as professional problems to be treated in a confidential manner.
- **Scientific synthesis:** This is an interpretation of the evidence that is more than a mere enumeration of data secured, it embraces diagnosis in identifying casual factor, and prognosis in looking toward treatment or developmental procedure.

3.8.2 Stages of a Case Study

In the case study method, there are normally three stages, which need to be completed before the whole study is complete. These are briefly discussed as under:

- If the unit is to be studied as a whole, it is essential that there should be a broad array of data, no matter whether such a unit is a social relationship, a group or a person. In the words of Goode and Hatt: ‘Although mere quantity of data is not sufficient since the collection must be guided by research problem, there is greater opportunity to grasp the pattern of an individual’s life if a substantial body of data concerning many facts of that is available.’
- The case study method is further distinguished by the use of data from other abstract levels than the purely sociological. Recourse to other levels gives added dimensions to the individual being studied. It is rightly pointed out that when an individual is seen in his total network of relationship, it is more difficult to lose sight of him as unit.

- Goode and Hatt are of the view that in the case study method, indices and types are most important and as such proper care should be taken in their formation. According to them: 'However, the most important technique in preserving the wholeness of social unit is the development of typologies and indexes; so that the various traits are actually used in characterizing the units. It is equally essential that the data collected should be timely processed.'

  The steps to be followed for a case study are:

  (i) **Statement of the Problem:** In this respect, it is essential that the problem should be clearly stated and specified. It should be clearly stated as to what types of cases have been selected for the study and how many of these cases have actually been picked up for the study. The statement should also show as to what are the types of units which have been picked up, and what is the scope of analysis once the data has been collected.

  (ii) **Description of Events:** The next step is description of events. It is a very essential step and implies that every unit must be carefully and clearly studied. As already mentioned, carrying out a case study means in-depth extensive and quantitative study of a subject. Accordingly, in this method, no event can either be partially or completely missed or its study can be slightly overlooked, neglected or underestimated in any manner.

  (iii) **Factors of Influence:** There are different factors which influence a social unit. Nobody can underestimate the importance of these factors, which can be both general and particular. Such factors can be those which may have influenced a social unit directly or indirectly. If a case study is to be considered complete, it is essential that in the first instance these factors should be identified and then each such factor should be very carefully and thoroughly studied. Usually, indirect factors are given less importance as compared with direct factors. It is essential that this tendency should be avoided in case it is desired that the study should be completed and perfect.

  (iv) **Analysis of Data:** In this method of study, a social unit can be an individual/ group or a particular community. The investigator collects data from his social unit and makes records taking into consideration various influences and factors. Once the data has been collected, it should be carefully and properly recorded and analysed. As in the case of every other method of social research, in this case also, both at the data collection and analysis stage no biases or prejudices should be introduced.

3.8.3 Sources of Information for a Case Study

Case studies can be prepared with the help of personal documents, life histories and other similar sources. Personal documents, as the name itself indicates, relate to the personal lines of people. These give a lot of information about episodes connected with the lives of the individuals, the place(s) at which the episodes occurred also help in knowing concepts, attitudes and experiences of the persons concerned. The documents also help in knowing the circumstance of those happenings and stages through which a person had to pass. With the help of personal documents, ample light is thrown on the personal life of the individual, which otherwise would have remained obscure. Information about the mental make-up and psychological thinking of the person with whom the documents are

connected are also provided as is information about social relationships and whether the person concerned was socially placed in an advantageous and disadvantageous position. If the person concerned has been frank in his personal documents, then many secrets, which can be very useful for research purposes, can come to light. In short, in the case study method, personal documents play an important role.

Another source of information is 'life history' which incorporates various events of the life of a person and also their significance to society. Such life histories not only narrate events but also discuss motives and the significance of each event to the individual on the one side and the society on the other. In life histories, the data is collected by interviewing the person himself and the people associated or working with him. A good historical account is one which gives detailed information about the respondent right from his infancy to his old age. Obviously, such a history can be prepared only when material is taken both from written sources and with the help of interviews.

In addition to these two direct and important sources, there are certain indirect sources of information which include books and magazines, literature and previous studies, government documents and communications which are issued from time to time and made public.

3.8.4 Comparing the Statistical and Case Study Techniques

In some respects statistical techniques and case study method differ from each other, whereas in many other respects these frequently supplement each other. While discussing the relationship between the two, P.V. Young says: 'A case study seeks to determine social processes, it reveals the complexity of factors and indicates their sequences and their interrelationship. Statistical studies on the other hand, deal with relatively few factors but are able to provide scope by indicating extent, frequency, trends and degree of association.

Also, statistics confirm or disprove hypothesis in studies of social changes, social adjustments and maladjustments. These also help in determining existing correlations and aid in avoiding conclusions based on exceptional cases. Statistical studies of human behaviour can be enriched if supplemented by individual case studies.

But there are certain basic differences between the case study and statistical techniques. One difference between the two is that statistical techniques are quantitative, whereas case study techniques are qualitative and do not much care about quantity. Another difference is that in the statistical method there is no in-depth study. Particular aspects of numerous methods are only studied. On the other hand, in case studies there is a deep and thorough study of each aspect of the case and thus there is all-round probing.

In so far as a case study is concerned, there is no question of sample size because a sample is picked up only when it is not possible to study the whole universe of study thoroughly. Since in a case study, the whole case is completely and thoroughly studied from all angles and proper care is taken of the past, present and future, the question of samples does not arise. On the other hand, in the statistical method samples are studied and thus there is a difference between the two in this regard as well.

In the statistical method there is no stress on emotional aspects of the subject matter because emotions cannot be quantified. Thus, in the statistical method there is only a formal and generalized approach to the whole problem. On the other hand, in the case

study method, emotions play a very important role. In fact, it is difficult to study a case without taking into account the emotions which influenced a person when he was performing a particular action. Without properly accounting for emotions, research cannot properly study either an individual or a social phenomenon.

Another difference is that in the statistical method strictly mathematical techniques and qualifications are used and as such there is very little scope for the use of general knowledge. On the other hand, in the case study method conclusions are drawn on theoretical basis and as such quality and general knowledge play an important role in it.

Keeping in view the interrelationship between the two, on the one hand, and differences on the other, it can be said that both are closely linked with each other and thus inter-connected and inseparable, in the words of Goode and Hatt, 'the statistical and case worker may profit by borrowing from each other than by quarrelling over the merits of their respective techniques.' The statistical studies help and guide in the selection of units for case study. Secondly, a prior case study may help the statistician, in developing a final questionnaire and finally, both analysis and processing of material has to be treat statistically to confirm or reject the hypothesis and to determine a more precise correlation. In the word of M.H. Gopal, the case study has to turn to statistics, if its data are frequencies, types, trends, uniformities, patterns and so on'.

3.8.5 Advantages and Disadvantages of the Case Study Method

Case study method has its own value and difficulties. Some advantages are as follows:

- **Helps in the Formulation of Hypothesis:** One important advantage of this method is that case studies help in the formulation of hypotheses. Every researcher, before finalizing his hypothesis and questionnaire tries to get a proper analysis of many cases which centre around his subject problem. Preliminary study of the process is greatly facilitated by case documents, incorporating the pertinent data which will guide the later stages of research.
- **Intensive Study Possible:** Another advantage is that with the help of this method, it becomes possible to intensively study a unit from all aspects and this leads to deep probing, which is very essential for research work.
- **Helps in Understanding Behaviour Patterns:** One more advantage of this method is that being an exhaustive study, this method enables the researcher to understand behaviour patterns of the concerned unit directly and he can obtain information about the inner workings of the person concerned.
- **No Need of Sampling:** Sampling, as we know, involves many serious problems. Usually, there is a complaint that some biases and personal prejudices have found entry in the sample. It is a method in which there is no need to pick up any sample and as such all the defects of the sampling method do not get introduced in this method of study.
- **Study of Subjective Aspects:** It is with the help of this method that subjective aspects can be studied. This method lays stress on the psychology of the person concerned, behaviour of the individual, circumstances in which be placed himself and his reaction to certain situations of life and so on. It is with the help of the study that subjective aspects can be studied as thoroughly, as possible.

- **Helps Studying Social Changes:** The case study method also helps in studying social changes by thoroughly studying different facets of social units and changes which came with the passing of time by making certain inferences. It is an important method for understanding the past of a social unit and suggests measures for improvement in the present context.
- **Helps in Removing Defects of Research:** This is a method in which the case studied is the same throughout. It then becomes possible to find out, locate and identify possible defects which may creep in a full-scale study. In this way, this method helps in removing many defects of a full-fledged study.
- **Helps in Comparative Studies:** With the help of this method, two different sets of cases can be picked up and compared. Though in actual practice it is not possible to pick up two types of cases, but once that has been done, it becomes easy to compare the two and as such comparative study becomes both easy and possible.
- **Increases Knowledge:** When a researcher or an investigator studies all aspects of a social unit, both past, present and likely future and no aspect of the problem is left out, then his knowledge helps both in that particular study and in all his subsequent research work. In this way this method provides a very good training ground for social science researches.

The case study method has its advantages but along with it there are certain disadvantages as well. The difficulties in the operation of this method need careful study. They are as follows:

- **False Sense of Prestige:** A difficulty is that the researcher develops a false sense of prestige. In the words of Goode and Hatt: 'The researcher comes to feel a false sense of certainty about his own conclusions. The danger then does not lie in any technical weakness of this approach but to social processes or individual as a whole.' The result of this certainty is that there is a temptation to ignore basic principles of research designs. As the researcher feels so very certain about the area of experience he is investigating, he feels no need to check the overall design of study.
- **No Method of Checking:** In this method, an investigator is assigned the responsibility of preparing a case history and study a particular case. He collects some information with some labour and provides that to society. But there is no method of checking the information, because no other investigator is working on the same or similar case. Thus, whatever information is supplied by the researcher that must be accepted. This is not healthy for an objective research.
- **Danger of Subjectivity:** In this method of study, there is every danger of subjectivity because in it the researcher is too closely associated with the social unit under study. The greater the rapport, the more subjective is the whole study. The subject then is more likely to be self-justificatory than factual.
- **Comparison Not Possible:** In social research, the investigator is to deal with human beings. They are quite different from each other. There values, attitudes, behaviours, reactions, circumstance, etc., very widely differ from each other. Accordingly, it is very difficult to find out two identical cases. As such it is not possible to compare two case studies, because no two case studies can be similar.

- **It is Time Consuming:** A case history can be prepared after a lot of labour. In fact, the whole process is very time consuming. The investigator has to study the case from all aspects and also its past, present and likely future. Not only this, his behaviour, approaches and attitudes on the one hand and the circumstances on the other are also required to be studied.
- **Possibility of Wrong Conclusions:** In this method, the investigator tries to arrive at certain conclusions on the basis of a case study. But it is always possible that the conclusions drawn on the basis of one case study may be wrong. In this way, the researcher may draw wrong conclusions to the disadvantage of society as a whole.
- **Reliability of Source Material:** A case study is prepared with the help of diaries, memories and personal papers and records of the persons concerned. Usually when a person records his life events, he does not give the true picture and considerable colouring is added. Usually more stress is laid on the strong and brighter side, whereas the weaker side is either concealed or underestimated and in many cases even sidelined and ignored. It is more or less impossible to remove colours from the events with the result that the conclusions drawn are coloured ones and thus undependable.
- **False Generalization:** In a case study, only one social unit is studied on the basis of conclusions drawn, efforts are made to derive certain gene conclusions, which is not good for society, particularly, when no set rules are followed in case studies.
- **Too Much Dependence on Memory:** In a case study, the individual case history is prepared by interviewing him and asking him questions what his past, circumstances under which he behaved in a particular manner, and so on. In this way, he is required to lay too much stress on his memory. There is every chance that the memory may fail him and he may not gist true information or he may remember certain events.
- **Time Gap:** In a case study where the individual is a social unit, and he asked to justify his past actions, there is every possibility that the information supplied may be undependable because of the time gap between actual time of action and the time at which he is being questioned. Obviously it will need sufficient time to think, to justify his actions according to changing situations and social considerations and so on, but a social researcher cannot afford waiting so long.
- **Tendency to Give Easy Answers:** Usually when a person is approach by a researcher to give information about certain happenings with which he has been closely associated, he picks up the easiest way of answering the questions, so that time is saved and there is controversy. He will therefore prefer to be very brief in giving answers or will simply avoid the researcher by saying, 'I do not remember' or 'I do not know' and so on. This tendency becomes even more pronounced when his investigator is a stranger and the social unit does not know him.

The problems are of course there, but a question arises as to whether it is possible in any way to avoid these difficulties. One such method of avoiding the difficulties is that the researcher should use an adequate sampling pattern.

The case study method is thus a method of study in which the researcher is expected to play a comparatively more important role as compared with any other method of study.

Since it is difficult to find good and expert researchers, it can be said that this method should he used only when it has been ascertained that competent are available to do justice to the work.

ACTIVITY

1. Write an article using the steps of experimental research as outlined in the unit. The topic is 'Operation Tiger'.
2. Design a survey for school children to gauge what sports they would like to incorporate in the school curriculum.

DID YOU KNOW

Simple random sampling is the process of selecting a sample that allows individual in the defined population to have an equal and independent chance of being selected for the sample.

3.9 SUMMARY

- The qualitative technique provides depth and detailed information for research. Depth and detail emerge through direct questioning and careful descriptions and will vary depending upon the nature and purpose of a particular study.
- In the quantitative technique, the data are studied from a variety of angles to explore the new facts. Analysis requires an observant, flexible and open-mind, it is worthwhile to prepare a plan of analysis before the actual collection of data.
- Historical research attempts to establish facts so as to arrive to conclusions concerning past events. It is a process by which a researcher is able to reach a conclusion as to the likely truth of an event in the past, studying objects available for observation in the present.
- The terminology of descriptive survey research is designed to obtain pertinent and precise information concerning the existing status of phenomena and, whenever possible, to draw valid generalizations for the facts discovered without making any interference or control over the situation. Such type of studies arc restricted not only to fact finding but may often result in the formulation of important principles of knowledge and solution of significant problems concerning local, state, national and international issues.
- In experimental research, variables are manipulated and their effect upon other variables is studied. Experimental research provides a systematic and logical method for answering the question. Experimenters manipulate certain stimuli, treatment or environmental conditions and observe how the condition or behaviour of the subject is affected or changed. Their manipulation is deliberate and systematic.
- Qualitative research is a specific method of inquiry used in various different educational disciplines. Qualitative researchers aim to collect an in-depth perceptive of human activities and the reasons that govern such activities.
- The qualitative method exceptionally investigates the 'why' and 'how' of decision making along with 'what', 'where' and 'when'.

- The techniques of participating and observing may differ from situation to situation. Some of the distinctive qualitative methods include the use of focus groups and key informant interviews.
- Qualitative research is a generic term specifically used for investigative methodologies. It emphasizes the use of the significant variables in their natural surroundings.
- The phenomenological research describes the 'subjective reality' of an event as perceived by the population under study; thus it is the study of a phenomenon. The underlying principle of the phenomenological approach is to elucidate and identify the specific phenomena through how they are perceived by the actors/samples in a situation.
- Phenomenology is typically concerned with the study of experience from the perspective of the individual, 'bracketing' taken-for-granted assumptions and standard techniques of perceiving.
- Epistemologically, phenomenological approaches are exclusively based in a paradigm of individual knowledge and subjectivity, and emphasize the significance :1 of personal perspective and interpretation.
- The objective of qualitative phenomenological research is to describe a 'lived experience' of a phenomenon. Since this is a qualitative analysis of narrative data, hence methods used to analyse the data must also be quite different as compared to traditional or quantitative methods of research.
- The phenomenological researcher aims to provide affluent textured descriptions of live experiences. The term live experience typically refers to a key perception and the focus of investigation for phenomenological study.
- Ethnographic research studies various national and foreign cultures to gain an understanding about native people who are isolated from civilization.
- The case study method is a technique by which an individual factor whether it be an institution or just an episode in the life of an individual or a group is analysed in I its relationship with any other in the group.

3.10 KEY TERMS

- **Content analysis:** A research technique for the objective, systematic, and quantitative description of the manifest content of communication
- **Tabulation:** The process of transferring classified data from data-gathering tools to the tabular form in which they may be systematically examined
- **Sample survey:** Gathering relevant information about a smaller representation I of the population under study
- **Variable:** Any feature or aspect of an event, function or process that, with its presence and nature, affects some other event or process which is being studied
- **Ethnography:** A qualitative research method that is used by anthropologists to describe a culture of a group

3.11 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Qualitative technique seeks to describe or explain psycho-social events from the point of view of people involved.
2. Computers help in organizing data by developing systematic and comprehensive classification schemes using code numbers for different categories and sub-categories.
3. Two methods of tabulation are: (i) Hand tabulation and (ii) Modern mechanical aids like the computer.
4. While interpreting results, researchers should keep in mind the influence of unstudied factors and also not ignore selective factors.
5. Historical research has some unique characteristics. It is non-experimental research, so no variables are directly manipulated by the researcher. It relies heavily on source materials from the past.
6. The two sources of historical research are: (i) Primary source and (ii) Secondary source.
7. Two types of historical research are: (i) Legal research and (ii) Biographical research.
8. Two advantages of historical research are that firstly, the researcher is not physically involved in the situation under study and secondly, there is no danger of experimenter-subject interaction.
9. Survey research can include a status quo study or a study in which the interrelationships of sociological or psychological variables are determined and summarized.
10. In longitudinal surveys, one explores the status of variables as investigated on different points in time in order. Through such studies the changes in the status of the variables over a period of time are explored.
11. Descriptive surveys provide information on how to achieve a goal, by exploring possible ways and means on the basis of the experience of others or opinions of experts.
12. Descriptive research is the most widely used research method in education because at times, descriptive surveys are the only means through which opinions, attitudes, suggestions for important educational practices and instruction, and other data can be obtained.
13. In experimental research, variables are manipulated and their effect upon other variables is studied. Experimental research provides a systematic and logical method for answering the question. Experimenters manipulate certain stimuli treatment or environmental conditions and observe how the condition or behaviour of the subject is affected or changed. Their manipulation is deliberate and systematic.
14. A pre-test is the test that is administered to the subjects before the independent variable, and a post-test is the test that is administered to the subjects after the independent variable is applied.
15. The qualitative researchers rely on the following methods for collecting required information:

- Participant Observation
- Non-Participant Observation
- Field Notes
- Reflexive Journals
- Structured Interview
- Semi-Structured Interview
- Unstructured Interview
- Analysis of Documents and Materials

16. The live experiences include the world of objects that are around us as we perceive them and our own live experience about our self, body and relationships. Characteristically, it is the "Locus of interaction between ourselves and our perceptual environments and the world of experienced horizons within which we meaningfully dwell together." It can be described as the world that is lived and experienced, i.e., a world that emerges significantly to consciousness in its qualitative approach. This lived world is considered pre-reflective as it automatically occurs before a person think about it or put it into narrative language. Typically, the lived world includes the day-to-day world that is completely filled with multifaceted meanings which structure the background of everyday actions and interactions.
17. Ethnography is a qualitative research method that is uscd by anthropologists to describe a culture of a group.
18. The objective of ethnography is to develop a comprehensive understanding of how people embedded in specific contexts experience and react to their social and cultural worlds.
19. A 'case study' is an intensive investigation of a social unit that may be an individual a student or any organization.
20. An advantage of the case study method is that it can remove the defects of research by in-depth study of the subject.

3.12 QUESTIONS AND EXERCISES

Short-Answer Questions

1. Write a short note on the qualitative methods used by researchers to explore diverse issues.
2. List the limitations of historical research.
3. Which are the three strategies used to analyse educational concepts?
4. What is the purpose of descriptive surveys?
5. Name some most commonly used qualitative research methods.
6. List the limitations of the case study method.

Long-Answer Questions

1. Differentiate between the quantitative and qualitative methods of research in detail.

2. What should the researcher keep in mind while interpreting results using the quantitative technique?
3. Elaborate on the steps involved in historical research.
4. Describe the different types of surveys in the descriptive method.
5. Explain the two most commonly used method for qualitative research.
6. What are the essential characteristics of a case study? Discuss with the help of examples.

3.13 FURTHER READING

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UNIT-IV

TOOLSAND TECHNIQUES IN EDUCATIONAL RESEARCH

Structure

4.0. INTRODUCTION

To carry out the types of research investigation described in the preceding chapters, the researcher must gather data with which to test the hypothesis or answer the questions. Many different methods and procedures have been developed to aid in the acquisition of data. These tools employ distinctive way of describing and quantifying the data. Each is particularly appropriate for certain sources of data, yielding information of the kind and in the form that can be most effectively used.

Many writers have argued the superiority of the interview over the questionnaire if the use of the psychological test over the interview. The late Arvil S. Barr, University of Wisconsin teacher and researcher, resolved discussion of this short 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. Some researchers become pre-occupied with one method of inquiry and neglect the potential of others. Examining the publications of some authors shows that many studies use the same method applied to many different problems, possibly indicating that the authors have become attached to one particular method and choose problems that are appropriate to its use.

There is probably too much dependence upon single methods of inquiry. Because data-gathering procedure or device has its own particular weakness or bias, there is merit in using multiple methods, supplementing one with others counteract bias and generate more adequate data. Students of research should familiarize themselves with each of these research tools and attempt to develop skills in their use and sensitivity to their effectiveness in specific situations.

The main aim of research is to discover principles that have universal application. Generally, research in education includes all such assumptions that are based on a large number of samples/units/objects. It would be impractical if not impossible to test or observe each unit of population under controlled conditions in order to arrive at principles having universal validity. 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 'sample' is a small percentage of the larger group who are selected for research. A sample can be statistically explained as being a subset of a population. The sample will be able to give an idea of the characteristics of the larger group from where it has been drawn. It is possible to make deductions about the larger population on the basis of the sample. This unit discusses the concept of population and sample, methods of sampling, sampling design, sampling distribution and sampling errors.

In this unit, some of the most commonly used tools or techniques for data collection like observation, questionnaire, interviews and sociometry are discussed. Each of these tools differs in their nature and scope. The researcher has to keep in mind the suitability of these tools, i.e., relevancy and effectiveness depending upon the type of problem under consideration. In this unit, you will also learn the concept of a research proposal, written and oral reports. An effective written report is a creative activity that requires a lot of imagination.

4.1. UNIT OBJECTIVES

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

- Discuss the importance of various tools of educational research like observation, questionnaires, interviews and sociometry
- Apply the tools of education research practically
- Describe various probability and non-probability sampling methods
- Explain the significance of sampling techniques in education research
- Specify the steps involved in sampling
- Describe the types of sampling
- Explain the different methods of sampling distribution
- Describe the concept of sampling errors
- Explain the concept of a research proposal
- Discuss the essentials of a research process
- Learn the characteristics of a good report
- List the precautions for writing research reports
- Explain the significance of written and oral reports

➢ INQUIRY FORMS

Those data gathering instruments through which respondents answer questions or respond to statements in writing are known as inquiry forms. Common Inquiry forms used to collect data are observation, interview, sociometry, rating scale and questionnaire etc.

4.2. Observation

When observation is used in qualitative research, it usually consists of detailed notation of behaviours, events and the contexts surrounding the events and behaviours. On the other hand, in qualitative research, observation is usually employed to collect data regarding the number of occurrence in a specific period of time or the duration, of very specific behaviours or events. Observations have lead to some of the most important scientific discoveries in human history. Charles Darwin used his observations of animal and marine life at the Galapagos Islands to help him formulate his theory of evolution that he described in *On the Origin of Species*. Today, social scientists, natural scientists, engineers, computer scientists, educational researchers and many others use observations as a primary research method. The kind of observations one makes depends on the subject being researched. Traffic or parking patterns on a campus can be observed to ascertain what improvements could be made. Clouds, plants, or other natural phenomena can be observed as can people, though in the case of the latter one may often have to ask for permission so as to not violate any privacy issue.

4.2.1. Concept of Observation Method

Observation method is one of the commonly used methods of data collection. Observation may be defined as the process in which one or more persons monitor some real-life situation and record pertinent occurrences. It is used to evaluate the overt behaviour of the individual in controlled and uncontrolled situations.

According to Jahoda: ‘Observation method is a scientific technique to the extent that it (a) serves a formulated research purpose, (b) is planned systematically rather than occurring haphazardly, (c) is systematically recorded and related to more general propositions than presented as a set of interesting curios, and (d) is subjected to checks and controls with respect to validity, reliability, and precision much as is all other scientific evidence.’

According to Good and Hatt: ‘Observation may take many forms and is at once the most primitive and the 2most modem of research techniques. It includes the most casual, uncontrolled experiences as well as the most exact film records of laboratory experimentation.’

4.2.2. Types of Observation

On the basis of nature and conditions of observation we can categorise into different types.

1) **Participant Observation**

If the observer is directly observe the situation making himself/herself a member of the group is called as participant observation. In the process of 'participant observation' the observer becomes more or less one of the group members and may actually participate in some activity or the other of the group here the observer directly experiences the activities of the members of the group. The observer can observe the natural behaviour of the observee.

2) **Non-Participant Observation**

If the observer is not a part of the group and he/she observes the situation from outside it is called non-participant observation. In the process of 'non-participant observation', the observer takes a position where his/her presence is not felt by the group. He/she may follow the behaviour of an individual or characteristics of one or more groups closely. In this type of observation, a one-way 'vision screen' permits the observer to see the subject but prevents the subject from seeing the observer.

3) **Structured Observation**

When the observation is characterized by a careful definition of the units to be observed, the style of recording the observation, standardized conditions of observation and the selection of pertinent data of observation at that time it is called as structured observation. Structured observation works according to a plan and involves specific information of the units that are to be observed and also about the information that is to he/she recorded. The operations that are to be observed and the various features that are to be noted or recorded are decided well in advance. Such observations involve the use of special instruments for the purpose of data collection that are also structured in nature.

4) **Unstructured Observation**

When the observation is not planned or designed previously it is called as unstructured observation. Especially it is used in descriptive studies. In the case of unstructured observation, its basics are diametrically against the structured observation. In such observations, the observer has the freedom to note down what he/she feels is correct and relevant to the point of study. This approach of observation is very suitable for exploratory research.

5) Controlled Observation

Controlled observations are the observations made under the influence of some external forces. Such observations rarely lead to improvement in the precision of

the research results. However, these observations can be very effective if these are made to work in coordination with mechanical synchronizing devices, film recordings, etc.

6) Uncontrolled Observation

If the observation is carried on the natural environment without making any changes in the situation, it is known as uncontrolled observation. It is reverse to the controlled observation these observations involve no influence or guidance of any type of external force.

7) Direct Observation

With the help of the direct method of observation, one comes to know how the observer is physically present in which type of situation is he present and then this type of observation monitors what takes place.

8) Indirect Observation

Indirect method of observation involves studies of mechanical recording or the recording by some of the other means like photographic or electronic. Direct observation is relatively straightforward as compared to indirect observation.

4.2.3. Recording Techniques of Observation

Many different techniques may be employed to study and document a subject's behaviour the data collection techniques are all accurate but may be suitable for different purposes. While certain methods help gather detailed descriptions of behaviour, certain others facilitate documenting behaviour promptly and with bare minimum description.

- **Anecdotal Records:** Anecdotal records refer to a few sentences jotted down in a notebook. These sentences pertain to what the subject is engaged in at a particular moment. Only those behaviours that can be seen or heard and that can be counted are documented while creating an anecdotal record.
- **Narrative Description:** Narrative description is also known as running behaviour record and specimen record, and is a formal method of observation. When following this technique, you are supposed to record continuously, as detailed as possible, what the subject is doing and saying when alone or when interacting with other people. In its methodology, it is similar to anecdotal record but is definitely more detailed. The researcher studies the context setting, the behaviour patterns, and the order in which they take place. The main aim of this technique is to gain an objective description of a subject's behaviour without conjecture, analysis, or assessment.

- **Checklists:** Checklists are usually standardized forms which list specific skills and behaviours based on standard levels, or are specifically compiled by the researcher for a particular research study.
- **Interviewing:** In this observation technique, the researching team tries to identify the subject's feelings or beliefs that are not visible through simple observation. During the process of interviewing, everything that the subject says must be recorded exactly as is. The interviewer should avoid any kind of editing of the interview subscript.
- **Time Sampling:** This method is distinct from others in two ways— it monitor and keeps account of a few chosen samples of subject's behaviour, and only during prearranged periods of time. When a behaviour pattern is seen during the specified time interval, it is recorded. This technique therefore helps to gather representative examples of behaviour.
- **Frequency Counts:** In some cases, a researcher may be more interested in studying the frequency of an occurrence or behaviour or another pattern, such as how often a consumer buys a particular product or how often an individual started a conversation with a colleague. To get this data, the researcher will need to keep a count of the frequency of the particular behaviour and study how long the behaviour lasts. This is usually done by simply marking an occurrence on a chart each time the behaviour is repeated.
- **Event Sampling:** This technique is focused on observing specific behaviours or events in a subject's behaviour pattern. However, it does not take into account the frequency or the length of the recording interval.

4.2.4. Steps of Observation

In order to obtain valid and reliable data through an observation procedure the researcher must follow the following steps.

1. **Planning for the observation**

At this stage the researcher must define the specific activities to be observed. The units of behaviour to be observed must be decided. The researcher should determine the nature of the groups of the subject to be observed, the scope and length of the observation. The tools to be used during the observation should also be decided at this stage.

2. **Executing the observation**

This is the stage when the real work of observation is done. The researcher should make arrangement of the specific conditions for the subject or subjects to be

observed. He/she should assume the proper physical position for observing specific activities or units if behaviour under observation. At this stage the researcher has to handle the recording instruments properly.

3. **Recording the observation**

Recording of the observation may be done at the time of observation or soon after the observation is over. If the recording is done at the time of observation, the observer may record it in writing or he/she may use some electronics medium like tape recorder, of concealed camera, one way vision screen etc. but when the recording is made after the observation is over at that time the observer may record the facts in writings for different aspects of behaviour.

4. **Interpreting the observation**

The next step in observation is to interpret the observed data. It must be done without any business or influence of his/her personal attitude and values. The emotional involvement of the observer or his/her selective perception may increase the subjectivity of interpretation.

4.2.5. Advantages of Observation

The advantages of observation are as follows:

i. This technique is employed to observe characteristics of various designs of school buildings and equipment.
ii. For coaching purposes, an observation of various skills in games and athletics is made.
iii. A study of the significant aspects of personality which express themselves in behaviours can he made.
iv. The behaviour of the children in a classroom situation can he effectively analyzed.
v. The behaviour of those who cannot read, write or speak can be observed.
vi. Observation of skills in the workshop is made directly.
vii. Observation of pupils' behaviour as recorded in the cumulative records of pupils could serve as anecdotal evidence and supply data for research studied.

4.2.6. Disadvantages of Observation

The disadvantages of observation are as follows:

i. It is very difficult to establish the validity of observations.

ii. Many items of observation cannot be defined.
iii. The problem of subjectivity is involved.
iv. Observation may give undue stress to aspects of limited significance simply because they can be recorded easily, accurately and objectively.
v. Various observers observing the same event may concentrate on different aspects of a situation.
vi. The observer has little control over the physical situation.
vii. Children being observed become conscious and begin to behave in an unnatural manner.
viii. Many children try to pose and exhibit at the time of observation.
ix. There are certain situations which the observer is not allowed to observe, and he is helpless in that way to produce an accurate account.
x. It may not be feasible to classify all the events to be observed.
xi. Observation is a slow and laborious process.
xii. There may be lack of agreement among the observers.
xiii. The data to be observed may be unmanageable.
xiv. Observation needs competent observers and it may be difficult to find them.
xv. Observation is a costly affair. It involves lot of expenses on travelling, staying at the places where the event is taking place and purchase of sophisticated equipment.

4.2.7. Characteristics of Observation for Research

The characteristics of observation for research are as follows:

i. Observation schedule should be specific.
ii. Steps should be systematic.
iii. It should be quantitative.
iv. It should be recorded immediately.
v. It should be made by experts.
vi. Schedule should be scientific. We should be able to check and substantiate the results.

Symonds gives a list of nine essential characteristics of good observation:

i. Good eyesight
ii. Alertness
iii. The ability to estimate
iv. The ability to discriminate
v. Good physical condition
vi. An immediate record

vii. Good perception
viii. Freedom from preconceptions
ix. Emotional disinterest

Check Your Progress

1. What are two types of Observation? 2. Mention three limitations of observation.

3. What is participant observation? 4. Give three advantage of observation.

5. Mention one point for planning effective observation.

4.3. Questionnaire

The questionnaire is a widely used and useful instrument for collecting survey information, providing structured, often numerical data, being able to be administered without the presence of the researcher, and often being comparatively straightforward to analyse (Wilson and McLean 1994). These attractions have to be counterbalanced by the time taken to develop, pilot and refine the questionnaire by the possible unsophistication and limited scope of the data that are collected, and from the likely limited flexibility of response (though, as Wilson and McLean (1994: 3) observe, this can frequently be an attraction). The researcher will have to judge the appropriateness of using a questionnaire for data collection, and, if so, what kind of questionnaire it should be.

A questionnaire is a tool for research, comprising a list of questions whose answers provide information about the target group, individual or event. Although they are often designed for statistical analysis of the responses, this is not always the case. This method was the invention of Sir Francis Galton. Questionnaire is used when factual information is desired. When opinion rather than facts are desired, an opinionative or attitude scale is used. Of course, these two purposes can be combined into one form that is usually referred to as 'questionnaire'. Questionnaire may be regarded as a form of interview on paper. The procedure for the construction of a questionnaire follows a pattern similar to that of the interview schedule. However, because the questionnaire is impersonal, it is all the more important to take care of its construction. A questionnaire is a list of questions arranged in a specific way or randomly, generally in print or typed and having spaces for recording answers to the questions. It is a form which is prepared and distributed for the purpose of securing responses. Thus a questionnaire relies heavily on the validity of the verbal reports. According to Goode and Hatt, in general, the word questionnaire refers to a device for securing answers to questions by using a form which the respondent fills himself'. Barr, Davis and Johnson define questionnaire as, 'a questionnaire is a systemic compilation of questions that are submitted to a sampling of population from which information is desired' and Lundberg says, 'fundamentally,

questionnaire is a set of stimuli to which literate people are exposed in order to observe their verbal behaviour under these stimuli'.

Questionnaire is the most popular and easy means to collect data. Especially in educational research questionnaire are widely used. A questionnaire can be directly administered in an individual or group of individuals of it can be mailed to them for the purpose of data collection. Generally when the target population or sample cannot be contacted personally at that time it is mailed. When a questionnaire is administered personally, the person administering the tool has an opportunity to establish rapport with the respondent to explain the purpose of the study, and to explain the meaning of the questions to the respondent.

4.3.1. Types of Questionnaire

According to the nature of the questions used in a questionnaire, it can be classified into two types such as:

a) Closed form
b) Open form

a) Closed Form

Questionnaire that calls for short, check-mark responses are known as closed-form type or restricted type. They have highly structured answers like mark a yes or no, write a short response or check an item from a list of suggested responses. For certain type of information, the closed form questionnaire is entirely satisfactory. It is easy to fill out, takes little time, keeps the respondent on the subject, is relatively objective and is fairly easy to tabulate and analyze.

For example-

Put a tick mark against your answer

How did you obtain your Bachelors' degree?

(a) As a regular student

(b) As a private student

(c) By distance mode.

Closed form questionnaire is very much useful collecting certainty of information. These types of questionnaires are very suitable for research purposes. However, construction of such type of questionnaire requires a lot of labour and thought. It is generally lengthy as all possible alternative answers are given under each question.

b) Open Form

Those questionnaires which call for a free response in the respondent's own words are called as the open form or unrestricted questionnaires. The responses have greater depth as the respondents have to give reasons for their choices. The drawback of this type of questionnaire is that not many people take the time to fill these out as they are more time consuming and require more effort, and it is also more difficult to analyse the information obtained.

Example: Why did you choose to obtain your graduation degree through correspondence?

No alternative or plausible answers are provided. The open form questionnaire is good for depth studies and gives freedom to the respondents to answer the questions without any restriction.

Limitations of open questionnaire are as follows:

- They are difficult to fill out.
- The respondents may never be aware of all the possible answers.
- They take longer to fill.
- Their returns are often few.
- The information is too unwieldy and unstructured and hence difficult to analyse, tabulate and interpret.

Some investigators combine the approaches and the questionnaires carry both the closed and open form items. In the close ended questions, the last alternative is kept open for the respondents to provide their optimum response. For example, 'Why did you prefer to join B.Ed. programme? (i) Interest in teaching (ii) Parents' wish (iii) For securing a government job (iv) Other friends opted for this (v) Any other.'

c) Pictorial Form

Pictorial questionnaires contain drawings, photographs or other such material rather than written statements and the respondents are to choose answers in terms of the pictorial material. Instructions or directions can be given orally. This form is useful for working with illiterate persons, young children and persons who do not know a specific language. It keeps up the interest of the respondent and decreases subjects' resistance to answer.

4.3.2. Principles for Constructing Questionnaire

As we have discussed the questionnaire serves as an important tools for data collection. Therefore the researcher must carefully construct, administer and analyze the data gathered from a questionnaire. The following principles help a researcher in constructing good questionnaire:

1. **The objective of the questionnaire must be clearly stated:** The questions in the questionnaire must convey the exact meaning and objective of each question. The questions should be so prepared that it motivates the respondent to communicate the desired information.
2. **The terms that may easily be misinterpreted should be clearly defined:** There are some common words like 'how much', 'new', 'value' etc may be misinterpreted by the respondent. Therefore the words must be clearly defined or stated.
3. **Descriptive objectives and adverbs that have no agreed upon meaning should be used carefully:** Sometimes the words like 'frequently', 'occasionally' and 'rarely' do not have same meaning to all. One respondent's occasionally may be another's rarely.
4. **Adequate alternatives should be given**: Sometimes the alternatives given in the question may not be sufficient for respondent. For example if we are asking " are you married?" with alternatives yes/no. a person who is 'widowed' or 'divorced' or 'separated' feels puzzled to answer the question.
5. **Double negative statements should be avoided:** In the questionnaire, no double negative statements should be given.
6. **Double barreled questions should be avoided:** These questions should be divided into two separate questions.

Example-

Do you agree that the slow learners should be placed in homogeneous groups and taught in separated classes?

Here a respondent may agree for homogeneous grouping but may not agree for separate class.

7. **Questions should be so framed that they are appropriate for all respondents:** The questions should not be framed keeping a particular individual in mind. It should be general enough, so that it will be general enough to suit all respondents.
8. **The questions should be so designed that it will demand a complete response:** While framing questions for a questionnaire, they should demand a complete response.

9. **While framing questions the information level of the respondents must be kept in mind:** If the questions are above the informational level of the respondent, it may result in resentment and embarrassment among the respondents.
10. **The questionnaire should be such that it is responses are according to social acceptability:** If the responses threat to the respondent's ego, if the respondent feels it is socially unacceptable, the respondent will hesitate to answer the questionnaire. There should be no embarrassing or annoying statements.
11. **The question should be objective with no leading suggestions:** There are certain words which involve the respondent emotionally, either favourably or un favourably in a particular culture. These emotionally loaded words should not be used in a question.
12. **Each question should include a single idea or single reference:** In a questionnaire, in one question only one idea should be presented. The arrangement of question should be made in such a manner that they permit the ideas of respondent to flow logically.
13. **The questionnaire should not be too long:** If too many questions are presented in a single questionnaire the respondent feels tired to answer the question.
14. **Tryout the questionnaire on a sample:** Questionnaire is prepared it must be tried out on sample in order to justify its validity or reliability.
15. **Determine the validity of the questionnaire:** On the basis of the try out results the researcher should determine the validity of the questionnaire. It means the questionnaire should be related to the topic and behaviour under investigation.
16. **Determine the reliability of the questionnaire:** Reliability means consistency. So the questionnaire must be consistent from the administration point of view. Some experts opine that putting cross questions we can also check the reliability of the questionnaire.

4.3.3. Questionnaire Administration Modes

A. *Decisions about question content*
   a) Is the question necessary? Just how will it be useful?
   b) Are several questions needed on the subject matter of this question?
   c) Do respondents have the information necessary to answer the question?
   d) Does the question need to be more concrete, specific and closely related to the respondent's personal experience?
   e) Is the question content sufficiently general and free from spurious concreteness and specificity?
   f) Do the replies express general attitudes and only seem to be as specific as they sound?
   g) Is the question content biased or loaded in one direction, without accompanying questions to balance the emphasis?
   h) Will the respondents give the information that is asked for?

B. *Decisions about question wording*
   a) Can the question be misunderstood? Does it contain difficult or unclear phraseology?
   b) Does the question adequately express the alternative with respect to the point?
   c) Is the question misleading because of unstated assumptions or unseen implications?
   d) Is the wording biased? Is it emotionally loaded or slanted towards a particular kind of answer?
   e) Is the question wording likely to be objectionable to the respondent in any way?
   f) Would a more personalized wording of the question produce better results?
   g) Can the question be better asked in a more direct or a more indirect form?

C. *Decisions about form of response to the question*
   a) Can the question best be asked in a form calling for check answer (or short answer of a word or two, or a number), free answer or check answer with follow-up answer?
   b) If a check answer is used, which is the best type for this question – dichotomous, multiple-choice ('cafeteria' question), or scale?
   c) If a checklist is used, does it cover adequately all the significant alternatives without overlapping and in a defensible order? Is it of reasonable length? Is the wording of items impartial and balanced?
   d) Is the form of response easy, definite, uniform and adequate for the purpose?

D. *Decisions about the place of the question in the sequence*
   a) Is the answer to the question likely to be influenced by the content of preceding questions?
   b) Is the question led up to in a natural way? Is it in correct psychological order?
   c) Does the question come too early or too late from the point of view of arousing interest and receiving sufficient attention, avoiding resistance, and so on?

Main modes of questionnaire administration are:

i. Through Mail: Mailed questionnaires are the most widely used and also perhaps the most criticized tool of research. They have been referred to as a 'lazy person's way of gaining information'. The mailed questionnaire has a written and signed request as a covering letter and is accompanied by a self-addressed, written and stamped envelope for the return by post. The method of mailing out the questionnaire is less expensive in terms of time, funds required; it provides

freedom to the respondent of work at his own convenience and enables coverage of a large population.

ii. **Personal Contact/Face-to-Face:** Personally administered questionnaires both in individual and group situations are also helpful in some cases and have the following advantages over the mailed questionnaire (i) the investigator can establish a rapport with the respondents; (ii) the purpose of the questionnaire can explained; (iii) the meaning of the difficult terms and items can he explained to the respondents; (iv) group administration when the respondents are available at one place is more economical in time and expense; (v) the proportion of non-response is cut down to almost zero; and (vi) the proportion of usable responses becomes larger. However, it is more difficult to obtain respondents in groups and may involve administrative permission which may not be forthcoming.

iii. **Computerized Questionnaire**: It is the one where the questions need to answer on the computer.

iv. **Adaptive Computerized Questionnaire**: It is the one presented on the computer where the next questions are adjusted automatically according to the responses given as the computer is able to gauge the respondent's ability or traits.

4.3.4. Steps Preparing and Administering the Questionnaire

The steps involved in preparing and administering the questionnaire are as follows:

i. **Planning the Questionnaire:** One should get all the help possible in planning: and constructing the questionnaire. Other questionnaires should be studied and items should be submitted for criticism to other members of the class or faculty.

ii. **Modifying Questions:** Items can be refined, revised or replaced by better items. If a computer is not readily available for easily modifying questions and rearranging the items, it is advisable to use a separate card or slip for each item. This procedure also provides flexibility in arranging items in the most appropriate psychological order before the instrument is finalized.

iii. **Validity and Reliability of Questionnaire:** Questionnaire designers rarely deal with the degree of validity of reliability of their instrument. There are ways to improve both validity and reliability of questionnaires. Basic to the validity of a questionnaire is asking questions in the least ambiguous way. The meaning of all terms must be clearly defined so that they have the same meaning to all respondents. The panel of experts may rate the instrument in terms of how effectively it samples significant aspects of content validity. The reliability of the questionnaire may be tested by a second administration of the instrument with a small sub-sample, comparing the responses with those of the first. Reliability may also be estimated by comparing the responses of an alternate form with the original from.

iv. **Try Out or Pilot Testing:** The questionnaire should be tried on a few friends and acquaintances. What may seem perfectly clear to the researcher may be confusing to the other person who does not have the frame of reference that the researcher has gained from living with and thinking about an idea over a long period. It is

also a good idea to pilot test the instrument with a small group of persons similar to those who will be used in the study. They may reveal defects that can be corrected before the final form is printed.

v. **Information Level of Respondents:** It is important that the questionnaire be sent only to those who possess the desired information and are likely to be sufficiently interested to respond objectively and conscientiously. A preliminary card asking whether the individual would respond is recommended by some research authorities.

vi. **Getting Permission:** If the questionnaire is to be used in a public school, it is essential that approval for the project is secured from the Principal. Students should be informed that participation is voluntary. If the desired information is delicate or intimate in nature, the possibility of providing for anonymous responses should be considered. The anonymous instrument is most likely to produce objective and honest responses.

vii. **The Cover Letter:** A courteous, carefully constructed cover letter should be included to explain the purpose of the study. The cover letter should assure the respondent that all information will be held in strict confidence. The letter should promise some sort of inducement to the respondent for compliance with the request. In educational circles, a summary of questionnaire results is considered an appropriate reward, a promise that should be scrupulously honoured after the study has been completed.

viii. **Follow-Up Procedures:** Recipients are often slow to return completed questionnaires. To increase the numbers of returns, a vigorous follow-up procedure may be necessary. A courteous postcard reminding the recipient may bring in some additional responds. A further step in follow-up may involve a personal letter or reminder. In extreme cases, it may be appropriate to send the copy of questionnaire with a follow-up letter.

ix. **Analysing and Interpreting Questionnaire Responder:** Data obtained by the questionnaire is generally achieved through calculation and counting. The totals are converted into proportion or percentages. Calculation of contingency coefficient of correlation is often made in order to suggest probability of relation among data. Computation of chi-square statistics in is also advisable.

4.3.5. Advantages of Questionnaire

As a matter of fact, this method can be applied in a very narrow field. It can be used only if the respondents are educated and willing to cooperate. However, it is still widely used due to the following advantages-

i. **Economical:** The questionnaire requires paper, printing and postage only. There is no need to visit the respondents personally or continue the study over a long period.

ii. **Time Saving:** Besides saving money, the questionnaire also saves time. Data can be collected from a large number of people within a small time frame.

iii. **Most Reliable in Special Cases:** It is a perfect technique of research in some cases.

iv. **Research in Wide Area:** Mailed questionnaire comes very handy if the sample comprises of people living at great distances.
v. **Suitable in Specific Type of Responses:** The information about certain problems can be best obtained through questionnaire method.

4.3.6. Disadvantages of Questionnaire Method

Like all other methods, the questionnaire is also limited in value and application. This means that it cannot be used in every situation and that its conclusions are not always reliable. Limitations of the method are-

i. **Limited Response:** As noted earlier, this method cannot be used with illiterate or semi-illiterate groups. The number of persons who cooperate and respond to the questionnaire is very small.
ii. **Lack of Personal Contact:** There is very little scope of personal contact in this method. In the absence of personal contact, very little can be done to persuade the respondents to fill up the questionnaire.
iii. **Useless In-Depth Problems:** If a problem requires deep and long study, it is obvious that it cannot be studied by the questionnaire method.
iv. **Possibility of Wrong Answers:** A respondent may not really understand a question or may give the answer in a casual manner. In both cases, there is a strong likelihood of misleading information being given.
v. **Illegibility:** Some persons write so badly that it is difficult to read their handwriting.
vi. **Incomplete Response:** There are people who give answers which are so brief that the full meaning is incomprehensible.

Check Your Progress

1. What are the moods of getting information through questionnaire?
2. List two steps to improve the validity of a questionnaire?
3. How can questionnaires be administered?

4.4. INTERVIEW

The interview is a flexible tool for data collection, enabling multi-sensory channels to be used: verbal, non-verbal, spoken and heard. The order of the interview may be controlled while still giving space for spontaneity, and the interviewer can press not only for complete answers but also for responses about complex and deep issues. In short, the interview is a powerful instrument for researchers. On the other hand, the researcher using interviews has to be aware that they are expensive in time, they are open to interviewer bias, they may be inconvenient for respondents, issues of interviewee fatigue may hamper the interview, and anonymity may be difficult. We explore these

several issues in this chapter. An interview is not an ordinary, everyday conversation (Dyer 1995: 56–8). For example, in contrast to an everyday conversation, it has a specific purpose, it is often question-based with the questions being asked by the interviewer; the interviewer alone may express ignorance (and not the interviewee), and the responses must be as explicit and often as detailed as possible. The interview is a constructed rather than naturally occurring situation, and this renders it different from an everyday conversation; therefore the researcher has an obligation to set up, and abide by, the different 'rules of the game' in an interview.

According to Rummel J. Francis, "The interview method of collecting data requires the actual physical proximity of two or more persons, and generally requires that all the normal channels of communication be open to their use. It is necessary to see one another, to hear each other's voices, to understand one another's language, and to use all that is psychologically inherent in physical proximity. It usually entails a non-reciprocal relation between the individuals concerned. One party desires to get information from another one party interviews the other — for a particular purpose."

Theodore L. Torgerson has stated that the interview method of study extends certain aspects of the observational technique.

Thus, the interview method permits the gathering of development data to supplement the cross-sectional data obtained from observations. The interviewer can probe into casual factors, determine attitudes, discover when the problem started, enlist the interviewee in an analysis of his own problem and secure his support of the therapy to be applied.

4.4.1. Purposes of the Interview

The purposes of the interview in the wider context of life are many and varied, for example:

i. to evaluate or assess a person in some respect.
ii. to select or promote an employee.
iii. to effect therapeutic change as in the psychiatric interview.
iv. to test or develop hypotheses.
v. to gather data, as in surveys or experimental situations.
vi. to sample respondents' opinions, as in doorstep interviews.

Although in each of these situations the respective roles of the interviewer and interviewee may vary and the motives for taking part may differ, a common denominator is the transaction that takes place between seeking information on the part of one and supplying information on the part of the other.

4.4.2. Types of Interviews

Basically interview can be categorized mainly into two types. These are as follows:

1. **Structured Interview**

In structured interview, the interviewer follows a predetermined plan of questioning. For this, he/she may use either a checklist or a list of questions. In this type of interview desired data can be collected without omitting anything.

2. **Unstructured Interview**

In unstructured interview, the questions is situational. The interviewers are free to develop the conversation along the lines that seem most suitable to him/her. He/she chooses questions depending upon the situational and the topic about which the data are required. The interviewer is free to decide the form and timing of the questions.

Besides these two categories, there is some other categorization of questionnaire based on different dimensions. These are as follows-

1. **Group Interview:** A proper setting for group interviews requires a group of not more than 10 to 12 persons with some social, intellectual, and educational homogeneity, which ensures effective participation by all. For a full spontaneous participation of all, it is better to arrange a circular seating arrangement.

2. **Diagnostic Interview:** Its purpose is to locate the possible causes of an individual's problems, getting information about his past history, family relations and personal adjustment problem.

3. **Clinical Interview:** Such an interview follows after the diagnostic interview. It is a means of introducing the patient to therapy.

4. **Research Interview:** Research interview is aimed at getting information required by the investigator to test his hypothesis or solve his problems of historical, experimental, survey or clinical type.

5. **Single Interviewer or Panel Interviews:** For the purpose of research, a single interviewer is usually present. In case of selection and treatment purposes, panel interviews are held.

6. **Directed Interview:** It is structured, includes questions of the closed type and is conducted in a prepared manner.

7. **Non-Directive:** It includes questions of the open-end form and allows much freedom to the interviewee to talk freely about the problem under-study.

8. **Focused Interview:** It aims at finding out the responses of individuals to exact events or experiences rather than on general lines of enquiry.

9. **Depth Interview:** It is an intensive and searching type of interview. It emphasizes certain psychological and social factors relating to attitudes, emotions or convictions.

4.4.3. Interview Techniques

Interviewing in itself is an art. If it is done with care it can elicit valid and reliable data. The following research elements or techniques enable the researcher in conducting interview successfully.

a) Preparation for Research Interview

- Decide the category and number of persons that you would like to interview.
- Have a clear conception of the purpose and the information required.
- Prepare a clear outline, a schedule or a check list of the best sequence of questions that will systematically bring out the desired information.
- Decide the type of interview that you are going to use, i.e., structured or non- structured interview.
- Have a well thought-out plan for recording responses.
- Fix up the time well in advance.
- Procure the tools to be used in recording responses.

b) Executing an Interview

- Be friendly and courteous and put the respondent at ease so that he/she talks freely.
- Listen patiently to all opinions and never show surprise or disapproval of a respondent's answer.
- Assume an interested manner towards the respondent's opinion, and as far as possible do not divulge your own.
- Keep the direction of the interview in your own hands and avoid irrelevant conversation and try to keep the respondent on track.
- Repeat your questions slowly and with proper emphasis in case respondent shows signs of failing to understand a particular question.

c) Obtaining the Response

Perhaps the most difficult part of the job of an interviewer is to obtain a specific, complete response. People can often be evasive and answer 'do not know' if they do not want to make the effort of thinking. They can also misunderstand the question and answer incorrectly in which case the interviewer would have to probe more deeply.

An interviewer should be skilled in the technique as only then can he gauge whether the answers are incomplete or non-specific. Each interviewer must fully understand the motive behind the asking of the particular question and whether the answer is giving the information required. He should form the habit of asking himself, 'Does that completely answer the question that I just asked?'

Throughout, the interviewer must be extremely careful not to suggest a possible reply. The interviewer should always content himself with mere repetition (if the question is not understood to answer).

d) Reporting the Response

There are two chief means of recording opinion during the interview. If the question is preceded, the interviewer need only check a box or circle or code, or otherwise indicate which code comes closest to the respondent's opinion. If the question is not preceded, the interviewer is expected to record the response verbatim. The following points may he kept in view in this respect:

- Quote the respondents directly, just as if the interviewers were newspaper reporters taking down the statement of an important official without paraphrasing the reply, summarizing it in the interviewer's own words, 'polishing up' any slang, or correcting bad grammar that distorts the respondent's meaning and emphasis.
- Ask the respondent to wait until the interviewer gets down 'that last thought'.
- Do not write as soon as you have asked the question and do not write while the respondent talks. Wait until the response is completed.
- Use common abbreviations.
- Do not record and evaluate the responses simultaneously.

e) Closing the Interview

It should be accompanied by an expression of thanks in recognition of the respondent's generosity in sparing time and effort.

f) Use of Tape Recorder in Interview

- It reduces the tendency of the interviewer to make an unconscious selection of data favouring his/her bias.

- The tape recorded data can be played more than once and thus it permits a thorough study of the data.
- Tape recorder speeds up the interview process.
- Tape recorder permits the recording of some gestures.
- The tape recorder permits the interviewer to devote full attention to the respondent.
- No verbal productions are lost in a tape recorded interview.
- Other things being equal, the interviewer who uses a tape recorder is able to obtain more interviews during a given time period than an interviewer who takes notes or attempts to reconstruct the interview from memory after the interview has been completed.

4.4.4. Advantages of the Interview Method

As a data collection instruments, interview has the followings advantages-

i. A well-trained interviewer can obtain more data and greater clarity by altering the interview situation. This cannot be done in a questionnaire.
ii. An interview permits the research worker to follow-up leads as contrasted with the questionnaire.
iii. Questionnaires are often shallow and they fail to dig deeply enough to provided true picture of opinions and feelings. The interview situation usually permits much greater depth.
iv. It is possible for a skilled interviewer to obtain significant information through; motivating the subject and maintaining rapport, other methods do not permit such a situation.
v. The respondents when interviewed may reveal information of a confidential nature which they would not like to record in questionnaire.
vi. Interview techniques can be used in the case of children and illiterate persons who cannot express themselves in writing. This is not possible in a questionnaire.
vii. The percentage of response is much higher than in case of a mailed questionnaire.
viii. **Removal of Misunderstanding*:*** The field worker is personally present to remove any doubt or suspicion regarding the nature of enquiry or meaning of any question or term used. The answers are, therefore, not biased because of any misunderstanding.
ix. **Creating a Friendly Atmosphere:** The field worker may create a friendly atmosphere for proper response. He may start a discussion, and develop the interest of the respondent before showing the schedule. A right atmosphere is very conducive for getting correct replies.
x. **Possible to Secure Confidential Interview:** The interviewee may disclose personal and confidential information which he would not ordinarily place in

writing on paper. The interviewee may need the stimulation of personal contacts in order to be drawn out.

xi. **Advantages of Clues:** The interview enables the investigator to follow-up leads and to take advantage of small clues, in dealing with complex topics and questions.

xii. **Permits Exchange of Ideas:** The interview permits an exchange of ideas and information. It permits 'give and take'.

xiii. **Useful in the Case of Some Categories of Persons:** The interview enables the interviewee to deal with young children, illiterates and those with limited intelligence or in who's state of mind is not quite normal.

xiv. **Useful Apart from Research Purposes:** Interviews are also used for pupil counseling, for selection of candidates for instructional purposes, for employment for psychiatric work, etc.

xv. **Possibility of Asking Supplementary *Questions:*** The respondent does not feel tired or bored. Supplementary questions may be put to enliven the whole discussion.

xvi. **Avoiding Handwriting:** The difficulties of bad handwriting of the respondent, use of pencil, etc., are also avoided as every schedule is filled in by the interviewer.

xvii. **A Probe into Life Pattern is Possible:** The personal contact with the respondent enables the field worker to probe more deeply into the character, living conditions and general life pattern of the respondent. These factors have a great bearing in understanding the background of any reply.

xviii. **Reliable Information:** The information gathered through interviews has been found to be fairly reliable.

xix. **Deeper Probe:** It is possible for the interviewer to probe into attitudes, discover the origin of the problem, etc.

xx. **Interview Technique is Very Close to the Teacher:** It is generally accepted that no research technique is as close to the teacher's work as the interview.

xxi. **Useful for Several Purposes:** Interviews can be used for student counselling, occupational adjustment, selection of candidates for educational courses, etc.

xxii. **Wide Applicability:** Interviews can be used for all kinds of research methods normative, historical, experimental, case studies and clinical studies.

xxiii. **Wider Opportunities to Know the Interviewee:** Through the respondent's incidental comments, facial expression, bodily movements, gestures, etc., an interviewer can acquire information that could not be obtained easily by other means.

4.4.5. Disadvantages of the Interview Method

The method of interview, in spite of its numerous advantages, also has the following limitations:

i. **Very Costly:** It is a very costly affair. The cost per case is much higher in this method than in case of mailed questionnaires. Generally speaking, the cost per questionnaire is much less than the cost per interview. A large number of field workers may have to be engaged and trained in the work of collection of data. All this entails a lot of expenditure and a research worker with limited financial means finds it very difficult to adopt this method.

ii. **Biased Information:** The presence of the field worker while encouraging the respondent to reply, may also introduce a source of bias in the interview. At times the opinion of the respondent is influenced by the field worker and his replies may not be based on what he thinks to be correct but what he thinks the investigator wants.

iii. **Time Consuming:** It is a time consuming technique as there is no guarantee how much time each interview can take, since the questions have to be explained, interviewees have to assured and the information extracted.

iv. **Expertness Required:** It requires a high level of expertise to extract information from the interviewee who may be hesitant to part with this knowledge. Among the important qualities to be possessed by an interviewer are objectivity, insight and sensitivity.

Check your Progress

1. Define Interview?
2. Name the various types of interviews.
3. Give one advantage of using a tape recorder in an interview.
4. Name one advantage that the interview has over other methods of research like questionnaire.

4.5.SOCIOMETRY

Sociometry is another technique of data collection in educational research. It enables the researcher to study social adjustments, group dynamics, learning, motivation, discipline and other problem areas which involve social relations. It is the technique that measures the social interpersonal relationship of members of a group. There are several techniques to measure social interaction of groups out of which Sociogram and Socio Matrices are two most commonly used techniques.

Franz defines sociometry as ‘a method used for the discovery and manipulation of social configurations by measuring the attractions and repulsions between individuals in a group’.

It is a technique to study the choices a person makes, the way he communicates and interacts with other people in his group. It is concerned with the dynamics between individuals in a group. In this method, a person is asked to select one or more persons from the group given certain criteria and it is interesting to note who the person would choose.

William J. Goode and others state: ‘These and other variants of sociometric techniques offer rather simple methods of ranking individuals on a continuum of ‘acceptability’ or ‘outgoingness’ on the part of group members. When their use is justified they may be powerful research tools since they meet the general problems of scaling very well.’

4.5.1. Sociometry Test

The key method used in this technique is the ‘sociometric test’. Here, a member of a group is asked to select amongst the other members who they would choose for certain situations. The situation must be a real one to the group under study, e.g., ‘group study’, ‘play’, ‘classroom seating’, class monitor for students of a school, etc. The person can be allowed to make two or three choices depending on the size of the group and each choice can be assigned a level of preference.

For example, if asked to choose from a group of eight who they would like to work with for a group assignment, the person can choose three people stating his preference by numbering them 1, 2 and 3.

Another example would be, each member of a group consisting of 10 students is asked to write his first, second and sometimes third choices about some significant and pertinent type of social setting. He may be asked questions like:

5. Whom would you choose to be the secretary of your debating society?
6. Whom would you like to sit next to you in the class or in the bus while going for a picnic?
7. With whom do you enjoy the most?
8. With whom would you like to work in the science laboratory?
9. With whom would you like to walk home?

All these questions are positive questions and hence show social acceptances. Negative questions may also be given to show social rejections. In the above example, the individual has to name three persons in order of preference.

Data may be tabulated as under:

i. Let the members of the group be numbered from A to J.
ii. Write 'Choosers' in the vertical column and 'Chosen' in the horizontal column.
iii. Total choices received by each member are shown at the bottom.
iv. In the cells, check marks may be shown.
v. Let 'f' stand for first, 's' for second and 't' for third choices respectively.
vi. Add the number of each choice.

A similar table can be prepared for social rejections. In the vertical column will be listed the 'rejecters' and in the horizontal column 'rejectees'.

Given below is an illustrative example of a sociogram table of 15 students.

Table- 4.1: Sociometric Data Table

Sl. No.	Students	Students Choice			Other's Choice to the Student			Total Choice
		1st	2nd	3rd	1st	2nd	3rd	
1	Sureet	3	5	8	2	1	0	3
2	Itishree	11	7	6	2	2	2	6
3	Sandhya	5	2	9	2	3	1	6
4	Manindra	3	1	13	0	0	0	0
5	Binti	10	3	11	0	2	0	2
6	Hena	7	11	15	1	1	1	3
7	Ambika	6	15	2	0	1	0	1
8	Ashima	11	6	13	2	0	3	5
9	Bibhasini	6	5	11	1	0	1	2
10	Prakash	9	3	8	1	1	0	2
11	Lita	2	15	8	2	2	2	6
12	Papun	8	11	15	0	0	0	0
13	Nirod	2	3	15	0	0	2	2
14	Abinash	1	10	2	0	0	0	0
15	Novesh	1	2	3	0	2	3	5

The above table shows that three students Itishree, Sandhya and Lita have been chosen 6 times, and Ashima and Novesh have been chosen 5times. These students may be called as “Stars”, three students Manindra, Abhinash and Papun have not been chosen by anybody. This may be called as ‘Isolate’.

❖ **Guidelines for using this Technique and Interpretation of the Sociomatrix**

- One person should be concentrated on at a time.
- A detailed study of the choices made and received should be made.
- The ‘isolates’ and the ‘starts’ may be looked for. An ‘isolate’ is one whom nobody chooses. Of course he is not rejected. A ‘star’ is a member of the group who receives most of the choices. Here ‘E’ is the ‘star’ with maximum choices in his favour. T’ is an ‘isolate’ with one choice only.
- Attempts should be made to discover the causes for such selections. An individual may be isolated because:
  a) She is a new member of the group.
  b) She has a shy and withdrawing nature.
  c) She does not try to be friends with others.
  d) She may belong to a lower or upper socio-economic level and therefore is not acceptable to the group.
- Look for individuals who select each other. This might be due to factors like:
  a) Close relations.
  b) Neighbours.
  c) Common interests and the like.
- A triangle shows three persons selecting each other. This may be an evidence of cliques, or sharp divisions in the group.

❖ **Simplest Form of Sociometric Matrix**

For finding out the social structure of a group of 10 students, a one line questionnaire is given to the students asking ‘Who would you like to be the secretary of your club? Students would be asked to mark against one of the roll members. Thereafter, the results are tabulated.

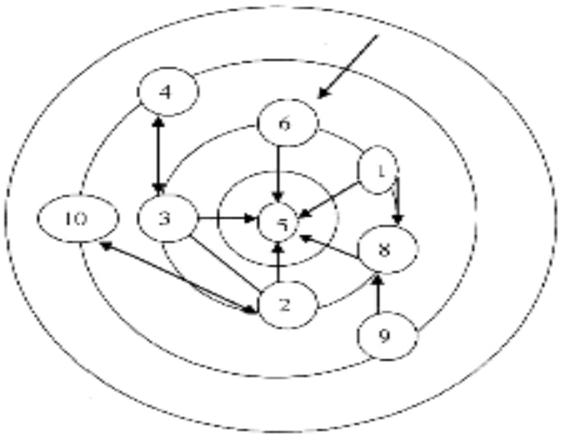

Fig. 4.2. Sociometric Matrix Showing Who Chooses Whom

Interpretation

- Student No. 5 is the 'star' as she has been chosen by the maximum number of students.
- Student Nos. 7 and 9 did not get any choice. This indicates that they tended to be isolated, i.e., not being social.
- Student No. 2 and 8 came next to roll No. 1. •Student No. 5, i.e., the star has preferred roll No. 2.
- Mutual choices were: 2 and 5; 3 and 4; and 2 and 10.

4.5.2. Role of the Research Worker

In general, the research worker can work on three points:

i. Providing opportunities for developing friendly relations.
ii. Improving social skills of the group.
iii. Building up competency for among the group members.

Reliable results can be achieved only when all the members constituting a group are fully acquainted with each other. The worker of the counsellor must establish friendly relations with the members of the group so that they may give their frank opinion about an individual or individuals.

4.5.4. Advantages of Sociometry

Followings are the major advantages of Sociometry-

i. This technique helps us get an idea of the group at a glance.
ii. This enables us to form appropriate groups of students for carrying out various activities and projects.
iii. Such tests at different times enable us to find out the changes taking place in the group structure.
iv. It is useful in enabling us to understand the characteristics of an individual who is liked or disliked by the group. It gives an insight into the qualities of leadership which arc appreciated by a particular group and helps us to compare one group with the other.
v. It is very helpful for the guidance worker who studies the pupil relationships.
vi. It helps us to compare one group with the other.

Check Your Progress

1. Define the term sociometry?
2. Define the purpose of the sociometry test?
3. Write the advantage of the sociometric technique.

4.6. RATING SCALE

Rating scale is one of the significant techniques used in context with inquiry form. It is a specific term used to define expression or judgment regarding some situation, object or character. Basically, these opinions are expressed or rated on a scale of values. The values are rated using rating techniques, a strategy by which such judgments can be quantified. Rating scale thus is extremely useful method to assess quality, especially when it is difficult to measure quality objectively. For example, 'How good was the performance?' is such a question which cannot be answered objectively. Rating scales record the judgment or opinions and then specifies the degree or amount of different degrees of quality. All these degrees are typically arranged along a line as the rating scale as shown below.

Excellent Very Good Good Average Below Average Poor Very Poor
____|_____|_____|_____|_____|_____|____ _|____

These rating scales are used to measure the performance degree of answers given by an individual selected as a sample. Also these degrees of rating scale are used by organizations/offices for making appraisals. Typically, it provides a scale for rating/assigning values to each trait being rated a scale value giving a valid estimate of its status and then comparing the separate ratings into an overall score. The traits are the

abilities, behavioural characteristics and performance of individual that can be judged and evaluated through suitable rating scales. These are, in general, of two types qualitative scales and frequency scales. Qualitative scales rate the quality or characteristics of the behaviour or performance using terms like ‘excellent’ and ‘very poor’, as illustrated below (for a biology class):

The trait or characteristic to be rated: **Laboratory skill/handling of the apparatus / taking readings and reporting observations.**

5	4	3	2	1
Excellent	Good	Average	Poor	Very Poor

In frequency scales, the frequency of a behaviour is to be rated by using terms ranging from ‘always’ to ‘never’ as shown below.

The skill or behaviour to be rated: **Solves numerical problems with proper steps and relevant diagrams.**

5	4	3	2	1
Always	Frequently	Sometimes	Rarely	Never

4.7. SAMPLING TECHNIQUES IN EDUCATIONAL RESEARCH

The quality of a piece of research stands or falls not only by the appropriateness of methodology and instrumentation but also by the suitability of the sampling strategy that has been adopted (Morrison 1993: 112–17). Questions of sampling arise directly out of the issue of defining the population on which the research will focus. Researchers must take sampling decisions early in the overall planning of a piece of research. Factors such as expense, time, and accessibility frequently prevent researchers from gaining information from the whole population. Therefore they often need to be able to obtain data from a smaller group or subset of the total population in such a way that the knowledge gained is representative of the total population (however defined) under study. This smaller group or subset is the *sample*. Experienced researchers start with the total population and work down to the sample. By contrast, less experienced researchers often work from the bottom up, that is, they determine the minimum number of respondents needed to conduct the research (Bailey, 1978). However, unless they identify the total population in advance, it is virtually impossible for them to assess how representative the sample is that they have drawn.

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 NIOS, the National Institute of Open Schooling. For assessing the study habits of adolescent girls in a city, all the adolescent girls of that city who are studying in schools and colleges, make up the population for this study.

Usually, the population covers a very large group of people or objects making ai accurate record of all the characteristics in the population are impossible. Researchers rarely survey the entire population for two reasons—the cost is too high and the population is dynamic in that the individuals making up the population may change over time. The population may be classified as real, artificial or hypothetical. A real population is one which actually exists.

A ‘sample’ is a small percentage of the larger group who are selected for research. A sample can be statistically explained as being a subset of a population. The sample will be able to give an idea of the characteristics of the larger group from where it has been drawn. It is possible to make deductions about the larger population on the basis of the sample. For selecting a sample, it is necessary to have a sampling frame. This is a complete, accurate and up-to-date list of units in the population. After defining a population and listing all the units, a researcher selects a sample of units from the sampling frame.

The term ‘sampling’ refers to the technique whereby a smaller group is selected from a larger one so that the more manageable smaller group can be observed and those observations can be applied to the larger group as well. This is only possible when the sample group shares the same characteristics as the larger group. Results deduced from sampling are particularly useful when inferences have to be made based on statistics. Sampling is an important aspect of data collection. It is the selection of a certain percentage of a group of items according to predetermined plan. The benefits of sampling are that the cost is lower, data can be collected faster, and since the data set is smaller it is possible to monitor the accuracy and quality of the data closely. The limitations could be less accuracy, changeability of units, and misleading conclusions.

4.7.1. Methods/Designs of Sampling

The sampling method was used in social sciences research in early 1754 by A.L. Bowley. Since then the method has been progressively used. The sampling methods are

broadly classified into two types: (i) Probability Sampling and (ii) Non-Probability Sampling.

4.7.2. Criteria for Selecting Sampling

The type of sample has to be selected depending on the area of research. For this purpose, a variety of sampling methods can be employed, individually or in combination. Factors commonly influencing the choice of the sampling design include:

i. Nature and quality of the frame.
ii. Availability of supporting information about units on the frame. •Accuracy requirements and the need to measure accuracy.
iii. Whether detailed analysis of the sample is expected.
iv. Cost/operational concerns.

As there are various sampling methods, it becomes crucial to select an appropriate: sampling method. Young has suggested the following three criteria to be considered while selecting a sampling method:

i. A measurable or known probability sampling technique should be used to control the risk of errors in the sample estimate.
ii. Simple, straightforward and workable methods adapted to available facilities and personnel should be used.
iii. Achieving optimum balance between expenditure incurred and maximum of reliable information should he 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: (i) Objectives of the study, (ii) Type of study, and (iii) Availability of the resources for the study.

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

4.7.3. Probability Sampling

Probability sampling is a technique of sampling which gives the probability that a sample is representative of population. This kind of sample is selected in such a way that every element chosen has a known probability of being included. 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 smaller groups are not selected based on the researcher's decision but by means of techniques which ensure that every member of the larger group has the likelihood of being included in the sample group. It is also called 'random sampling'.

The *Law of Large Number* states that as the sample size becomes larger, 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 representativeness of the sample, because a large sample does not automatically guarantee representativeness.

As per the second concept, sampling distribution approaches normal distribution provided more the irregular distribution iii the population larger is the sample selected to avoid biases. The following are different methods of probability sampling.

1. Simple Random Sampling

In simple random sampling, each member of the population under study has an equal chance of being selected and the probability of a member of the population being selected is unaffected by the selection of other members of the population, i.e. each selection is entirely independent of the next. The method involves selecting at random from a list of the population (a sampling frame) the required number of subjects for the sample. This can be done by drawing names out of a container until the required number is reached, or by using a table of random numbers set out in matrix form (these are reproduced in many books on quantitative research methods and statistics), and allocating these random numbers to participants or cases (e.g. Hopkins *et al*. 1996: 148–9). Because of probability and chance, the sample should contain subjects with characteristics similar to the population as a whole; some old, some young, some tall, some short, some fit, some unfit, some rich, some poor etc. One problem associated with this particular sampling method is that a complete list of the population is needed and this is not always readily available.

In a Simple Random Sample (SRS) can be cumbersome and tedious when sampling from an unusually large target population. In certain instances where research is very specific, for example, researchers might be interested in examining whether mechanical skills are equally applicable across racial groups, SRS cannot be used as random selection of a sub-group as it may not provide accurate findings.

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:

i. Defining population by specifying its various limits.
ii. Preparing the sampling frame.
iii. 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 re-emphasize here that a random sample is not necessarily an identical representation of the population. After this, to get the required '*n*' units different techniques are available. These techniques are discussed below.

a) **Lottery Method:** After numbering every unit in the population, they are well mixed. The required numbers of units are then drawn from all these well mixed units. The individuals' objects with these identification named 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.
b) **Random Table Method:** The use of random numbers or manual lot drawing will be too cumbersome to recommend in case of a large population. In such situations, computer generated random selection should be resorted, 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 tables by Rand Corporation and prepared by Kendall & Smith, by Fisher & Yates and by Tippet are frequently used. The required numbers of units are selected from such a table in any convenient and systematic way. Now suppose we have to select 20 distance learners for interviews 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 22 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 the 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.

c) **Selection of Sample:** In this method, names are arranged under the intended plan alphabetically, geographically or simply serially. Then, out of the list, every tenth or any other number of cases is taken up. If every tenth unit is to be selected, the selection begins as seventh, seventeenth, twenty-seventh, and so on, or fifth, fifteen, twenty-fifth, and so on.

d) **Grid System:** In this method, selection of sample is made from a particular area. A map of the entire area is prepared, and then a screen of squares is placed on the map. The areas falling within the selected squares are taken as samples.

❖ ***Advantages of Random Sampling***

The advantages of random sampling are as follows:

i. This method calls for no special expertise and training or even insight. It can be used mechanically by anybody.
ii. Each individual of the population has an equal chance of being selected into the sample.
iii. One individual does not affect the selection of the other.
iv. It is free from subjective issue or personal error or bias and imagination of the investigator.
v. It requires minimum knowledge of the population.
vi. It provides appropriate data for research purposes.
vii. Data can be used for inferential purposes.

❖ ***Disadvantages of Random Sampling***

The disadvantages of random sampling are as follows:

i. Practically listing of all the units in the population may not be possible.
ii. In case of heterogeneous population, the selected random sample may not truly represent the characteristics of the population.
iii. Representativeness cannot be assured.
iv. This method does not use knowledge about population.
v. Inferential accuracy of finding depends upon size of sample.

vi. In case of population with infinite numbers, listing is out of the question.
vii. It is difficult though not impossible as it involves high cost.

2. Systematic Sampling

Systematic sampling is a variant of the random process of sampling. In this technique of the requisite number of sample units are selected from the population. This sampling entails organizing the population in a predetermined order and then selecting from the list at regular intervals. One starts from a random number and then proceeds with the selection of every *k*th element from then onwards. In this ease, *k* = (population size/ sample size). It should be noted that the starting point is not automatically the first in the list, but should be randomly chosen from the first to the *k*th element in the list, e.g., every 10th name from the telephone directory (an 'every 10th' sample, also referred to as 'sampling with a skip of 10').

As long as the starting point is randomized, systematic sampling is a type of probability sampling. It is easy to implement and the stratification induced can make it efficient, if the variable by which the list is ordered is correlated with the variable of interest. 'Every 10th' sampling is especially useful for efficient sampling from databases. However, systematic sampling is especially vulnerable to intervals in the list. If periodic intervals are present and the period is a multiple or factor of the interval used, the sample is not going to be an accurate representation of the target population, making the scheme less accurate than simple random sampling. Thus, we see that systematic sampling is an EPS (Equal Probability Sampling) method, as all elements share the same likelihood of - being selected (in the example given, one in ten). It is not 'simple random sampling' because different subsets of the same size have different selection probabilities—e.g., the set {4, 14, 24, ...994} has a one-in-ten probability of selection, but the set (4, 13, 24, 34, ...} has zero probability of selection. Thus, it involves the following steps:

i. Listing the population elements in some order, say alphabetically, merit-wise, etc.
ii. Determining the desired number to be selected from the population, e.g., 10 per cent of 1000 means 100 out of 1000.
iii. Starting with any number from among the numbers 1 to 10 (i.e., 1 to *k*, both inclusive), to select every '10' (or '*k*') element from the list. If the number chosen from 1 to 10 is 4, then the selected numbers will be the 4, 14th, 24th…...994th elements making the sample with 100 elements.
iv. As the elements are chosen from regular intervals, this technique is also known as 'sampling by regular intervals', sampling by fixed intervals or sampling by every *k* unit.

❖ ***Advantages of Systematic Sampling***

The advantages of systematic sampling are as follows:

i. It is more practical in that it involves less labour.
ii. As it is simpler to perform, it may reduce errors.
iii. The procedure is speedy in comparison with simple random sampling.
iv. Reduces the field cost.
v. Inferential statistics may be used.

❖ ***Disadvantages of Systematic Sampling***

The disadvantages of systematic sampling are as follows:

i. Selection of every element, other than the first which is 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 the other one.
ii. When the list of elements has a periodic arrangement, there is a risk that the sample interval may coincide with the periodic interval iii the list. Suppose, A, B, C, D and E are the 5 schools selected and then 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 selects per cent 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'.
iii. 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 mean the size of interval is '5'. We can draw many samples from this listed population. If we randomly pick up a number from among I to 5, say 3 then the sample will comprise the elements '3', 8th, 13th, 18th 98th.
iv. This is not free from error, since bias may creep in due to different ways of making systematic list by differentiation.

v. Knowledge of population is essential.
vi. Information of each individual is essential.
vii. There is risk in drawing conclusions from observation.

3. Stratified Sampling

Stratified sampling involves dividing the population into homogenous groups, each group containing subjects with similar characteristics. For example, group A might contain males and group B, females. In order to obtain a sample representative of the whole population in terms of sex, a random selection of subjects from group A and group B must be taken. If needed, the exact proportion of males to females in the whole population can be reflected in the sample. The researcher will have to identify those characteristics of the wider population which must be included in the sample, i.e. to identify the parameters of the wider population. This is the essence of establishing the sampling frame.

To organize a stratified random sample is a simple two-stage process. First, identify those characteristics that appear in the wider population that must also appear in the sample, i.e. divide the wider population into homogenous and, if possible, discrete groups (strata), for example males and females. Second, randomly sample within these groups, the size of each group being determined either by the judgment of the researcher or by reference to Boxes 4.1 or 4.2.

The decision on which characteristics to include should strive for simplicity as far as possible, as the more factors there are, not only the more complicated the sampling becomes, but often the larger the sample will have to be to include representatives of all strata of the wider population.

A stratified random sample is, therefore, a useful blend of randomization and categorization, thereby enabling both a quantitative and qualitative piece of research to be undertaken. A quantitative piece of research will be able to use analytical and inferential statistics, while a qualitative piece of research will be able to target those groups in institutions or clusters of participants who will be able to be approached to participate in the research.

❖ ***Advantages of Stratified Sampling***

There are many advantages of dividing into sub-sections.

i. Researchers can study these specific sub-groups closely, which may otherwise have got lost in a generaliz random sample.

ii. Applying the stratified sampling method gives accurate statistical estimates provided that the categories or sub-divisions are chosen according to their relevance to the topic being researched rather than randomly and that the group size is proportionate to the entire population.
iii. Data is more readily available for an individual than for a large group.
iv. As each category or sub-division is treated as a separate population, different sampling techniques can be used on each, enabling researchers to apply the most appropriate approach.

❖ ***Limitations of Stratified Sampling***

Certain limitations to using stratified sampling:

i. Breaking down the population into so many sub-divisions can complicate the research and monitoring process. The researcher may also lose count of the size of the population.
ii. Many of the criteria may not apply to the sub-divisions, reducing the value of having so many strata.
iii. In some cases such as designs with a large number of strata or those with a specified minimum sample size per group, stratified sampling can potentially require a larger sample than would other methods although in most cases, the required sample size would be no larger than would be required for simple random sampling.

❖ **Steps of Stratified Sampling**

The steps to be followed in this method are as follows:

i. 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.
ii. Dividing the population under consideration into strata on the basis of requisite number of elements from each stratum using appropriate random selection technique.
iii. Listing the units in each stratum separately.
iv. 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 while doing stratified sampling:

i. The criteria for dividing the population into strata should be correlated with the variable being studied.
ii. The criteria should be practical. It should not yield an unwieldy number of strata.
iii. A good measure of the stratification criteria should be available, e.g., if a 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 carried out. Or a simple random sample of the required size is selected and the classification into strata is observed.

Stratified random sampling can be of following three types:

a) **Proportionate Sampling**

It refers to the selection of a sample from each sampling unit that is proportionate to the size of unit. Its advantages include representativeness with respect to various variables used as basis of classifying categories and increased chances of comparison between strata.

b) **Disproportionate Sampling**

It means that the size of the sample in each unit is not proportionate to the size of unit, but depends upon considerations involving personal judgment and convenience. This is more effective for comparing strata which have different error possibilities.

c) **Optimum Allocation Stratified Sampling:** It is representative as it selects units from each stratum in proportion to corresponding stratum in the population.

4. Multiple/Double Sampling

Double sampling is a type of sampling which includes both questionnaire and interview methods for probing a research problem.

Multi-Stage and Multi-Phase Sampling

This is used in large-scale surveys for more comprehensive investigation. The researcher may have to use two, three or four stage sampling. In the multi-stage sampling, a selection of different types of sampling units, such as some Districts in a State, some Talukas 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 iii multi-stage sampling but not in multi-phase sampling.

❖ ***Advantages of Multi-Stage and Multi-Phase Sampling***

The advantages of multi-stage and multi-phase sampling are as follows:

i. In both the sampling methods, burden on respondents is reduced.
ii. Relative cost also gets reduced.
iii. Two-phase sampling is useful in studying rare cases.
iv. In two-phase sampling, the resulting gain in precision is more due to possibility of getting more information in details.
v. This kind of sampling gives a good reorientation of the population. (vi)It is an objective procedure of sampling.
vi. Observations thus derived can be used for inferential purposes.

❖ ***Disadvantages of Multi-Stage and Multi-Phase Sampling***

The disadvantages of multi-stage and multi-phase sampling are as follows:

i. The disadvantage with this kind of sampling is that it is difficult and complex.
ii. Error may creep in at the primary or secondary stages.
iii. It is subjective.

5. Cluster Sampling

In this type of sampling, the units of samples close to each other are chosen in clusters, for example, households in the same street or successive items of a production-line. The population is divided into clusters and some of them are chosen randomly. Then, the clustered units are selected using random sampling method.

In this method, the items to be studied are picked up at random at different stages. For example, if the idea is to study the problem of middle class working couples in a State, the first stage will be to pick up few districts in the State. The next stage will be to pick up at random few rural and urban areas for the study. The third stage will come when from each area few families belonging to the middle class will be picked up, and the last stage will be when working couples out of these families will be chosen for study. Thus the stages would be: State—Districts—Rural and Urban Areas— Middle Classes—Working Couples

❖ ***Advantages of Cluster Sampling***

The advantages of cluster sampling arc as follows:

i. This method of sampling is very economical, especially when the cost of measuring a unit is relatively small.
ii. It is easier to administer.
iii. Large number of units can be sampled for a given cost. (iv)Practical when the population is large.

❖ ***Disadvantages of Cluster Sampling***

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

4.7.4. Non-Probability Sampling

The non-probability sampling methods are based on the judgments of the investigator as the most important elements of control. The guiding principles in non-probability methods are— availability of the subjects, the personal judgment of the investigator, and convenience in carrying out the research.

Such samples use human judgment in selecting units and have no theoretical base for estimating population characteristics. The non-probability sampling methods are of following types:

- Incidental or accidental sampling
- Judgment sampling
- Purposive sampling
- Quota sampling
- Snowball sampling

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 iris 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.

1. **Incidental or Accidental 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’. Samples are taken because they are more frequently available. It refers to groups which are used as samples of population because they are readily available. Incidental sampling is an easy method but parametrical tests cannot be used for it. A teacher-educator, e.g., may select the students from a school situated in the same campus which serves as a practising school for the concerned college of education, find the effectiveness of concept attainment model to teach a mathematical concept say, a quadrilateral.

❖ ***Advantages of Incidental Sampling***

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

❖ ***Disadvantages of Incidental Sampling***

Since there is no well-defined population and no random sampling method is applied to select the sample, the standard error formulae are applied 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.

2. **Purposive Sampling**

Purposive Sampling is also known as Judgment sampling. This is another non-probability sampling method is ‘purposive sampling’. The sample is selected by some arbitrary method because it is known to be representative of the total population, or it is known that it will produce well matched groups. The idea is to pick out the sample in relation to some criterion which is considered important for the particular study.

In this method, samples are chosen because they resemble some larger group with respect to one or more characteristics. The controls of 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.

It has to be noticed here that up to this stage the controls are somewhat similar to stratification criteria. After deciding upon the category required for the research, the researcher has to select the sample. Actual selection of the units for inclusion in the sample is done purposively and not randomly, e.g., in order to tackle the problem of indiscipline only the undisciplined students are selected as the sample, excluding others on the basis of past experience.

- ***Advantages of Purposive Sampling***

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

- ***Disadvantages of Purposive Sampling***

This method is applicable only for the selection of samples, such as special cases like ‘best teacher award winners’ from the population of teachers or ‘meritorious past students of the school’ from the population of the past students.

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 judgment 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 college teachers) is decided it 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 the 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 the school teachers will be stratified into men and women teachers, quotas for these strata will be fixed and then the teachers will be selected (not randomly).

4. **Snowball Sampling**

In snowball sampling researchers identify a small number of individuals who have the characteristics in which they are interested. These people are then used as informants to identify, or put the researchers in touch with, others who qualify for inclusion and these, in turn, identify yet others – hence the term snowball sampling. This method is useful for sampling a population where access is difficult, maybe because it is a sensitive topic (e.g. teenage solvent abusers) or where communication networks are undeveloped (e.g. where a researcher wishes to interview stand-in 'supply' teachers – teachers who are brought in on an *ad-hoc* basis to cover for absent regular members of a school's teaching staff – but finds it difficult to acquire a list of these stand-in teachers), or where an outside researcher has difficulty in gaining access to schools (going through informal networks of friends/acquaintance and their friends and acquaintances and so on rather than through formal channels). The task for the researcher is to establish who are the critical or key informants with whom initial contact must be made.

4.7.5. Sampling Design

Sampling design refers to a definite plan for obtaining a sample from the sampling frame. It refers to the technique or procedure, which a researcher adopts in selecting some sampling units from where inferences about population are drawn. Sampling data is obtained before collecting the final data.

- **Need for Sampling**

We can define sampling as the process of obtaining information about an entire population by examining only a part of it. Sampling is required for the following reasons:

- It saves time and money. A sample study is usually less expensive than a census study.
- It produces results at a faster speed.
- It enables more accurate measurement for a sample study as it is conducted by experienced investigators.
- It is the only method for an infinitely large population.

It usually enables a researcher to estimate sampling errors and thus assists him/ her in obtaining information concerning some characteristics of the population, such as age group or gender.

- ***Advantages of Sampling***

The various advantages of sampling are as follows:

i. The solution to know the true or actual values of the various parameters of the population would be to take into account the entire population. This is not feasible due to the cost and time involved; therefore, sampling seems more economical.
ii. As the magnitude of operation involved in a sample survey is small, the execution of the field work and the analysis of results can be carried out at a faster rate and in a lesser time.
iii. Very small staff is required for gathering and analysing information and preparing reports; therefore, sampling is a very cheap process.
iv. A researcher can collect detailed information in a lesser time than is possible in a census survey.
v. As the scale of operation involved in a sample survey is small, the quality of interviewing, supervision and other related activities is better than the census survey.
vi. Sampling provides adequate information needed for the purpose and is sufficiently reliable for surveys.

4.7.6. Steps in Sampling

The sampling process involves the following seven tasks:

1. **Defining the Population**: It involves completely defining the population by specifying the following terms:
    i. Elements
    ii. Sampling units
    iii. Extent
    iv. Time
2. **Selecting the Sampling Frame**: The sampling frame should be selected in such a way that it consists of almost all the sampling units. A sample should be selected in such a way that it has all the characteristics of the population. Some of the popular sampling frames are census reports, and electoral registers.
3. **Specifying the Sampling Unit:** Sampling unit is the basic unit that contains elements of the target population.
4. **Specifying the Sampling Method:** This method depicts how the sample units are selected. The most important decision in this method is to determine, which of the two—probability and non-probability—samples is to be chosen.
5. **Determining the Sample Size:** This method includes decision-making about the number of elements to be chosen.
6. **Specifying the Sampling Plan:** This method dictates that one should indicate how decisions made so far are to be implemented. All the expected issues in relation to the sampling survey must be answered by the sample plan.

7. **Selecting the Sample:** This is the final step in the sample process, which includes a good deal of fieldwork and office work. This is introduced in the actual selection of the sample elements. It mainly depends on the sampling plan and the sample size required.

4.7.7. Characteristic of Good Sampling

Samples can be of different types. The following are the characteristics of a good sample:

i. **True Representative:** A good sample is a true representative of the population corresponding to its properties.
ii. **Free from Bias:** A good sample does not permit prejudices, pre-conceptions and imagination to influence its choice.
iii. **Comprehensive:** Comprehensiveness is a quality of a sample which is controlled by the specific purpose of the investigation. A sample may be have all the traits required, but still not be a good representative of population.
iv. **Economical:** A sample should be economical from energy, time and money viewpoint.
v. **Approachable:** A sample should be easily approachable. The research tools can be easily administered on them.
vi. **Good Size:** Size of a sample should be such that it yields an accurate result. The probability of error can be estimated.
vii. **Feasible:** A good sample makes the research more feasible.
viii. **Practical:** A good sample has the practicability for research situations.
ix. **Objective:** This refers to objectivity in selecting a sampling procedure or absence of subjective elements from situation.
x. **Accurate:** A good sample yields accurate estimates of statistics and does not allow for errors.

4.7.8. Sampling Errors

Even if utmost care has been taken in selecting a sample, the results derived from a sample study may not be exactly equal to the true value in the population. The reason is that estimate is based on a part and not on the whole and samples are seldom, if ever, perfect miniature of the population. Hence, sampling gives rise to certain errors known as ‘sampling errors’ or sampling fluctuations. In other words, a sample survey requires study in small portions of population as there can be certain amount of inaccuracy in the information collected during sampling [analysis. This inaccuracy is called sampling error or error variance. Sampling errors are those errors, which arise on account of sampling

and generally happen to be random variations in the sample estimates of the actual population values. Figure 4.3 shows sampling error.

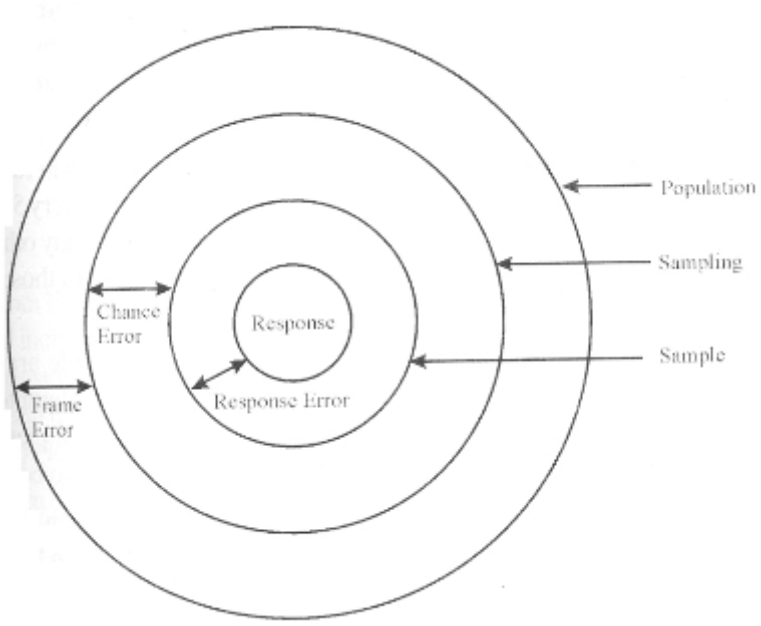

Fig. 4.3 Sampling Error

Sampling errors occur randomly and are equally likely to be in either direction and the magnitude of sampling error depends on the nature of the universe. The more uniform the universe is, the smaller is the sampling error. Sampling error is inversely proportional to the size of the sample and vice-versa. In addition, sampling error is the product of the critical value at a certain level of significance and the standard error.

Sampling Error = Frame Error + Chance Error + Response Error

Sampling errors would not be present in a complete enumeration survey. However, the errors can be controlled. The modern sampling theory helps in designing the survey in such a manner that the sampling errors can be made insignificant. Sampling errors are of two types: (i) Biased and (ii) Unbiased.

These errors arise from any bias in selection, estimation, etc. For example, if in place of simple random sampling, if deliberate sampling has been used in a particular case; some bias is introduced in the result, and hence such errors are called ‘biased sampling errors’. An error in statistics is the difference between the value of a statistic and that of the corresponding parameter. These errors arise due to chance differences between the members of population included in the sample and those not included.

Thus, the total sampling error is made up of errors due to bias, if any, and the random sampling error. The essence of bias is that it forms a constant component of error that does not decrease in a large population as the number in the sample increases. Such error is, therefore, also known as 'cumulative/non-compensating error'. The random sampling error, on the other hand, decrease as an average as the size of the sample increases. Such error is, therefore, also known as 'non-cumulative/compensating error'. Bias may arise due to: (i) Faulty process of selection, (ii) Faulty work during the collection, and (iii) Faulty methods of analysis.

Faulty selection of the sample may give rise to bias in a number of ways. Some of which are discussed below:

a) **Deliberate Selection:** The deliberate selection of a 'representative' sample.
b) **Conscious/Unconscious Bias in the Selection of 'Random' Sample:** The randomness of selection may not really exist, even though the investigator claims that he/she had a random sample if he/she allows his/her desire to obtain a certain result to influence his/her selection.
c) **Substitution:** Substitution of an item in place of one chosen in random sample sometimes leads to bias. Thus, if it were decided to interview every 50th household in a street, it would be inappropriate to interview the 51st or any other number its place as the characteristics possessed by it will differ from those which were originally to be included in the sample.
d) **Non-Response:** If all the items to be included in the sample are not covered then, there will be bias even though no substitution has been attempted. This fault particularly occurs in mailed questionnaires, which are incompletely returned, Moreover, the information supplied by the informants may also be biased.
e) **An Appeal to the Vanity:** An appeal to the vanity of the person questioned may give rise to yet another kind of bias. For example, the question 'Are you a good student?' is such that most of the students would answer 'yes'.

Any consistent error in measurement will give rise to bias whether the measurements are carried out on a sample or on all the units of the population. The danger of error is, however, likely to be greater in sampling work, since the units measured are usually smaller.

Bias may arise due to improper formulation of the decision problem or wrongly defining the population, specifying the wrong decision, securing an inadequate frame, and so on. Biased observations may result from a poorly designed questionnaire, an ill-trained interviewer, failure of a respondent's memory, etc. Bias in the flow of data may be due to unorganized collection procedure, faulty editing or coding of responses.

In addition to bias which arises from faulty process of selection and faulty collection of information, faulty methods of analysis may also introduce bias. Such bias can avoided by adopting the proper methods of analysis. If possibilities of bias exist, fully objective conclusions cannot be drawn. The first essential of any sampling or census procedure must, therefore, be the elimination of all sources of bias. The simplest and the only certain way of avoiding bias in the selection process is for the sample to be drawn either entirely at random or subject to restrictions, which while improving the accuracy are of such a nature that they do not introduce bias in the results. In certain cases, systematic selection may also be permissible.

Once the absence of bias has been ensured, attention should be given to the random sampling errors. Such errors must be reduced to the minimum so as to attain the desired accuracy. Apart from reducing errors of bias, the simplest way of increasing the accuracy of a sample is to increase its size. The sampling error usually decreases with increase in sample size and in fact in many situations the decrease is inversely proportional to the square root of the sample size. Figure 4.4 illustrates the increase and decrease proportion between sampling error ad sample size.

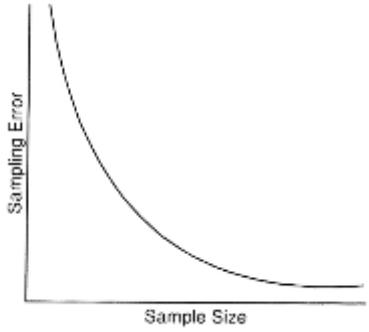

Fig. 4.4. Sampling Error and Sample Size

From Figure 4.4, it is clear that though the reduction in sampling error is substantial for initial increases in sample size, it becomes marginal after a certain stage. In other words, considerably great effort is needed after a certain stage to decrease the sampling error than in the initial instances. Hence after that stage sizable reduction in cost can be achieved by lowering even slightly the precision required.

From this point of view, there is a strong case for resorting to a sample survey to provide estimates within permissible margins of error instead of a complete enumeration survey, as in the latter the effort and the cost needed will be substantially higher due to the attempt to reduce the sampling error to zero.

As regards non-sampling error, they are likely to be more in case of complete enumeration survey than in case of a sample survey, since it is possible to reduce the non-

sampling errors to a greater extent by using better organization and suitably trained personnel at the field and tabulation stages.

The behaviour of the non-sampling errors with increase in sample size is likely to be opposite of that of sampling error, that is, the non-sampling error is likely to increase with increase in sample size. In many situations, it is quite possible that the non-sampling error in a complete enumeration survey is greater than both the sampling and non-sampling errors taken together in a sample survey, and naturally in such situations the latter is preferred to the former.

When a complete enumeration of units in the universe is made, one would expect that it would give rise to data free from errors. However, in practice it is not so. For example, it is difficult to completely avoid errors of observation or ascertainment. So also in the processing of data tabulation errors may be committed affecting the find results. Errors arising in this manner are termed as non-sampling errors, as they are due to factors other than the inductive process of inferring about the population from a sample.

Thus, the data obtained in an investigation by complete enumeration, although free from sampling error, would still be subject to non-sampling error, whereas the results of a sample survey would be subject to sampling error as well as non-sampling error. Non-sampling errors can occur at every stage of planning and execution of the census or survey. Such errors can arise due to a number of causes, such as defective methods of data collection and tabulation, faulty definition, incomplete coverage of the population or sample, etc. More specifically, non-sampling errors may arise from one or more of the following factors:

i. Data specification being inadequate and inconsistent with respect to the objective of the census or survey.
ii. Inappropriate statistical unit.
iii. Inaccurate/Inappropriate methods of interview, observation or measurement with inadequate or ambiguous schedules, definitions or instructions.
iv. Lack of trained and experienced investigators.
v. Lack of adequate inspection and supervision of primary staff.
vi. Errors due to non-response, i.e., incomplete coverage in respect of units.
vii. Errors in data processing operations, such as coding, punching, verification, etc.
viii. Errors committed during presentation and printing of tabulated results.

These sources are not exhaustive, but are given to indicate some of the possible sources of error. In a sample survey, non-sampling errors may also arise due to defective frame and faulty selection of sampling units. In some situations, the non-sampling errors may be large and deserve greater attention than the sampling errors. While, in general sampling errors decrease with increase in sample size, non-sampling errors tend to increase with the sample size. In the case of complete enumeration, non-sampling errors and in the case of, sample surveys, both sampling and non-sampling errors require to be

controlled and reduced to a level at which their presence does not vitiate the use of final results. The reliability of samples can be tested in the following ways:

i. More samples of the same size should be taken from the same universe and their results be compared. If results are similar, the sample will be reliable.
ii. If the measurements of the universe are known then they should be compared with the measurements of the sample. In case of similarity of measurement, the sample will be reliable.
iii. Sub-samples should be taken from the samples and studied. If the results of sample and sub-sample study show similarity, the sample should be consider reliable.

Check Your Progress

1. Define the terms sample and sampling?
2. Define the term sampling design?
3. How the sampling frame is selected? Name some popular sampling frames?
4. What is sampling error? How it occurs?
5. How the reliability of samples can be tested?

4.8. Method of Data Collection

The task of data collection begins after a research problem has been defined and research design/ plan chalked out. While deciding about the method of data collection to be used for the study, the researcher should keep in mind two types of data viz., primary and secondary. The *primary data* are those which are collected afresh and for the first time, and thus happen to be original in character. The *secondary data*, on the other hand, are those which have already been collected by someone else and which have already been passed through the statistical process. The researcher would have to decide which sort of data he would be using (thus collecting) for his study and accordingly he will have to select one or the other method of data collection. The methods of collecting primary and secondary data differ since primary data are to be originally collected, while in case of secondary data the nature of data collection work is merely that of compilation. We describe the different methods of data collection, with the pros and cons of each method.

4.8.1. Collection of Primary Data

We collect primary data during the course of doing experiments in an experimental research but in case we do research of the descriptive type and perform surveys, whether sample surveys or census surveys, then we can obtain primary data

either through observation or through direct communication with respondents in one form or another or through personal interviews.* This, in other words, means -

* An experiment refers to an investigation in which a factor or variable under test is isolated and its effect(s) measured. In an experiment the investigator measures the effects of an experiment which he conducts intentionally. Survey refers to the method of securing information concerning phenomena under study from all or a selected number of respondents of the concerned universe. In a survey, the investigator examines those phenomena which exist in the universe independent of his action.

There are several methods of collecting primary data, particularly in surveys and descriptive researches. Important ones are: (i) observation method, (ii) interview method, (iii) through questionnaires, (iv) through schedules, and (v) other methods which include (a) warranty cards; (b) distributor audits; (c) pantry audits; (d) consumer panels; (e) using mechanical devices; (f) through projective techniques; (g) depth interviews, and (h) content analysis. We briefly take up each method separately.

1. **The Observation Method**

The observation method is the most commonly used method specially in studies relating to behavioural sciences. In a way we all observe things around us, but this sort of observation is not scientific observation. Observation becomes a scientific tool and the method of data collection for the researcher, when it serves a formulated research purpose, is systematically planned and recorded and is subjected to checks and controls on validity and reliability. Under the observation method, the information is sought by way of investigator's own direct observation without asking from the respondent. For instance, in a study relating to consumer behaviour, the investigator instead of asking the brand of wrist watch used by the respondent, may himself look at the watch. The main advantage of this method is that subjective bias is eliminated, if observation is done accurately. Secondly, the information obtained under this method relates to what is currently happening; it is not complicated by either the past behaviour or future intentions or attitudes. Thirdly, this method is independent of respondents' willingness to respond and as such is relatively less demanding of active cooperation on the part of respondents as happens to be the case in the interview or the questionnaire method. This method is particularly suitable in studies which deal with subjects (i.e., respondents) who are not capable of giving verbal reports of their feelings for one reason or the other

2. **The Interview Method**

The interview method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses. This method can be used through personal interviews and, if possible, through telephone interviews.

Personal interview method requires a person known as the interviewer asking questions generally in a face-to-face contact to the other person or persons. (At times the interviewee may also ask certain questions and the interviewer responds to these, but usually the interviewer initiates the interview and collects the information.) This sort of interview may be in the form of direct personal investigation or it may be indirect oral investigation. In the case of direct personal investigation the interviewer has to collect the information personally from the sources concerned. He has to be on the spot and has to meet people from whom data have to be collected. This method is particularly suitable for intensive investigations. But in certain cases it may not be possible or worthwhile to contact directly the persons concerned or on account of the extensive scope of enquiry, the direct personal investigation technique may not be used.

We may as well talk about focussed interview, clinical interview and the non-directive interview. *Focussed interview* is meant to focus attention on the given experience of the respondent and its effects. Under it the interviewer has the freedom to decide the manner and sequence in which the questions would be asked and has also the freedom to explore reasons and motives. The main task of the interviewer in case of a focussed interview is to confine the respondent to a discussion of issues with which he seeks conversance. Such interviews are used generally in the development of hypotheses and constitute a major type of unstructured interviews. The *clinical interview* is concerned with broad underlying feelings or motivations or with the course of individual's life experience. The method of eliciting information under it is generally left to the interviewer's discretion. In case of *non-directive interview*, the interviewer's function is simply to encourage the respondent to talk about the given topic with a bare minimum of direct questioning. The interviewer often acts as a catalyst to a comprehensive expression of the respondents' feelings and beliefs and of the frame of reference within which such feelings and beliefs take on personal significance.

3. Collection of Data Through Questionnaires

This method of data collection is quite popular, particularly in case of big enquiries. It is being adopted by private individuals, research workers, private and public organisations and even by governments. In this method a questionnaire is sent (usually by post) to the persons concerned with a request to answer the questions and return the questionnaire. A questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms. The questionnaire is mailed to respondents who are expected to read and understand the questions and write down the reply in the space meant for the purpose in the questionnaire itself. The respondents have to answer the questions on their own. (We have already discussed about questionnaire earlier in details).

4. Collection of Data Through Schedules

This method of data collection is very much like the collection of data through questionnaire, with little difference which lies in the fact that schedules (proforma containing a set of questions) are being filled in by the enumerators who are specially appointed for the purpose. These enumerators along with schedules go to respondents, put to them the questions from the proforma in the order the questions are listed and record the replies in the space meant for the same in the proforma. In certain situations, schedules may be handed over to respondents and enumerators may help them in recording their answers to various questions in the said schedules. Enumerators explain the aims and objects of the investigation and also remove the difficulties which any respondent may feel in understanding the implications of a particular question or the definition or concept of difficult terms.

This method requires the selection of enumerators for filling up schedules or assisting respondents to fill up schedules and as such enumerators should be very carefully selected. The enumerators should be trained to perform their job well and the nature and scope of the investigation should be explained to them thoroughly so that they may well understand the implications of different questions put in the schedule. Enumerators should be intelligent and must possess the capacity of cross examination in order to find out the truth. Above all, they should be honest, sincere, hard working and should have patience and perseverance. This method of data collection is very

5. Some Other Methods of Data Collection

Let us consider some other methods of data collection, particularly used by big business houses in modern times.

a) Warranty Cards: Warranty cards are usually postal sized cards which are used by dealers of consumer durables to collect information regarding their products. The information sought is printed in the form of questions on the 'warranty cards' which is placed inside the package along with the product with a request to the consumer to fill in the card and post it back to the dealer.

b) Distributor or Store Audits: Distributor or store audits are performed by distributors as well as manufactures through their salesmen at regular intervals. Distributors get the retail stores audited through salesmen and use such information to estimate market size, market share, seasonal purchasing pattern and so on. The data are obtained in such audits not by questioning but by observation. For instance, in case of a grocery store audit, a sample of stores is visited periodically and data are recorded on inventories on hand either by observation or copying from store records. Store audits are invariably panel operations, for the derivation of sales estimates and compilation of sales trends by stores are their principal '*raison deter*'. The principal advantage of this method is that it offers the most efficient way of evaluating the effect on sales of variations of different techniques of in-store promotion.

c) **Pantry Audits:** Pantry audit technique is used to estimate consumption of the basket of goods at the consumer level. In this type of audit, the investigator collects an inventory of types, quantities and prices of commodities consumed. Thus in pantry audit data are recorded from the examination of consumer's pantry. The usual objective in a pantry audit is to find out what types of consumers buy certain products and certain brands, the assumption being that the contents of the pantry accurately portray consumer's preferences. Quite often, pantry audits are supplemented by direct questioning relating to reasons and circumstances under which particular products were purchased in an attempt to relate these factors to purchasing habits. A pantry audit may or may not be set up as a panel operation, since a single visit is often considered sufficient to yield an accurate picture of consumers' preferences. An important limitation of pantry audit approach is that, at times, it may not be possible to identify consumers' preferences from the audit data alone, particularly when promotion devices produce a marked rise in sales.

d) **Consumer panels:** An extension of the pantry audit approach on a regular basis is known as 'consumer panel', where a set of consumers are arranged to come to an understanding to maintain detailed daily records of their consumption and the same is made available to investigator on demands. In other words, a consumer panel is essentially a sample of consumers who are interviewed repeatedly over a period of time. Mostly consume panels are of two types viz., the transitory consumer panel and the continuing consumer panel. *A transitory consumer panel* is set up to measure the effect of a particular phenomenon. Usually such a panel is conducted on a before-and-after-basis. Initial interviews are conducted before the phenomenon takes place to record the attitude of the consumer. A second set of interviews is carried out after the phenomenon has taken place to find out the consequent changes that might have occurred in the consumer's attitude. It is a favourite tool of advertising and of social research. A *continuing consumer panel* is often set up for an indefinite period with a view to collect data on a particular aspect of consumer behaviour over time, generally at periodic intervals or may be meant to serve as a general purpose panel for researchers on a variety of subjects. Such panels have been used in the area of consumer expenditure, public opinion and radio and TV listenership

e) **Use of Mechanical Devices:** The use of mechanical devices has been widely made to collect information by way of indirect means. Eye camera, Pupilometric camera, Psychogalvanometer, Motion picture camera and Audiometer are the principal devices so far developed and commonly used by modern big business houses, mostly in the developed world for the purpose of collecting the required information.

f) **Projective Techniques:** Projective techniques (or what are sometimes called as indirect interviewing techniques) for the collection of data have been developed by psychologists to use projections of respondents for inferring about underlying motives, urges, or intentions which are such that the respondent either resists to reveal them or is unable to figure out himself. In projective techniques the respondent in supplying information tends unconsciously to project his own attitudes or feelings on the subject under study. Projective techniques play an important role in motivational researches or in attitude surveys.

g) **Depth Interviews:** Depth interviews are those interviews that are designed to discover underlying motives and desires and are often used in motivational research. Such interviews are held to explore needs, desires and feelings of respondents. In other words, they aim to elicit unconscious as also other types of material relating especially to personality dynamics and motivations. As such, depth interviews require great skill on the part of the interviewer and at the same time involve considerable time. Unless the researcher has specialised training, depth interviewing should not be attempted.

4.8.2. Collection of Secondary Data

Secondary data means data that are already available i.e., they refer to the data which have already been collected and analysed by someone else. When the researcher utilizes secondary data, then he has to look into various sources from where he can obtain them. In this case he is certainly not confronted with the problems that are usually associated with the collection of original data. Secondary data may either be published data or unpublished data. Usually published data are available in: (a) various publications of the central, state are local governments; (b) various publications of foreign governments or of international bodies and their subsidiary organizations; (c) technical and trade journals; (d) books, magazines and newspapers; (e) reports and publications of various associations connected with business and industry, banks, stock exchanges, etc.; (f) reports prepared by research scholars, universities, economists, etc. in different fields; and (g) public records and statistics, historical documents, and other sources of published information. The sources of unpublished data are many; they may be found in diaries, letters, unpublished biographies and autobiographies and also may be available with scholars and research workers, trade associations, labour bureaus and other public/ private individuals and organizations.

Researcher must be very careful in using secondary data. He must make a minute scrutiny because it is just possible that the secondary data may be unsuitable or may be inadequate in the context of the problem which the researcher wants to study. In this connection Dr. A.L. Bowley very aptly observes that it is never safe to take published statistics at their face value without knowing their meaning and limitations and it is

always necessary to criticise arguments that can be based on them. By way of caution, the researcher, before using secondary data, must see that they possess following characteristics:

i. **Reliability of data:** The reliability can be tested by finding out such things about the said data: (a) Who collected the data? (b) What were the sources of data? (c) Were they collected by using proper methods (d) At what time were they collected? (e) Was there any bias of the compiler? (t) What level of accuracy was desired? Was it achieved?

ii. **Suitability of data:** The data that are suitable for one enquiry may not necessarily be found suitable in another enquiry. Hence, if the available data are found to be unsuitable, they should not be used by the researcher. In this context, the researcher must very carefully scrutinise the definition of various terms and units of collection used at the time of collecting the data from the primary source originally. Similarly, the object, scope and nature of the original enquiry must also be studied. If the researcher finds differences in these, the data will remain unsuitable for the present enquiry and should not be used.

iii. **Adequacy of data:** If the level of accuracy achieved in data is found inadequate for the purpose of the present enquiry, they will be considered as inadequate and should not be used by the researcher. The data will also be considered inadequate, if they are related to an area which may be either narrower or wider than the area of the present enquiry.

4.8.3. Selection of Appropriate Method for Data Collection

Thus, there are various methods of data collection. As such the researcher must judiciously select the method/methods for his own study, keeping in view the following factors:

i. **Nature, scope and object of enquiry:** This constitutes the most important factor affecting the choice of a particular method. The method selected should be such that it suits the type of enquiry that is to be conducted by the researcher. This factor is also important in deciding whether the data already available (secondary data) are to be used or the data not yet available (primary data) are to be collected.

ii. **Availability of funds:** Availability of funds for the research project determines to a large extent the method to be used for the collection of data. When funds at the disposal of the researcher are very limited, he will have to select a comparatively cheaper method which may not be as efficient and effective as some other costly method. Finance, in fact, is a big constraint in practice and the researcher has to act within this limitation.

iii. **Time factor:** Availability of time has also to be taken into account in deciding a particular method of data collection. Some methods take relatively more time, whereas with others the data can be collected in a comparatively shorter duration.

The time at the disposal of the researcher, thus, affects the selection of the method by which the data are to be collected.

iv. **Precision required:** Precision required is yet another important factor to be considered at the time of selecting the method of collection of data.etc.

4.9. Organization and Statistical Analysis of Data

A research study produces a mass of raw data. These data are obtained from administration of one or more standard tools or self developed instruments or from naturally available sources. In order to arrive at a conclusion the researcher need to interpret the data, so that the collected data can be analysed in accordance with the sated hypotheses. Thus, analysed data means editing, coding, organizing, classifying and tabulation of the collected data.

The term analysis means computation of certain measures along with searching for patterns of relationship that exist among data groups. So that in the process of analysis, relationship or differences supporting or conflicting with original or new hypotheses should be subjected to statistical tests of significance to determine with what validity data can be said to indicate any conclusions. Therefore before analyzing the data must be organized.

4.9.1 Meaning, Importance and Steps Involved in Processing Data

Research does not merely consist of data that is collected. Research is incomplete without proper analysis of the collected data. Processing of data involves analysis and manipulation of the collected data by performing various functions. The data has to be processed in accordance with the outline laid down at the time of developing the research plan. Processing of data is essential for ensuring that all relevant data has been collected to perform comparisons and analyses. The functions that can be performed on data are as follows:

- Editing
- Coding
- Tabulation
- Classification

Usually, experts are of the opinion that the exercise of processing and analysing of data is inter-related. Therefore, the two should be thought as one and the same thing. It

is argued that analysis of data generally involves a number of closely-related operations, which are carried out with the objective of summarizing the collected data and organizing it in such a way that they are able to answer the research questions associated with it.

However, in technical terms, processing of data involves data representation in a way that it is open to analysis. Similarly, analysis of data is defined as the computation of certain measures along with searching for the patterns of relationship that may exist among data groups.

1. Editing of Data

Editing of data involves the testing of data collection instruments in order to ensure maximum accuracy. This includes checking the legibility, consistency and completeness of the data. The editing process aims at avoiding equivocation and ambiguity. The collected raw data is also examined to detect errors and omissions, if any. A careful scrutiny is performed on the completed questionnaires and schedules to assure that the data has the following features:

- Accuracy
- Consistency
- Unity
- Uniformity
- Effective arrangement

The stages at which editing should be performed can be classified as follows:

- **Field Editing:** This involves reviewing the reporting forms, by the investigator, that are written in an abbreviated or illegible form by the informant at the time of recording the respondent's responses. Such type of editing must be done immediately after the interview. If performed after some time, such editing j becomes complicated for the researcher, as it is difficult to decipher any particular individual's writing style. The investigator needs to be careful while field editing and restrain the researcher from correcting errors or omission by guesswork.
  \
- **Central Editing:** This kind of editing involves a thorough editing of the entire data by a single editor or a team of editors. It takes place when all the schedules created according to the research plan have been completed and returned to the researcher. Editors correct the errors such as data recorded in the wrong place or the data recorded in months when it should be recorded in weeks. They can provide an appropriate answer to incorrect or missing replies by I reviewing the other information in the schedule. At times, the respondent can be contacted for

clarification. In some cases, if the answer is inappropriate or incomplete and an accurate answer cannot be determined on any basis, then I the editor should delete or remove that answer from the collected data. He / She can put a note as 'no answer' in this case. The answers that can be easily deciphered as wrong should be dropped from the final results.

Besides using the above-stated methods according to the data source, the researcher should also keep in mind the following points while editing:

- Familiarity with the instructions given to interviewers and coders
- Know-how of editing instructions
- Single line striking for deleting of an original entry •Standardized and distinctive editing of data
- Initialization of all answers that are changed

2. Coding of Data

Coding of data can be defined as representing the data symbolically using some predefined rules. Once data is coded and summarized, the researcher can analyse it and relationships can be found among its various categories.

➢ Checklist for Coding

This enables the researcher to classify the responses of the individuals according to a limited number of categories or classes. Such classes should possess the following important characteristics:

- Classes should be appropriate and in accordance to the research problem under consideration.
- They must include a class fur every data element.
- There should be a mutual exclusivity, which means that a specific answer can be placed in one and only one cell of a given category set.
- The classes should be one-dimensional. This means that every class is defined in terms of only one concept.

➢ Significance of Coding

Coding of data is necessary for its efficient analysis. Coding facilitates reduction of data from a variety to a small number of classes. Thus, only that information which is important and critical for analysis is retained in the research. Coding decisions are usually

taken at the designing stage of the questionnaire. This makes it possible to pre-code the questionnaire choices, which in turn, is helpful for computer tabulation.

However, in case of hand coding, some standard method should be used. One such method is to code in the margin with a coloured pencil. The other method is to transcribe data from the questionnaire to a coding sheet. Whatever method is adopted, you should ensure that coding errors are altogether eliminated or reduced to a minimum level.

3. Classification of Data

Research studies involve extensive collection of raw data and usage of the data to implement the research plan. To make the research plan easier, the data needs to be classified in different groups for understanding the relationship among the different phases of the research plan. Classification of data involves arrangement of data in groups or classes on the basis of some common characteristics. The methods of classification can be divided under the following two headings:

- Classification according to attributes
- Classification according to class intervals

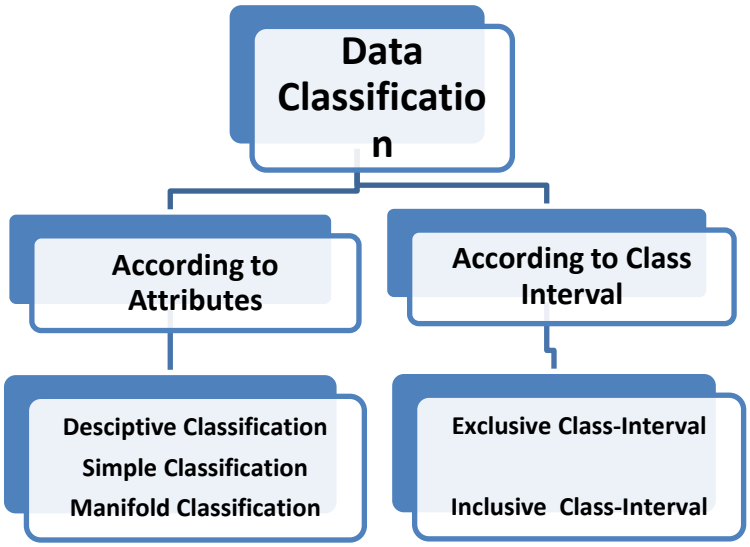

Figure 4.5 shows the categories of data.

❖ **Classification of Data According to Attributes**

Data is classified on the basis of Similar features as follows:

a) **Descriptive Classification:** This classification is performed according to the qualitative features and attributes which cannot be measured quantitatively. These features can be either present or absent in an individual or an element. The features related to descriptive classification of attributes can be literacy, sex, honesty, solidarity, etc.
b) **Simple Classification:** In this classification the elements of data are categorized on the basis of those that possess the concerned attribute and those that do not.
c) **Manifold Classification:** In this classification two or more attributes are considered simultaneously and the data is categorized into a number of classes on the basis of those attributes. The total number of classes of final order is given by 2^n where n = number of attributes considered.

❖ **Classification of Data According to Class Intervals**

Classifying data according to the class intervals is a quantitative phenomenon. Class intervals help categorize the data with similar numerical characteristics, such as income, production, age, weight, etc. Data can be measured through some statistical tools like mean, mode, median, etc. The different categories of data according to class intervals are as follows:

a) **Statistics of Variables:** This term refers to the measurable attributes, as these typically vary over time or between individuals. The variables can be discrete, i.e., taking values from a countable or finite set, continuous, i.e., having a continuous distribution function, or neither. This concept of variable is widely utilized in the social, natural and medical sciences.
b) **Class Intervals:** They refer to a range of values of a variable. This interval is used to break up the scale of the variable in order to tabulate the frequency distribution of a sample. A suitable example of such data classification can be given by means of categorizing the birth rate of a country. In this ease, babies aged zero to one year will form a group; those aged two to five years will form another group, and so on. The entire data is thus categorized into several numbers of groups or classes or in other words, class intervals. Each class interval has an upper limit as well as a lower limit, which is defined as 'the class limit.' The difference between two class limits is known as class magnitude. Classes can have equal or unequal class magnitudes.

The number of elements, which come under a given class, is called the frequency of the given class interval. All class intervals, with their respective frequencies, are taken together and described in a tabular form called the frequency distribution.

❖ **Problems Related to Classification of Data**

The problems related to classification of data on the basis of class intervals are divided into the following three categories:

I. **Number of Classes and their Magnitude:** There are differences regarding the number of classes into which data can be classified. As such, there are no pre-defined rules for the classification of data. It all depends upon the skill and experience of the researcher. The researcher should display the data in such a way that it should be clear and meaningful to the analyst.

As regards the magnitude of classes, it is usually held that class intervals should be of equal magnitude, hut in some cases unequal magnitudes may result in a better classification. It is the researcher's objective and judgement that plays a significant role in this regard. In general, multiples of two, five and ten are preferred while determining class magnitudes. H.A. Sturges suggested the following formula to determine the size of class interval:

$$i = R/(1 + 3.3 \log N)$$

Where,

i = size of class interval.
R = Range (difference between the values of the largest element and smallest element among the given elements).
N = Number of items to be grouped.

Sometimes, data may contain one or two or very few elements with very high or very low values. In such cases, the researcher can use an open-ended interval in the overall frequency distribution. Such intervals can be expressed below two years; or twelve years and above. However, such intervals are not desirable, yet cannot be avoided.

II. **Choice of Class Limits:** While choosing class limits, the researcher must determine the mid-point of a class interval. A mid-point is, generally, derived by taking the sum of the upper and lower limit of a class and then dividing it by two. The actual average of elements of that class interval should remain as close to each other as possible. In accordance with this principle, the class limits should be located at multiples of two, five, ten, twenty and hundred and such other figures. The class limits can generally be stated in any of the following forms:

- **Exclusive Type Class Intervals:** These intervals are usually stated as follows:
    - 10-20
    - 20-30

- 30-40
- 40-50

These intervals should be read in the following way:

- l0 and under 20
- 20 and under 30
- 30 and under 40
- 40 and under 50

In the exclusive type of class intervals, the elements whose values are equal to the upper limit of a class are grouped in the next higher class. For example, an item whose value is exactly thirty would be put in 30— 40-class interval and not in 20-30-class interval. In other words, an exclusive type of class interval is that in which the upper limit of a class interval is excluded and items with values less than the upper limit, but not less than the lower limit, are put in the given class interval.

- **Inclusive Type Class Intervals:** These intervals are normally stated as follows:
  - 11-20
  - 21-30
  - 31-40
  - 41-50

This should be read as follows:

- 11 and under 21
- 21 and under 31
- 31 and under 41
- 41 and under 51

In this method, the upper limit of a class interval is also included in the concerning class interval. Thus, an element whose value is twenty will be put in 11– 20-class interval. The stated upper limit of the class interval 11– 20 is twenty but the real upper limit is 20. 999999 and as such 11– 20 class interval really means eleven and under twenty-one. When data to be classified happens to be a discrete one, then the inclusive type of classification should be applied. But when data happens to be a continuous one, the exclusive type of class intervals can be used.

III. Determining the Frequency of Each Class: The frequency of each class can be determined using tally sheets or mechanical aids. In tally sheets, the class groups are written on a sheet of paper and for each item a stroke (a small vertical line) is marked against the class group in which it falls. The general practice is that after every four small vertical lines in a class group, the fifth line for the element falling in the same group is indicated as a diagonal line through the above said four lines. This enables the researcher to perform the counting of elements in each one of the class groups. Table 4.1 displays a hypothetical tally sheet.

Table 4.1 *A Tally Sheet*

Income groups (Rupees)	Tally mark	Number of families (Class frequency)
Below 600	𝍸 𝍸 𝍸 III	15
601-900	𝍸 𝍸 I	9
901-1300	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 I	25
1301-1500	𝍸 𝍸 𝍸 IIII	16
1501 and above	𝍸 𝍸 II	10
Total		75

In case of large inquiries and surveys, class frequencies can be determined by means of mechanical aids, i.e. with the help of machines. Such machines function, either manually or automatically and run on electricity. These machines can sort out cards at a speed of around 25,000 cards per hour. Although this method increases the speed, it is an expensive method.

4. Tabulation of Data

Tabulation is the process of arranging data in a concise and logical order. It is a process of summarizing raw data and displaying the same in compact form, i.e. in the form of statistical tables. This process helps in the analysis of data i.e. in the simple terms, tabulation means placing the results and data collected from research in a tabular form.

❖ Methods of Tabulation

Tabulation can be done either manually or mechanically using various electronic devices. Several factors like the size and type of study, cost considerations, time pressures and availability of tabulating machines decide the choice of tabulation. Relatively large data requires computer tabulation. Manual tabulation is preferred in case

of small inquiries, when the number of questionnaires is small and they are of relatively short length. The different methods used in hand tabulation are as follows:

a) **Direct Tally Method:** This method involves simple codes, which the researcher can use to directly tally data with the questionnaire. The codes are written on a sheet of paper called tally sheet and for each response, a stroke is marked against the code in which it falls. Usually, after every four strokes against a particular code, the fifth response is indicated by drawing a diagonal or horizontal line through the strokes. These groups are easy to count and the data is sorted against each code conveniently.
b) **List and Tally Method:** In this method, code responses may be transcribed into a large worksheet, allowing a line for each questionnaire. This facilitates listing of a large number of questionnaires in one worksheet. Tallies are then made for each question.
c) **Card Sort Method:** This is the most flexible hand tabulation method, where the data is recorded on special cards that are of convenient sizes and shapes and have a series of holes. Each hole in the card stands for a code. When the cards are stacked, a needle passes through a particular hole representing a particular code. These cards are then separated and counted. In this way, frequencies of various codes can be found out by the repetition of this technique.

❖ Significance of Tabulation

Tabulation enables the researcher to arrange data in a concise and logical order. It summarizes the raw data and displays the same in a compact form for further analysis. It helps in the orderly arrangement of data in rows and columns. The various advantages of tabulation of data are as follows:

- A table saves space and reduces descriptive and explanatory statements to the minimum.
- It facilitates and eases the comparison process.
- Summation of elements and detection of omissions and errors becomes easy in a tabular description.
- A table provides a basis for various statistical computations.

❖ Checklist for Tables

A table should communicate the required information to the reader in such a way that it becomes easy for him/her to read, comprehend and recall information when required. Certain conventions have to be followed during tabulation of data. These are as follows:

- All tables should have a clear, precise and adequate title to make them intelligible enough without any reference to the text.
- Tables should be featured with clarity and readability.
- Every table should be given a distinct number to facilitate an easy reference.
- The table should be of an appropriate size and tally with the required information.
- Headings for columns and rows should be in bold font letters. It is a general rule to include an independent variable in the left column or the first row. The dependent variable is contained in the bottom row or the right column.
- Numbers should be displayed such that they are neat and readable.
- Explanatory footnotes, if any, regarding the table should be placed directly beneath the table, along with the reference symbols used in the table.
- The source of the table should be indicated just below the table.
- The table should contain thick lines to separate data under one class from the data under another class and thin lines to separate the different subdivisions of the classes.
- All column figures should be properly aligned.
- Abbreviations should be avoided in a table to the best possible extent.
- If data happens to be large, then it should not be crowded in a single table. It makes the table unwieldy and inconvenient.

Tabulation can also be classified as complex and simple. The former type of tabulation gives information about one or more groups of independent variables, whereas, the latter shows the division of data in two or more categories.

4.9.2. Use of Statistical Tools for Analysis

A researcher needs to be familiar with different statistical methods so as to be able to use the appropriate method in his research study. There are certain basic statistical methods that can be classified into the following two groups:

- Descriptive Analysis
- Inferential Analysi

i. Descriptive Analysis

It is a procedure of analyzing data through descriptive statistics “Descriptive statistics permits the researcher to meaningfully describe many, many scores with a small number of indices.” If these indices are calculated for a sample drawn from a population

the resulting values are referred to as statistics. If they are calculated for an entire population they are called as parameters. According to Smith, descriptive statistics is the formulation of rules and procedures where data can be placed in a useful and significant order. The foundation of applicability of descriptive statistics is the need for complete data presentation.

Some of the major statistics used are Measures of Central Tendency, Measures of Variability, Measures of Relationships, and Measures of Relative Position. Measures of Central Tendency are used to measure the average or central value of the group. The mean, median and mode are the measures of central tendency. The Measures of Variability indicating the spread of the scores in a group. The statistics used to measure the spread of the scores are range, average deviation, quartile deviation, and the standard deviation. The measures of relationship indicate the degree to which two sets of scores are related. Measures of co-efficient of correlation help us to measure the relationship. Measures of Relative position describe a subject's performance compared to the performance of all other subjects. Another method for making idea about the distribution of scores is graphical representations of the scores. It uses graphs, histogram, bar diagram, frequency polygon, smoothed frequency polygon, cumulative frequency polygon or ogive and the pie diagram.

ii. Inferential Analysis

Inferential analysis is made with the help of inferential statistics. Inferential statistics deals with inference of all things. It is a process by which inference are made about the population on the basis of sample data. Most of the educational research deals with sample studies. Inferential statistics are concerned with determining how likely the results based on sample or sample is the same that would have been obtained for the total population. The values obtained form a sample is called as statistics and the corresponding value in the population are known as parameters. So if a mean is drawn from a sample it is called as statistics and if it is drawn from a population is called as parameter.

For example, if someone draws two sample randomly and after the study find that there is a difference between the mean of two groups. But now the question arises whether there is a real such difference existing in the population or not. But as we know there is no such difference in the population and the difference found in the sample are only due to chance error. Thus inferences concerning population are only based on probability. There are various methods of inferential statistics, Standard errors, Test of Significance, Analysis of Variance, Analysis of Covariance and Factorial Analysis.

4.10. INTERPRETATION OF DATA

Once the data collection, organization and analysis are made the researcher has to draw inferences. This is possible only by the process of interpretation. It enables us for a careful, logical and critical analysis if the results obtained after analysis by keeping in view the limitations of sample chosen, the tools selected and used in the study.

❖ What is Interpretation

Interpretation refers to the task of drawing inferences from the collected facts after an analytical and/or experimental study. In fact, it is a search for broader meaning of research findings. The task of interpretation has two major aspects viz., (i) the effort to establish continuity in research through linking the results of a given study with those of another, and (ii) the establishment of some explanatory concepts. "In one sense, interpretation is concerned with relationships within the collected data, partially overlapping analysis. Interpretation also extends beyond the data of the study to include the results of other research, theory and hypotheses." Thus, interpretation is the device through which the factors that seem to explain what has been observed by researcher in the course of the study can be better understood and it also provides a theoretical conception which can serve as a guide for further researches.

❖ Why Interpretation?

Interpretation is essential for the simple reason that the usefulness and utility of research findings lie in proper interpretation. It is being considered a basic component of research process because of the following reasons:

i. It is through interpretation that the researcher can well understand the abstract principle that works beneath his findings. Through this he can link up his/her findings with those of other studies, having the same abstract principle, and thereby can predict about the concrete world of events. Fresh inquiries can test these predictions later on. This way the continuity in research can be maintained.
ii. Interpretation leads to the establishment of explanatory concepts that can serve as a guide for future research studies; it opens new avenues of intellectual adventure and stimulates the quest for more knowledge.
iii. Researcher can better appreciate only through interpretation why his/her findings are what they are and can make others to understand the real significance of his research findings.
iv. The interpretation of the findings of exploratory research study often results into hypotheses for experimental research and as such interpretation is involved in the

transition from exploratory to experimental research. Since an exploratory study does not have a hypothesis to start with, the findings of such a study have to be interpreted on a *post-factum* basis in which case the interpretation is technically described as '*post factum*' interpretation.

4.10.1. Precautions In Interpretation

One should always remember that even if the data are properly collected and analysed, wrong interpretation would lead to inaccurate conclusions. It is, therefore, absolutely essential that the task of interpretation be accomplished with patience in an impartial manner and also in correct perspective. Researcher must pay attention to the following points for correct interpretation:

i. At the outset, researcher must invariably satisfy himself/herself that (a) the data are appropriate, trustworthy and adequate for drawing inferences; (b) the data reflect good homogeneity; and that (c) proper analysis has been done through statistical methods.

ii. The researcher must remain cautious about the errors that can possibly arise in the process of interpreting results. Errors can arise due to false generalization and/or due to wrong interpretation of statistical measures, such as the application of findings beyond the range of observations, identification of correlation with causation and the like. Another major pitfall is the tendency to affirm that definite relationships exist on the basis of confirmation of particular hypotheses. In fact, the positive test results accepting the hypothesis must be interpreted as "being in accord" with the hypothesis, rather than as "confirming the validity of the hypothesis". The researcher must remain vigilant about all such things so that false generalization may not take place. He/she should be well equipped with and must know the correct use of statistical measures for drawing inferences concerning his study.

iii. He/she must always keep in view that the task of interpretation is very much intertwined with analysis and cannot be distinctly separated. As such he/she must take the task of interpretation as a special aspect of analysis and accordingly must take all those precautions that one usually observes while going through the process of analysis viz., precautions concerning the reliability of data, computational checks, validation and comparison of results.

iv. He/she must never lose sight of the fact that his task is not only to make sensitive observations of relevant occurrences, but also to identify and disengage the factors that are initially hidden to the eye. This will enable him/her to do the job of interpretation on proper lines. Broad generalisation should be avoided as most research is not amenable to it because the coverage may be restricted to a particular time, a particular area and particular conditions. Such restrictions, if

any, must invariably be specified and the results must be framed within their limits.

v. The researcher must remember that “ideally in the course of a research study, there should be constant interaction between initial hypothesis, empirical observation and theoretical conceptions. It is exactly in this area of interaction between theoretical orientation and empirical observation that opportunities for originality and creativity lie.” He must pay special attention to this aspect while engaged in the task of interpretation.

4.11. WRITING OF RESEARCH PROPOSAL AND REPORT

The following are the various methods used in writing research proposal and report.

4.11.1 Research Proposal

In simple terms, a research proposal means a written application that proposes to pursue or conduct a research study. It aims at presenting the idea around which the research study revolves. A research proposal should be able to communicate that the researcher has applied deep thought to the subject of research, and has put considerable effort in collecting the required information, scrutinizing the available data and contemplated a well-organized plan for the research. It tries to emphasize the need of conducting the research, and thus, necessarily involves formulation of a good research question. The basic components of a research proposal are as follows:

- Title
- Abstract
- Background
- Objective
- Technical approach
- Bibliography

Based on this format, the desired form and features of the contents contained in a research proposal can be enumerated as follows:

i. A research proposal starts with a foreword that contains the core question, which the researcher aims to answer. Thus, it is written with the purpose of explaining something.

ii. It also contains a concise review of the prevailing literature related to the researcher's subject. Here, the researcher aims at reviewing the major works related to his/her topic and specify the arguments that have been formulated.
iii. The research proposal includes a statement regarding the argument or explanation that the researcher aims to present.
iv. The proposal should also indicate the way in which the researcher's argument is going to be different from the arguments made by other authors. In other words, it should emphasize the aspects in which the argument is unique.
v. The proposal should also include a short summary of the different parts of the research.
vi. A short bibliography containing the important sources being used should also be written in the proposal. This can also mean including databases, websites and interviews.
vii. The researcher should opt for quality rather than quantity in writing his/her proposal. Thus, a proposal need not be long and an approximately 3-4 pages of research proposal is quite sufficient.

The research proposal is supposed to communicate the researcher's overall effort that is involved in conducting the research. As such, a researcher should take ample care while writing the research proposal. You should keep in mind while writing such a proposal that the ideas involved in the research study need to be presented in a comprehensive and reliable format. The reader should get a clear-cut idea of what the research is all about and what argument it aims to convey. It should also emphasize the researcher's thought process and the depth of his/her knowledge of the concerned subject matter of research.

4.11.2 Research Process

The process of research can be implemented as a series of actions or steps that are essential to be performed in a specific order. These actions or activities usually overlap each other rather than pursuing a specific sequence. A brief description of the steps is given as follows:

i. **Selecting the Topic:** The first step of a researcher is to select a topic of research. While doing so, he/she should restrict it to the most potential topic that is open for extensive research out of several alternatives. The factors to be considered for topic selection are:
    - Relevance
    - Scope for research, i.e., the required data should be available and accessible

- Contribution to knowledge in the specific field
- Required cooperation from the research guide

ii. **Define the Research Problem:** The research problems can be related to either the state of nature or to the relationship of variables. In defining the research problem, the researcher should study the existing literature including books and journals available in the field with an interdisciplinary perspective to base his/her research topic on some reliable background. He/She should also concentrate on the relevance of the present research with the past works.

iii. **Mention the Objective of Research:** After selecting the topic and defining the research problem, the researcher should mention the objective of research. This means that he/she should explain what he/she aims to achieve through the research. His/Her objective should also include an explanation of the extent to which the research work is related to the specific field.

iv. **Survey Existing Literature:** To understand the basis of research, it is important for the researcher to review the existing literature. This involves:

- Surveying the existing books available in the field.
- Reviewing other published materials like articles, journals, reports and conference proceedings.

The researcher should then prepare his/her own index fix a period, in chronological order, in addition to his/her consultation of various indices.

v. **Determine the Sample Design:** Often, we select only a few items for universal study purposes, for example, blood testing on sample basis to perform census inquiry. The item selected is technically known as a sample. The researcher must decide the way of selecting a sample or decide about the sample design. A sample design is a definite plan determined for data collection to obtain a sample from a given population. The various types of sample designs are as follows:

- Deliberate sampling
- Simple random sampling
- Systematic sampling
- Stratified sampling
- Quota sampling
- Cluster sampling
- Multi-stage sampling
- Sequential sampling

The researcher should decide the sample design after considering the nature of inquiry and other related factors. Sometimes, several of these methods of sampling are used in the same study, which in turn is called ‘mixed sampling’.

vi. **Data Collection:** There are a variety of ways to collect data. Primary data can be collected through experiments or through surveys. If the researcher performs an experiment, he/she observes some quantitative measurements. This helps him/her to examine the truth in his/her hypothesis. In the case of survey, however, the researcher can adopt one or more of the following ways to collect data:

- By observation
- Through personal interview
- Through telephone interview
- By mailing of questionnaires
- Through schedules

vii. **Execute the Project:** This is the most important step in the research process. The researcher should ensure that the project is performed in a logical way and in time. If a survey is to be carried out, steps should be taken to ensure that it is under statistical control so that the collected data is in accordance with the predetermined standard of accuracy.

viii. **Analysis of Data:** After data collection, the researcher turns to the task of analysing them. The bulk data should be compressed into a few manageable groups and tables for further analysis. The researcher can analyse the collected data by using various statistical measures.

ix. **Hypothesis Testing:** After analysing the data, the researcher should test the hypothesis, if any. He/She should check if the facts support the hypothesis or are contrary to the hypothesis. Statisticians have developed tests like Chi square test, t-test and F-test, for hypothesis testing. This testing further results in either acceptance or rejection of the hypothesis.

x. **Generalizations and Interpretations:** The real value of research lies in its ability to arrive at certain generalizations, If the researcher cannot find a hypothesis to start with, he/she might seek to explain his/her findings on the basis of some theory. This is called ‘interpretation’. This may give rise to new questions and further lead to more research.

xi. **Preparation of Report or Thesis:** This is the concluding step of research, where the researcher has to prepare the report of what has been done by him/ her. Generally, the report should be designed in accordance with the following layout:

- **The Preliminary Pages:** Here the title, date, acknowledgments and foreword with the table of contents should be mentioned.
- **The Main Text:** This should be divided into introduction, summary, main report and conclusion.

- **End Matter:** This should contain appendices, bibliography and index.

A report should be written in a precise and objective style in simple language. Charts and illustrations should be included to lay emphasis on the study of research.

4.11.3. Introduction to Report Writing

Research report is considered a major component of the research study for the research task remains incomplete till the report has been presented and/or written. As a matter of fact even the most brilliant hypothesis, highly well designed and conducted research study, and the most striking generalizations and findings are of little value unless they are effectively communicated to others. The purpose of research is not well served unless the findings are made known to others. Research results must invariably enter the general store of knowledge. All this explains the significance of writing research report. There are people who do not consider writing of report as an integral part of the research process. But the general opinion is in favour of treating the presentation of research results or the writing of report as part and parcel of the research project. Writing of report is the last step in a research study and requires a set of skills somewhat different from those called for in respect of the earlier stages of research. This task should be accomplished by the researcher with utmost care; he may seek the assistance and guidance of experts for the purpose.

A report can also be defined as a written document, which presents information in a specialized and concise manner. For example, a list of employees prepared by the HR department for salary distribution can be termed as a report. In other words, a report is information presented in a logical and concise manner. There is a difference between report writing and other compositions because a report is written in a very short and conventional form. A report should cover all mandatory matters but nothing extra should be written. For writing a report, at first the relevant data is collected and then it is presented in a concise and objective manner. Then after successfully establishing the structure of the report, the formatting features that improve the look and readability of the report are added.

❖ Different Steps in Writing Report

Research reports are the product of slow, painstaking, accurate inductive work. The usual steps involved in writing report are: (a) logical analysis of the subject-matter; (b) preparation of the final outline; (c) preparation of the rough draft; (d) rewriting and polishing; (c) preparation of the final bibliography; and (f) writing the final draft. Though

all these steps are self explanatory, yet a brief mention of each one of these will be appropriate for better understanding.

a) ***Logical analysis of the subject matter:*** It is the first step which is primarily concerned with the development of a subject. There are two ways in which to develop a subject (a) logically and (b) chronologically. The logical development is made on the basis of mental connections and associations between the one thing and another by means of analysis. Logical treatment often consists in developing the material from the simple possible to the most complex structures. Chronological development is based on a connection or sequence in time or occurrence. The directions for doing or making something usually follow the chronological order.

b) ***Preparation of the final outline:*** It is the next step in writing the research report "Outlines are the framework upon which long written works are constructed. They are an aid to the logical organization of the material and a reminder of the points to be stressed in the report."

c) ***Preparation of the rough draft:*** This follows the logical analysis of the subject and the preparation of the final outline. Such a step is of utmost importance for the researcher now sits to write down what he/she has done in the context of his research study. He/she will write down the procedure adopted by him /her in collecting the material for his/her study along with various limitations faced by him/her, the technique of analysis adopted by him/her, the broad findings and generalizations and the various suggestions he/she wants to offer regarding the problem concerned.

d) ***Rewriting and polishing of the rough draft****:* This step happens to be most difficult part of all formal writing. Usually this step requires more time than the writing of the rough draft. The careful revision makes the difference between a mediocre and a good piece of writing. While rewriting and polishing, one should check the report for weaknesses in logical development or presentation. The researcher should also "see whether or not the material, as it is presented, has unity and cohesion; does the report stand upright and firm and exhibit a definite pattern, like a marble arch? Or does it resemble an old wall of moldering cement and loose brick."4 In addition the researcher should give due attention to the fact that in his rough draft he has been consistent or not. He should check the mechanics of writing—grammar, spelling and usage.

e) ***Preparation of the final bibliography:*** Next in order comes the task of the preparation of the final bibliography. The bibliography, which is generally appended to the research report, is a list of books in some way pertinent to the research which has been done. It should contain all those works which the researcher has consulted. The bibliography should be arranged alphabetically and may be divided into two parts; the first part may contain the names of books and

pamphlets, and the second part may contain the names of magazine and newspaper articles. Generally, this pattern of bibliography is considered convenient and satisfactory from the point of view of reader, though it is not the only way of presenting bibliography. The entries in bibliography should be made adopting the following order:

For books and pamphlets the order may be as under:

i. Name of author, last name first.
ii. Title, underlined to indicate italics.
iii. Place, publisher, and date of publication.
iv. Number of volumes.

Example

Kothari, C.R., *Quantitative Techniques,* New Delhi, Vikas Publishing House Pvt. Ltd., 1978.

For magazines and newspapers the order may be as under:

i. Name of the author, last name first.
ii. Title of article, in quotation marks.
iii. Name of periodical, underlined to indicate italics.
iv. The volume or volume and number.
v. The date of the issue.
vi. The pagination.

Example

Robert V. Roosa, "Coping with Short-term International Money Flows", *The Banker,* London, September, 1971, p. 995.

The above examples are just the samples for bibliography entries and may be used, but one should also remember that they are not the only acceptable forms. The only thing important is that, whatever method one selects, it must remain consistent.

f) ***Writing the final draft:*** This constitutes the last step. The final draft should be written in a concise and objective style and in simple language, avoiding vague expressions such as "it seems", "there may be", and the like ones. While writing the final draft, the researcher must avoid abstract terminology and technical jargon. Illustrations and examples based on common experiences must be incorporated in the final draft as they happen to be most effective in communicating the research findings to others. A research report should not be dull, but must enthuse people and maintain interest and must show originality. It must be remembered that every report should be an attempt to solve some intellectual problem and must contribute to the solution of a problem and must add to the knowledge of both the researcher and the reader.

4.11.4. Layout of the Research Report

Anybody, who is reading the research report, must necessarily be conveyed enough about the study so that he/she can place it in its general scientific context, judge the adequacy of its methods and thus form an opinion of how seriously the findings are to be taken. For this purpose there is the need of proper layout of the report. The layout of the report means as to what the research report should contain. A comprehensive layout of the research report should comprise (A) preliminary pages; (B) the main text; and (C) the end matter. Let us deal with them separately.

A. Preliminary Pages

In its preliminary pages the report should carry a *title and date*, followed by acknowledgements in the form of 'Preface' or 'Foreword'. Then there should be a *table of contents* followed by *list of tables and illustrations* so that the decision-maker or anybody interested in reading the report can easily locate the required information in the report.

B. Main Text

The main text provides the complete outline of the research report along with all details. Title of the research study is repeated at the top of the first page of the main text and then follows the other details on pages numbered consecutively, beginning with the second page. Each main section of the report should begin on a new page. The main text of the report should have the following sections: (i) Introduction; (ii) Statement of findings and recommendations; (iii) The results; (iv) The implications drawn from the results; and (v) The summary.

i. ***Introduction:*** The purpose of introduction is to introduce the research project to the readers. It should contain a clear statement of the objectives of research i.e., enough background should be given to make clear to the reader why the problem was considered worth investigating. A brief summary of other relevant research may also be stated so that the present study can be seen in that context. The hypotheses of study, if any, and the definitions of the major concepts employed in the study should be explicitly stated in the introduction of the report.

The methodology adopted in conducting the study must be fully explained. The scientific reader would like to know in detail about such thing: How was the study carried out? What was its basic design? If the study was an experimental one, then what were the experimental manipulations? If the data were collected by means of questionnaires or interviews, then exactly what questions were asked (The questionnaire or interview schedule is usually given in an appendix)? If measurements were based on observation, then what instructions were given to the observers? Regarding the sample used in the study the reader should be told: Who

were the subjects? How many were there? How were they selected? All these questions are crucial for estimating the probable limits of generalizability of the findings. The statistical analysis adopted must also be clearly stated. In addition to all this, the scope of the study should be stated and the boundary lines be demarcated. The various limitations, under which the research project was completed, must also be narrated.

ii. ***Statement of findings and recommendations****:* After introduction, the research report must contain a statement of findings and recommendations in non-technical language so that it can be easily understood by all concerned. If the findings happen to be extensive, at this point they should be put in the summarised form.

iii. ***Results:*** A detailed presentation of the findings of the study, with supporting data in the form of tables and charts together with a validation of results, is the next step in writing the main text of the report. This generally comprises the main body of the report, extending over several chapters. The result section of the report should contain statistical summaries and reductions of the data rather than the raw data. All the results should be presented in logical sequence and splitted into readily identifiable sections. All relevant results must find a place in the report. But how one is to decide about what is relevant is the basic question. Quite often guidance comes primarily from the research problem and from the hypotheses, if any, with which the study was concerned. But ultimately the researcher must rely on his own judgment in deciding the outline of his report. Nevertheless, it is still necessary that he states clearly the problem with which he was concerned, the procedure by which he worked on the problem, the conclusions at which he arrived, and the bases for his conclusions.

iv. ***Implications of the results:*** Toward the end of the main text, the researcher should again put down the results of his research clearly and precisely. He should, state the implications that flow from the results of the study, for the general reader is interested in the implications for understanding the human behaviour. Such implications may have three aspects as stated below:

a) A statement of the inferences drawn from the present study which may be expected to apply in similar circumstances.
b) The conditions of the present study which may limit the extent of legitimate generalizations of the inferences drawn from the study.
c) The relevant questions that still remain unanswered or new questions raised by the study along with suggestions for the kind of research that would provide answers for them.

It is considered a good practice to finish the report with a short conclusion which summarises and recapitulates the main points of the study. The conclusion drawn from the study should be clearly related to the hypotheses that were stated in the introductory section. At the same time, a forecast of the probable future of the subject and an indication of the kind of research which needs to be done in that particular field is useful and desirable.

v. ***Summary:*** It has become customary to conclude the research report with a very brief summary, resting in brief the research problem, the methodology, the major findings and the major conclusions drawn from the research results.

C. End Matter

At the end of the report, appendices should be enlisted in respect of all technical data such as questionnaires, sample information, mathematical derivations and the like ones. Bibliography of sources consulted should also be given. Index (an alphabetical listing of names, places and topics along with the numbers of the pages in a book or report on which they are mentioned or discussed) should invariably be given at the end of the report. The value of index lies in the fact that it works as a guide to the reader for the contents in the report.

4.11.5. Mechanism of Writing a Research Report

There are very definite and set rules which should be followed in the actual preparation of the research report or paper. Once the techniques are finally decided, they should be scrupulously adhered to, and no deviation permitted. The criteria of format should be decided as soon as the materials for the research paper have been assembled. The following points deserve mention so far as the mechanics of writing a report are concerned:

1. ***Size and physical design:*** The manuscript should be written on unrolled paper 8 1 2^2 × 11^2 in size. If it is to be written by hand, then black or blue-black ink should be used. A margin of at least one and one-half inches should be allowed at the left hand and of at least half an inch at the right hand of the paper. There should also be one-inch margins, top and bottom. The paper should be neat and legible. If the manuscript is to be typed, then all typing should be double-spaced on one side of the page only except for the insertion of the long quotations.

2. ***Procedure:*** Various steps in writing the report should be strictly adhered (All such steps have already been explained earlier in this chapter).

3. ***Layout:*** Keeping in view the objective and nature of the problem, the layout of the report should be thought of and decided and accordingly adopted (The layout of the

research report and various types of reports have been described in this chapter earlier which should be taken as a guide for report-writing in case of a particular problem).

4. ***Treatment of quotations:*** Quotations should be placed in quotation marks and double spaced, forming an immediate part of the text. But if a quotation is of a considerable length (more than four or five type written lines) then it should be single-spaced and indented at least half an inch to the right of the normal text margin.

5. ***The footnotes:*** Regarding footnotes one should keep in view the followings:

a) The footnotes serve two purposes viz., the identification of materials used in quotations in the report and the notice of materials not immediately necessary to the body of the research text but still of supplemental value. In other words, footnotes are meant for cross references, citation of authorities and sources, acknowledgement and elucidation or explanation of a point of view. It should always be kept in view that footnote is neither an end nor a means of the display of scholarship. The modern tendency is to make the minimum use of footnotes for scholarship does not need to be displayed.

b) Footnotes are placed at the bottom of the page on which the reference or quotation which they identify or supplement ends. Footnotes are customarily separated from the textual material by a space of half an inch and a line about one and a half inches long.

c) Footnotes should be numbered consecutively, usually beginning with 1 in each chapter separately. The number should be put slightly above the line, say at the end of a quotation. At the foot of the page, again, the footnote number should be indented and typed a little above the line. Thus, consecutive numbers must be used to correlate the reference in the text with its corresponding note at the bottom of the page, except in case of statistical tables and other numerical material, where symbols such as the asterisk (*) or the like one may be used to prevent confusion.

d) Footnotes are always typed in single space though they are divided from one another by double space.

6. ***Documentation style:*** Regarding documentation, the first footnote reference to any given work should be complete in its documentation, giving all the essential facts about the edition used. Such documentary footnotes follow a general sequence. The common order may be described as under:

a) Regarding the single-volume reference

- Author's name in normal order (and not beginning with the last name as in a bibliography) followed by a comma;
- Title of work, underlined to indicate italics;
- Place and date of publication;
- Pagination references (The page number).

Example

John Gassner, *Masters of the Drama,* New York: Dover Publications, Inc. 1954, p. 315.

b) Regarding multivolumed reference

- Author's name in the normal order;
- Title of work, underlined to indicate italics;
- Place and date of publication;
- Number of volume;
- Pagination references (The page number).

c) Regarding works arranged alphabetically

For works arranged alphabetically such as encyclopedias and dictionaries, no pagination reference is usually needed. In such cases the order is illustrated as under:

Example 1

"Salamanca," *Encyclopaedia Britannica,* 14th Edition.

Example 2

"Mary Wollstonecraft Godwin," *Dictionary of national biography.*

But if there should be a detailed reference to a long encyclopedia article, volume and pagination reference may be found necessary.

d) Regarding periodicals reference

- Name of the author in normal order;
- Title of article, in quotation marks;
- Name of periodical, underlined to indicate italics;
- Volume number;
- Date of issuance;
- Pagination.

e) *Regarding anthologies and collections reference*

Quotations from anthologies or collections of literary works must be acknowledged not only by author, but also by the name of the collector.

f) Regarding second-hand quotations reference

In such cases the documentation should be handled as follows:

- Original author and title;
- "quoted or cited in,";
- Second author and work.

Example

J.F. Jones, *Life in Ploynesia,* p. 16, quoted in *History of the Pacific Ocean area,* by R.B. Abel, p. 191.

g) Case of multiple authorship

If there are more than two authors or editors, then in the documentation the name of only the first is given and the multiple authorship is indicated by "et al." or "and others".

Subsequent references to the same work need not be so detailed as stated above. If the work is cited again without any other work intervening, it may be indicated as *ibid*, followed by a comma and the page number. A single page should be referred to as p., but more than one page be referred to as pp. If there are several pages referred to at a stretch, the practice is to use often the page number, for example, pp. 190ff, which means page number 190 and the following pages; but only for page 190 and the following page '190f'. Roman numerical is generally used to indicate the number of the volume of a book. Op. cit. (opera citato, in the work cited) or Loc. cit. (loco citato, in the place cited) are two of the very convenient abbreviations used in the footnotes. Op. cit. or Loc. cit. after the writer's name would suggest that the reference is to work by the writer which has been cited in detail in an earlier footnote but intervened by some other references.

7. *Punctuation and abbreviations in footnotes:* The first item after the number in the footnote is the author's name, given in the normal signature order. This is followed by a comma. After the comma, the title of the book is given: the article (such as "A", "An", "The" etc.) is omitted and only the first word and proper nouns and adjectives are capitalized. The title is followed by a comma.

Information concerning the edition is given next. This entry is followed by a comma. The place of publication is then stated; it may be mentioned in an abbreviated form, if the place happens to be a famous one such as Lond. for London, N.Y. for New York, N.D. for New Delhi and so on. This entry is followed by a comma. Then the name of the publisher is mentioned and this entry is closed by a comma. It is followed by the date of publication if the date is given on the title page. If the date appears in the copyright notice on the reverse side of the title page or elsewhere in the volume, the comma should be omitted and the date enclosed in square brackets [c 1978], [1978]. The entry is followed by a comma. Then follow the volume and page references and are separated by a comma if both are given. A period closes the complete documentary reference. But one should remember that the documentation regarding acknowledgements from magazine articles and periodical literature follow a different form as stated earlier while explaining the entries in the bibliography.

8. *Use of statistics, charts and graphs:* A judicious use of statistics in research reports is often considered a virtue for it contributes a great deal towards the clarification and simplification of the material and research results. One may well remember that a good picture is often worth more than a thousand words. Statistics are usually presented in the form of tables, charts, bars and line-graphs and pictograms. Such presentation should be

self explanatory and complete in itself. It should be suitable and appropriate looking to the problem at hand. Finally, statistical presentation should be neat and attractive.

9. ***The final draft:*** Revising and rewriting the rough draft of the report should be done with great care before writing the final draft. For the purpose, the researcher should put to himself questions like: Are the sentences written in the report clear? Are they grammatically correct? Do they say what is meant'? Do the various points incorporated in the report fit together logically? Having at least one colleague read the report just before the final revision is extremely helpful. Sentences that seem crystal-clear to the writer may prove quite confusing to other people; a connection that had seemed self evident may strike others as a *non-sequitur*. A friendly critic, by pointing out passages that seem unclear or illogical, and perhaps suggesting ways of remedying the difficulties, can be an invaluable aid in achieving the goal of adequate communication.

10. ***Bibliography:*** Bibliography should be prepared and appended to the research report as discussed earlier.

11. ***Preparation of the index:*** At the end of the report, an index should invariably be given, the value of which lies in the fact that it acts as a good guide, to the reader. Index may be prepared both as subject index and as author index. The former gives the names of the subject-topics or concepts along with the number of pages on which they have appeared or discussed in the report, whereas the latter gives the similar information regarding the names of authors. The index should always be arranged alphabetically. Some people prefer to prepare only one index common for names of authors, subject-topics, concepts and the like ones.

4.11.6 Written and Oral Reports

A written report plays a vital role in every business operation. The manner in which an organization writes business letters and business reports creates an impression of its standard. Therefore, the organization should emphasize on the improvement of writing skills of the employees in order to maintain effective relations with their customers. Writing effective written report requires a lot of hard work. Therefore, before you begin writing, it is important to know the objective, i.e., the purpose of writing, collection and organization of required data.

❖ Guidelines for an Effective Written Report

Writing a report is the best way to communicate, and often the only way to convey one's ideas to others. Thus, it is necessary that the writing should be effective. To

improve the effectiveness of writing a report, following are the important points that should be kept in mind:

- Take breaks in between writing, since this gives you the time to incubate the ideas.
- Start writing a short manuscript first, and later on, the detailed one. Create an outline and organize the complete work.
- Make a checklist of the important points that are necessary to be covered in the manuscript. •Focus on one objective at a time.
- Use dictionary and relevant reference materials as and when required.

❖ Principles of Writing a Report

To write a useful report, it is necessary to follow certain principles. The following are the principles that must be followed while writing a report:

- **Principle of Purpose:** A report must have a clear and meaningful purpose that can be converted into an effective management. A clear statement of the purpose helps prepare a well-focussed report on which the management can work. Specification of the purpose is important because:
  i. Reports are the analysis of facts and proposals.
  ii. Reports are the record of a particular business activity.
- **Principle of Organization:** A report that is written should be well designed and well ordered. The managerial plan of a report must include the following:
  i. Purpose of report
  ii. Information required to be included in the report
  iii. Method used to collect report data
  iv. Summary of the report
  v. Problems and solutions of the subject mentioned in the report
  vi. An appendix that describes and confirms the content and conclusion of the report
- **Principle of Brevity:** Reports should be concise. It is essential because: o
  i. Long reports are costly.
  ii. Long reports are difficult to examine.
  iii. Long reports are prone to disapproval, as they seem insufficient.
  iv. Long reports focus on irrelevant minor details that may lead to ignorance of major points.

- **Principle of Clarity:** Reports should be clear. Clarity can be maintained by using simple language for writing the report. New terms, if any in the report, should be properly explained to avoid confusion.
- **Principle of Scheduling:** Reports should be prepared at that time when there is no undue burden on the staff or when the staff has sufficient time to prepare reports. However, the time period between the gathering of data and generating finished reports should not be long; otherwise, the report may become outdated and useless if it is not completed in time.
- **Principle of Cost:** While preparing reports, it is necessary that the cost-benefit analysis of the report should be done. A report should be minimum at costs and maximum at benefits. If the cost of preparation of the report is high but its benefit is low, then it is not advisable to prepare that report.

❖ **Different Formats of Written Reports**

A written report can be written in various formats, which are as follows:

i. **Straight-Line Format:** This format is used when the information is to be presented in alphabetical, sequential or numerical orders. This format is used to generate descriptive reports.
ii. **Building Blocks Format:** This format is used when the information presented leads to some conclusion. The report in this format starts with a brief introduction, contains some logical facts and finally the conclusions and recommendations.
iii. **Inverted Pyramid Format:** The report in this format has the most important item at the top, and the least important item at the bottom of the report. That is, items are listed in the descending order with the most important item at the top. This style of writing or format is also known as journalistic style or format.

❖ **Oral Report**

At times, oral presentation of the results that are drawn out of research is considered effective, particularly in cases where policy recommendations are to be made. This approach proves beneficial because it provides a medium of interaction between a listener and a speaker. This leads to a better understanding of the findings and their implications. However, the main drawback of oral presentation is lack of any permanent records related to the research. Oral presentation of the report is also effective when it is supported by various visual devices such as slides, wall charts and white boards that help in better understanding of the research reports.

❖ **Advantages of Oral Reports**

Oral reports help in direct communication without any delay. The following are some of the advantages of an oral report:

i. It provides immediate feedback to the participants of the oral report. Moreover, participants can also ask for further clarification, elaboration and justifications.
ii. It is time saving.
iii. It helps develop relationship among employees by building healthy atmosphere in an organization.
iv. It is an effective tool of persuasion in business.
v. It is economical as it saves large amount of money spent on stationery.
vi. It provides the speaker with the opportunity to correct and make himself/ herself clear on the spot.
vii. It helps speakers to immediately understand the reaction of the group that they are addressing.

❖ Disadvantages of Oral Reports

There are many disadvantages of oral reports, which are:

i. Oral reports may not always be time saving. Sometimes, the meeting between the speaker and the listener can continue for a very long time without any satisfactory conclusion.
ii. A listener of the oral report cannot always retain the entire message.
iii. The messages in the oral reports do not have any legal validity as they are not documented.
iv. Oral reports may sometimes be misleading, if the thoughts of the speaker are not organized carefully.
v. Lengthy oral messages may sometimes cause problems.

❖ Principles of Oral Reports

Oral reports should follow some principles in order to make communication of the oral report between the speaker and the listener effective. The following are the basic principles of oral reports:

i. It is the responsibility of a manager to inform his subordinates about the tasks that they have to perform.
ii. To obtain full commitment of employees for achieving their objectives, all important information that directly or indirectly affects the objective should be communicated to the employees. Also, employees should be aware of the matters that are relevant to their circumstances.

iii. It is the duty of a manager to see that the information of the report communicated to the subordinates is clear to them and is complete.
iv. Proper planning for information flow should be done.
v. The information in the oral report should provide proper feedback that helps maintain effective industrial relation.

Check Your Progress

1. What is report?
2. Cite a few characteristic of good report.
3. What is the uses of footnotes?
4. List the principles of report writing.

DID You Know

A report or account is any informational work (usually of writing, speech, etc.) made with the specific intention of relaying information or recounting certain events in a widely presentable form. Written reports are documents which present focused, salient content to a specific audience. Reports are often used to display the result of an experiment, investigation, or inquiry. The audience may be public or private, an individual or the public in general. Reports are used in government, business, education, science, and other fields. Reports use features, such as graphics, images, voice, or specialized vocabulary in order to persuade that specific audience to undertake an action.

4.12. SUMMARY

- Data collection is an important process of the research process. A researcher uses various tools to gather data like research, observation, questionnaires, interviews and sociometry.
- Observation is a process in which one or more persons observe some real-life situation and record pertinent occurrences. It is used to evaluate theovert behaviour of the individuals in controlled and uncontrolled situations.
- Observation can either be participant or non-participant.
- Questionnaire is a list of questions arranged in a specific way or randomly, generally in print or typed and having spaces for recording answers to the questions.
- Questionnaires can be either closed or open, with each form having its limitations and advantages. Questionnaires can be administered via mail, face to face or via the computer.

- Interview is a two-way systematic conversation between an investigator and an informant, initiated for obtaining information relevant to as a specific study.
- Sociometry is a method for discovering, describing and evaluating social status, structure, and development through measuring the extent of acceptance or rejection between individuals in a group.
- An artificial population is created by the researcher in order to illustrate a principle, or to make for more convenience and ease in carrying out the study of a problematic situation.
- The term ‘sampling’ refers to the technique whereby a smaller group is selected from a larger one so that the more manageable smaller group can be observed and those observations can be applied to the larger group as well.
- The sampling methods are broadly classified into two types: (i) Probability sampling and (ii) Non-probability sampling.
- Probability sampling is a technique of sampling which gives the probability that a sample is representative of population. This kind of sample is selected in such a way that every element chosen has a known probability of being included.
- Theoretically, random sampling 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.
- Systematic sampling is a variant of the random process of sampling. In this technique, the requisite number of sample units are selected from the population. This sampling entails organizing the population in a predetermined order and then selecting from the list at regular intervals.
- Double sampling is a type of sampling which includes both questionnaire and interview methods for probing a research problem.
- The main distinction between the multi-stage and the multi-phase sampling is the use of unit of sampling at different levels in multi-stage sampling but not in multi-phase sampling.
- The guiding principles in non-probability methods are— availability of the subjects, the personal judgment of the investigator, and convenience in carrying out the research.
- 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’.
- Sampling design refers to a definite plan for obtaining a sample from the sampling frame. It refers to the technique or procedure, which a researcher adopts in selecting some sampling units from where inferences about population are drawn. Sampling data is obtained before collecting the final data.

- The sampling frame should be selected in such a way that it consists of almost all the sampling units. A sample should be selected in such a way that it has all the characteristics of the population.
- Sampling unit is the basic unit that contains elements of the target population.
- A good sample is a true representative of the population corresponding to its properties. A good sample does not permit prejudices, pre-conceptions and imagination to influence its choice.
- Size of a sample should be such that it yields an accurate result. The probability of error can be estimated.
- Representative sample is the sample which possesses the same characteristics as that of its parent population or variable. Thus, it factually represents the variation that exists in the parent variable on the general level. The significance of a representative sample lies in the fact that it represents the population more accurately.
- Sampling distribution is often required in sampling analysis. Sampling distribution of mean refers to the probability distribution of all possible means of random samples of a given size.
- Sampling may give rise to certain errors known as 'sampling errors' or sampling fluctuations. Sampling errors are those errors, which arise on account of sampling and generally happen to be random variations in the sample estimates of the actual population values.
- A sample survey requires study in small portions of population, as there can be certain amount of inaccuracy in the information collected during sampling analysis. This inaccuracy is called sampling error or error variance.
- Sampling errors occur randomly and are equally likely to be in either direction and the magnitude of sampling error depends on the nature of the universe. The more uniform the universe is, the smaller is the sampling error.
- Sampling errors are of two types: (i) Biased and (ii) Unbiased. Biased errors arise from any bias in selection, estimation, etc.
- A research proposal should be able to communicate that the researcher has applied deep thought to the subject of research, and has put considerable effort in collecting the required information, scrutinizing the available data and contemplated a well- organized plan for the research.
- The research process involves preparation of a research report to explain the hypothesis. This is done by logical analysis of the subject, preparation of the rough draft and then making the final draft of the hypothesis.
- A report must have a clear and meaningful purpose that can be converted into an effective management. A clear statement of the purpose helps prepare a well-focussed report on which the management can work.

- According to the objective and nature of the research, the layout of the report should be decided and followed in a proper manner.
- A written report should be clear, specific and convincing in order to be effective. While writing, you should avoid ambiguity and follow a friendly, lively, pleasant and sophisticated style of writing.
- An oral report facilitates direct communication without any delay. It is time saving and also provides immediate feedback to the participants.
- Writing interpretive reports is different from writing an informational report because it contains different elements.

4.13. KEY TERMS

- **Observation :** A process in which one or more persons monitor some real-life situation and record pertinent occurrences.
- **Questionnaire:** A tool for research comprising a list of questions whose answers provide information about the target group, individual or event.
- **Sample:** It is a small percentage of the larger group selected for research.
- **Random error:** This is any form of error that can occur while performing activities like data collection, conducting surveys, coding, performing transfer and analysis.
- **Sampling design:** Refers to the technique or procedure adopted by a researcher in selecting some sampling units from where inferences about population are drawn.
- **Sampling frame:** A list containing all elementary units or a group of such units that may form the basis of a sampling process.
- **Informational report:** The report that consists of a collection of data or facts and is written in an orderly way.
- **Interpretive report:** These reports which contain a collection of data along with the interpretation or any recommendation explicitly specified by the writer.
- **Inventory report:** The report made to keep the stock of various things like furniture, equipment, stationery, utensils and other accessories.
- **Performance report:** The reports made to measure the performance of the employees in an organization for different purposes like appraisal or promotion.
- **Report:** A report is a written document which presents information in a specialized and concise manner.
- **Research layout:** Allotting the research findings in a comprehensible format.
- **Research proposal:** A written application that proposes to pursue or conduct a research study.

- **Research report:** A written document, which describes the findings of some individual or a group of individuals.
- **Sample design:** A definite plan determined for data collection to obtain a sample from a given population.

4.14. Answer to the Check Your Progress

1. Participatory and non-participatory observations are two types of observation.
2. The following are the limitations of observation:
    i. Observation may give undue stress to aspects of limited significance simply because they can be recorded easily, accurately and objectively.
    ii. Various observers observing the same event may concentrate on different aspects of a situation.
    iii. Try to pose and exhibit at the time of observation.
3. In the process of 'participant observation', the observer becomes more or less one of the group members and may actually participate in some activity or the other of the group as a listener, a visitor or any other role.
4. Observation technique is employed to observe characteristics of various designs of school buildings and equipment.
5. Too many variables may not be observed simultaneously to ensure effective observation.
6. Mail or post and face-to-face interview are the modes of getting information through questionnaire.
7. The questions should be relevant to the subject or problem and should be perfectly clear and unambiguous.
8. Questionnaires can be administered through mail, via personal contact and via the Internet.
9. The interview is, in a sense, the foundation upon which all other elements rest, for it is the data-gathering phase.
10. The various types of interview are: (i) Group Interview, (ii) Diagnostic Interview, (iii) Clinical Interview, (iv) Research Interview, (v) Single Interviewer or Panel Interviews, (vi) Directed Interview, (vii) Non-directive, (viii) Focused Interview, (ix) Depth Interview.
11. The tape recorder permits the interviewer to devote full attention to the respondent.
12. An interview permits the research worker to follow-up leads as contrasted with the questionnaire.
13. 'Sociometry' is a technique to study the choices a person makes, the way he communicates and interacts with other people in his group.

14. Sociometry is a test under which each member of a group is asked to choose from all other members those with whom she prefers to associate in a specific situation. The situation must be a real one to the group under study, e.g., ‘group study’, ‘play’, ‘classroom seating’, class monitor for students of a school.
15. Sociometry technique helps us to have an idea of the group at a glance. This enables us to form appropriate groups of students for carrying out various activities and projects. Such tests at different times enable us to find out the changes taking place in the group structure.
16. A ‘sample’ is a small percentage of the larger group who are selected for research. A sample can be statistically explained as being a subset of a population. The sample will be able to give an idea of the characteristics of the larger group from where it has been drawn. It is possible to make deductions about the larger population on the basis of the sample.

    The term ‘sampling’ refers to the technique whereby a smaller group is selected from a larger one so that the more manageable smaller group can be observed and those observations can be applied to the larger group as well. This is only possible when the sample group shares the same characteristics as the larger group.
17. Sampling design refers to a definite plan for obtaining a sample from the sampling frame. It refers to the technique or procedure, which a researcher adopts in selecting some sampling units from where inferences about population are drawn. Sampling data is obtained before collecting the final data.
18. The sampling frame should be selected in such a way that it consists of almost all the sampling units. A sample should be selected in such a way that it has all the characteristics of the population. Some of the popular sampling frames are census reports and electoral registers.
19. Sampling gives rise to certain errors known as ‘sampling errors’ or sampling fluctuations. Sampling errors are those errors, which arise on account of sampling and generally happen to be random variations in the sample estimates of the actual population values. These errors arise from any bias in selection, estimation, etc. Typically, a sampling error occurs when a sample survey requires study in small portions of population as there can be certain amount of inaccuracy in the information collected during sampling analysis. This inaccuracy is called sampling error or error variance.
20. The reliability of samples can be tested in the following ways:
    - More samples of the same size should be taken from the same universe and their results be compared. If results are similar, the sample will be reliable.

- If the measurements of the universe are known then they should be compared with the measurements of the sample. In case of similarity of measurement; the sample will be reliable.
- Sub-samples should be taken from the samples and studied. If the results of sample and sub-sample study show similarity, the sample should be considered reliable.

21. A 'report' is a written document which presents information in a specialized and concise manner. Research report is a written document, which describes the findings of some individual or a group of individuals.
22. A few characteristics of a good report include: (i) language and style of the report, (ii) structure of the report, (iii) presentation of the report, and (iv) references in the report.
23. Footnotes are meant for cross-references. They are placed at the bottom of the page, separated from the textual material by a space of half an inch as a line that is around one-and-a-half inches long. Footnotes are always typed in a single space, though they are divided from one another by double space.
24. The four types of informational report are: (i) inspection report, (ii) inventory report, (iii) assessment report, and (iv) performance report.
25. A written report can be written in various formats, that include: (i) straight-line format, (ii) building blocks format, and (iii) inverted pyramid format.
26. The principles of writing a report are: (i) Principle of purpose, (ii) Principle of organization, (iii) Principle of brevity, (iv) Principle of clarity, (v) Principle of scheduling, and (vi) Principle of cost.

4.15. QUESTIONS AND EXERCISES

Short-Answer Questions

1. What are the characteristics of 'observation'?
2. What are the major problems arising with in connection with observation technique?
3. List the steps involved in preparing and administering a questionnaire.
4. Name five steps which can be taken to improve a questionnaire.
5. What are the steps involved in preparing for a research interview?
6. List the various methods of sampling.
7. What criteria are required for selecting a sample?
8. List the steps required in sampling process.
9. What is representative sample?
10. What are sampling errors? What are its different types?
11. Mention the steps involved in the report writing process.
12. Write a note on oral presentation.

13. What do you mean by informational report?
14. Discuss the precautions that need to be taken while writing a research report.

Long-Answer Questions

1. Discuss the various types of observation.
2. Elaborate on the steps taken to ensure that observation is effective.
3. Discuss the types of commonly used questionnaires.
4. Describe the various types of interviews.
5. Explain the various methods of sampling. Discuss the criteria for selecting each sample type with the help of examples.
6. Elaborate in brief the various types of sampling distributions.
7. What are sampling errors? How they occur and what impact they have on research process?
8. 'Apart from reducing errors of bias, the simplest way of increasing the accuracy of a sample is to increase its size.' Justify the statement with the help of examples.
9. Explain the significance of a research report.
10. Explain the layout of a research report.
11. Give a detailed account on the mechanics of report writing.
12. Discuss the guidelines that must be followed while preparing a written report.

4.16. FURTHER READING

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