UNIT - I:

THE PROCESS AND METHODS OF CONDUCTING RESEARCH

(QUALITATIVE AND QUANTITATIVE)

Definition of Research- Steps in the process of Research- Characteristics of research, skills required to design and conduct Research. Quantitative Research Method: Definition, Characteristics- Methods: Survey - Correlational designs, Experiment designs. Qualitative Research Method: Definition, characteristics, designs: one to one interview, focus groups, ethnographic, Case study research, Record keeping and process of observation, Grounded theory designs, Ethnographic designs - Narrative Research designs.

Definition of Research

Webster's Third International Dictionary of the English Language defines research as "studious inquiry or examination, especially critical and exhaustive investigation or experimentation, having for its aim the discovery of new facts, and their correct interpretation, the revision of accepted conclusions, theories, or laws in the light of newly discovered facts, or practical applications of new or revised conclusions, theories, or laws."

According to the Random House Dictionary of the English Language, Research is a systematic inquiry into a subject in order to discover or revise facts, theories, etc.

In the Encyclopaedia of Social Sciences, Research is defined as "the manipulation of things, concepts or symbols for the purpose of generalization to extend, correct or verify knowledge whether that knowledge aids in the construction of a theory or in practice of an art."

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

Busha in his publication Research Methods in Librarianship says that Research is "a systematic quest for knowledge that is characterized by disciplined enquiry. Efficient and effective approach to expand knowledge is the conduct of special, planned and structured investigations."

Cook outlines research as an honest, exhaustive, intelligent searching for facts and their meanings or implications, with reference to a problem. He sees the word

'Research' as an acronym, each letter of the word, standing for a particular aspect as given below:

R = Rational way of thinking

E = Expert and Exhaustive treatment

S = Search and solution

E = Exactness

A = Analysis

R = Relationship of facts

C = Critical observation, Careful panning, Constructive attitude and Condensed generalisation

H = Honesty and Hard working

What are the Characteristics of Research?

Research is an activity that helps to generate knowledge. It helps in the testing of established knowledge as well as the development of new knowledge. Research is simply systematic inquiry, and it may aid us in the discovery of more efficient teaching and learning methods. Following are the important characteristics of research.

Knowledge Generation

Research contributes to the validation of established knowledge and, where possible, the generation of new knowledge. The research that results in knowledge generation is meticulously designed and performed in regulated environments.

Research is empirical (Scientific)

Research is a scientific process. Research is based on direct experience or observation by the researcher. Research is a systematic and critical investigation of a phenomenon. How did the term "science" come to be associated with it? Since it employs empirical techniques, protocols, and conclusions. The entire procedure is scientific in nature.

Research is logical

The research is conducted in accordance with defined procedures and principles. It employs rational reasoning to draw logical conclusions. It is empirically supported and founded on measurable experience.

Research is Cyclical

The research begins with and concludes with an issue. It establishes generalisations, concepts, and hypotheses. It was geared toward elucidating issues and resolving problems. Additionally, it results in novel solutions.

Research is Analytical

The research utilises proven analytical procedures in gathering data, whether historical, descriptive, experimental, and case study.

Research is Critical

The study demonstrates a high level of care and precision.

Research is Methodical

The research is performed in a systematic and non-biased manner, using systematic methods and procedures.

Research is Replicable

The researcher repeats the study design and procedures in order to obtain reliable and definitive results.

Describe the Meaning of Educational Research:

Educational research is a systematic and objective process of analyzing the phenomena in the field of Education. Educational research is an endeavour aimed at advancing the science of behaviour in educational settings. The ultimate purpose of this research is to provide educators with information that will allow them to accomplish their objectives most effectively. Educational study encompasses a range of techniques by which individuals analyse various facets of education, such as "student learning, instructional practises, teacher preparation, and classroom dynamics."

It encompasses all fields of study related to teaching and learning, teacher education, management, instruction and counselling, and so forth. Educational research entails the application of experimental methodology to the investigation of educational issues or educational thinking. Educational research's aim is to address educational issues.

According to Mouly, "Educational Research is the systematic application of the scientific method for solving educational problems."

Travers thinks, "Educational Research is the activity for developing science of behaviour in educational situations. It allows the educator to achieve his goals effectively. "According to Whitney, "Educational Research aims at finding out the solution to educational problems by using the scientific-philosophical method." Thus, educational research aims to solve the educational problem systematically and scientifically. In educational research, meaningful educational problems are identified and an attempt is made in a systematic, objective and deliberate manner to solve them.

What are the characteristics of educational research?

Research is a mental process leading to the generation of new ideas or concepts. It is the process of associating and relating existing ideas or concepts with new ideas or concepts. Innovation is the key notion in the research process. Educational research is a broad term. It refers to a variety of methods in which individuals evaluate different aspects of education including student learning, teaching methods, teacher training, classroom dynamics classroom management, school administration, study materials and transactional modalities.

Educational researches must be comprehensive and systematic in nature. Educational research follows an interdisciplinary approach. Numerous fields are represented in educational research to varying degrees. Psychology, sociology, anthropology, and philosophy are among them.

Describe the Characteristics of RESAERCH / Educational Research?

- Any research is conducted with a specific objective in mind. However, Educational Research is a highly purposeful endeavour. Since it addresses the concerns of both students and teachers.

- It is a method of inquiry that is accurate, analytical, empirical, and systematic.
- It makes an effort to quantitatively and qualitatively coordinate data in order to arrive at statistical inferences.
- It contributes to the development of new knowledge in the field of education.
- It is based on the educational theory.
- Its understanding and conclusions are contingent upon the researcher's skill, imagination, and experience.
- It needs an interdisciplinary approach to educational issues.
- In certain instances, it necessitates subjective analysis and deductive reasoning.
- It conducts studies in classrooms, schools, and colleges.

Gary Anderson outlined ten aspects of educational research. These can be classified into three categories, which are the purpose of research, the procedures of research, and the role of the researcher. The purposes of research are to solve the problems, investigate knowledge, and establish the principles in educational phenomena. In short, it focuses on solving problems and developing knowledge. Furthermore, the procedure is an important characteristic of educational research, which involves collecting data with accurate observation, objective interpretation, and verification. Finally, researchers need to be experts and familiar with their field of study, using the data to develop solutions and increase knowledge. The researchers also need to be patient and careful to use every step of research's procedures to achieve the purpose of research.

The ten aspects of Gary Anderson are:-

- Educational research makes an effort to resolve educational problems.

- Research entails either collecting new data from primary or first-hand sources or repurposing existing data.
- Research is based upon observable experience or empirical evidence.
- Research demands accurate observation and description.
- Research generally employs carefully designed procedures and rigorous analysis.
- The emphasis of research is on the creation of generalisations, concepts, and theories that aid in comprehension, prediction, and/or control.
- Research needs expertise—knowledge of the field; experience in methodology; and technical ability in data collection and analysis.
- The research attempts to find an objective, unbiased solution to the problem and takes great pains to validate the procedures employed.
- Research is a deliberate and unhurried activity which is directional but often refines the problem or questions as the research progresses.
- Research is carefully recorded and reported to other persons interested in the problem.

The chief characteristics of educational research as described by Lulla, Murty and Taneja in their book "Essentials of Educational Research " are presented below:

- Educational research is highly purposeful. It deals with the problems of teachers and educationists.
- Educational research follows a systematic process of investigation as precisely, objectively and scientifically as possible.
- Educational research involves the determination of the problem to be studied, formulation of hypotheses, gathering of information and necessary data from the concerned sources and using different tools of investigation.

- Educational research employs scientific methods, objective procedures, logical arguments and inductive reasoning.
- Educational research attempts to organize the data in quantitative and qualitative terms to arrive at the statistical inference
- Educational research emphasizes the discovery of new facts or interpretation of known facts in a new perspective
- Educational research has some underlying philosophic theory.
- Educational research depends on the ability, ingenuity and experience of the research for its conclusions and interpretations
- Educational research demands an interdisciplinary approach to solve many of its problems
- Educational research demands subjective interpretation deductive reasoning in some cases
- Educational research uses classrooms, schools and departments of education as the laboratories for conducting experiments, studies and surveys

Describe the scope/area of Educational Research:

Educational research is a wide field that can be viewed and categorised in a variety of ways. Among the most notable are the following:

Educational Research includes or covers the following fields:

- Learner and his problems
- Teaching-learning process
- Guidance and Counselling
- Textbooks
- Physically and mentally challenged children

•Educational Philosophy

• Objectives of Education

• Curriculum Organization

• Teaching Methods

• Problems of teachers, educational managers and parents

Describe the Need and Significance of Educational Research

The need and significance of educational research are:

- It helps in acquiring new knowledge about teaching, learning, classroom management, transactional modalities, education administration etc. Good and Scates say, "Science's goal is to improve knowledge, while research's goal is to advance science. " Thus research is essential for the development of Intelligence and knowledge. Educational research uses the scientific method to study best practices in teaching.
- Educational research is a means to attain educational objectives. Educational research is a purposeful activity or process. It is very necessary for attaining educational objectives. It accelerates the rate of social change. Research finds out new inventions or discoveries which help to speed up the social change.
- Educational research helps the researcher to know about national and international developments in the field of Education. It gives the researcher an idea about the latest developments in the field of education.
- Research is a modification process: Research gives scientific insight to curriculum makers to introduce reforms in the area. It gives teachers an idea of how to improve the classroom situation.

- It helps in administration: The Educational administration becomes effective by finding and implementing the solutions to many educational problems.
- It is an unavoidable necessity for teachers: Action-Research solves many problems and difficulties coming in the way of teachers. Thus, it is essential for teachers.

Describe the Purpose or Objectives of Educational Research

The main purpose or objectives of Educational Research is to diagnoses the educational problems and to find out its solutions. The purpose of educational research is also to develop new knowledge about the teaching-learning situation to improve educational practices. The assumption that the selection of transactional modalities should be based on research evidence and the emotional and cognitive development of the learner.

Educational research addresses the following aspects:

- To promote evidence-based (research-based) teaching practices.
- To enhance the credibility of the teaching profession
- To suggest innovative (best) teaching and learning strategies and to understand how students learn various subjects
- To identify what are the best practices for teachers to motivate their students to learn
- To identify the problem faced by learners and their emotional and cognitive developments
- To know about the best practices that make the classroom optimal for student learning

Describe the nature of educational research

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

Travers says "Educational research represents an activity directed towards the development of an organized body of scientific knowledge about the events with which educators are concerned. Of central importance are the behavioural patterns 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 conditions to provide to produce desired aspects of learned behaviour among young pupil who attends school"

Education is behavioural science. So, the major concern of educational research is to understand and explain and to some degree predict and control human behaviour. It aims to develop an organized and useful body of scientific knowledge about educational practices. Authors of research take issue with the nature of educational research. One view is that educational research is an applied science or engineering research. It is an applied science in the sense that it is concerned with the realization of certain practical ends which have social value. They argue that the function of education is to transmit the ideology of culture, knowledge and intellectual skills. Another opinion is that education aims to help an individual for the optimum development of potentiality for growth and development -not only concerning cognitive abilities but also concerning personality organization and adjustment.

STEPS IN THE PROCESS OF RESEARCH PROCESS

Preparing the research proposal is an important step because at this stage, entire research project gets a concrete shape. Researcher 's insight and inspiration are translated into a step by step plan for discovering new knowledge.

Research process refers to the various steps involved in carrying out research in a desired sequence. This does not assume that these steps are always performed in the same order. The different steps involved in research can be summarised in the flow chart below:

Defining Research Problem
Objectives of Research or Research Questions
Review of Literature
Formulation of Hypothesis
Research Design/Methodology
Data Collection
Data Analysis
Report Writing

1. Statement of the Problem

This is the first step in the research process. The entire subject of the study, as well as related principles and hypotheses in the area, are briefly presented here. The researcher would discuss how the problem emerged, the social and educational context in which it occurred, and the issue's importance. The issue can be mentioned widely at first and then narrowed operationally. Formulating the research issue entails two basic steps:

(i) Thoroughly comprehending the problem; and (2) Rephrasing it in practical terms from an operational/analytical standpoint. It is preferable to choose a familiar topic with easy access to research materials and data sources.

The researcher explains the definitions of technical terms and words or phrases used in the research. The researcher explains plainly the fundamental assumptions about the research issue. The time period and scope of the study must be defined precisely. The sources of data and its limitations must be explicitly mentioned.

2. Objectives of Research or Research Questions

Apart from the topic, the researcher should understand the significance of selecting a research problem, fixing of goals and objectives of the research problem and theoretical justifications for the research. The researcher should define the problem in general terms that will be refined later with the assistance of a literature review.

2. Review of Related Literature:

The researcher summarises what is known about the topic under investigation at the time of the investigation. The researcher refers to the work of other researchers in the field. The researcher explains how each of these studies is 'related' to my study. In this part, the researcher explores the insights gained through the study. He also justifies the importance of the

current research based on a review of relevant literature. The researcher should conclude by mentioning the following:

- What progress has been made in this arena so far?
- Where is it?
- When? (Area-wise) (Calendar year)
- How?
- What actions are required? (Methodologically)

Thus, the researcher will get the chance to identify the 'Research Gap'.

The literature reviewed can be classified into two categories: I philosophical and theoretical literature; and (ii) empirical literature, which includes quantitative findings from field studies. This will make it easier to come up with study questions. Academic papers, conference proceedings, government reports, and books are the main sources of literature. One can now access a large amount of literature through the internet, thanks to the spread of information technology. Academic papers, conference proceedings, government reports, and books are the main sources of literature. One can now access a large amount of literature through the internet, thanks to the spread of information technology. Academic papers, conference proceedings, government reports, and books are the main sources of literature. One can now access a large amount of literature through the internet, thanks to the spread of information technology.

3. Need and Significance of the Study (Rationale of the study)

Here the researcher will explain how this study will contribute to the field of education. How the findings / outcomes of this research will influence educational process in general. Additionally, the researcher

addresses the issue of 'why' this study is being performed. The researcher justifies the study's necessity.

4. Definition of Terms:

Each research study involves certain main or technical words that have a special meaning in the context of the study. As a result, it is often prudent to define certain main terms. There are two distinct categories of definitions.

(i) Theoretical / constitutive

(ii) Operational

(i) Theoretical / constitutive definition

A constitutive interpretation clarifies a definition and may provide further insight into the study. May be, this explanation is based on a hypothesis.

2. Operational definition

The operational definition refers to the precise way in which a variable is evaluated in a given sample. It is important to operationalize a variable in order to establish the methodology's credibility and to ensure the reproducibility of the study's findings.

5. Variables

The researcher should be very specific about the variable he is going to study. A variable is any object that has the ability to take on several values. Thus, what does this imply? Something, that is subject to variation is called a variable. For example, age can be considered a variable because it can take on different meanings for different individuals or for the same individual at different times. Similarly, nation may be called a variable since it is possible to attach a meaning to a person's country. A variable is a concept or abstract idea that can be quantified. This term refers to the

quantifiable characteristics, qualities, traits, or attributes of a person, object, or situation that is being studied in research.

6. Objectives of the study

When reading the problem statement, there can be some misunderstanding. To prevent such misunderstandings, a research problem must be defined. These specifications/objectives provide researchers clearness with additional clarification. The objectives serve as the base of the study. They will direct the entire research process.

7.Hypothesis:

The next step in the research process is to specify a working hypothesis (or hypotheses). A hypothesis is an argument that is made tentatively and must be checked for logical and empirical confirmation. A hypothesis is a proposition or collection of propositions that provides the most likely explanation for the existence of a specific event or phenomenon. When empirically tested, hypotheses may be accepted or rejected. As a result, every hypothesis must be testable. A hypothesis that is expressed as a relationship between the dependent and independent variables can be treated mathematically. The way a hypothesis is phrased is crucial because it offers the necessary emphasis for analysis. It also aids in determining the appropriate form of study.

Hypothesis a tentative assumption made in order to draw out and test its logical or empirical consequences. Formulation of hypothesis is an indication that researcher has sufficient knowledge in the area and it also gives direction for data collection and analysis. A hypothesis has to be: (I) testable, (ii) have explanatory power; (iii) state expected relationship between variables. (iv) Consistent with existing body of knowledge.

8.Limitations and Delimitations:

In any research, it is not possible to cover all aspects of the area of interest, variables, population and so on. Thus, a study has always certain limitations. Limitation is a broad term, but delimitation is a narrow term. It indicates boundaries of the study.

9. Method, Sample and Tools:

Method: Here the researcher should mention as to how the study will be conducted. The researcher should explain whether the study is qualitative or quantitative. The researcher should justify the method.

Sample: Sampling is concerned with the selection of a subset of individuals from within a population to estimate characteristics of the whole population. Researchers rarely survey the entire population because the cost of a census is too high. The three main advantages of sampling are that the cost is lower, data collection is faster, and since the data set is smaller it is possible to ensure homogeneity and to improve the accuracy and quality of the data.

Tools : The researcher should describe the steps of tool to be selected for the study. If readymade tools are used then its related details need to be reported. Details like author of the tool, its reliability, validity, and norms, along with scoring procedure need to be reported.

10.Analysis of Data

This is crucial step in proposal. The procedure of data collection, tabulation and organized for the purpose of further analysis is to be reported in this section.

11.Bibliography :

A bibliography is a systematic list of books and other works such as journals and articles .During preparation of proposal, researcher consults various

sources like books, journals, reports, Ph.D. theses etc. All such primary / secondary sources need to be reported in the bibliography.

12.Time Frame :

The proposal submitted for Ph.D. degrees, generally do not require time frame in all universities, but there is a fixed limit for these courses. It is advisable to give detailed time schedule. it helps to keep the researcher alert. Time schedule includes:

- Time required for preliminary work like review of literature.
- Time required for preparing tool/s.
- Time require for data collection, field visits etc.
- Time required for data analysis and report writing.

13. Budget:

The proposal submitted to the funding agency needs details regarding financial estimates. It may include expected expenditure keeping various budget needs. Following budget needs be kept in view along with amount.

- Remuneration for project team.
- Remuneration for secretarial staff like clerk, data entry operator, accountants, helpers etc.
- Remuneration for appointing project fellow, field investigators etc.
- Expenditure towards purchase of books, journals, tools etc.
- Expenditure towards printing, Xeroxing, stationery etc.
- Expenditure for data entry, tabulation and analysis of data.
- Expenditure for field work, travel for monitoring purpose etc.
- Expenditure for preparing final report.

14.Chapterisation :

Generally scheme of chaptalization is given in synopsis. If it is not possible to mention in research proposal write down various captions, sub captions in each chapter.

Quantitative Research Method: Definition

What is Quantitative Research?

Quantitative research is a research method employed to gain new knowledge. It is based on the measurement of quantity or amount. Quantitative research is a type of empirical (experimental) investigation. Here the researcher focuses on verifiable observations as opposed to theory or logic. Most often this type of research is expressed in numbers. Here the researcher manipulates certain observations to see the result. The overall goal is to convey numerically what is being seen in the research and to arrive at specific and observable conclusions.

Quantitative research method gives a numeric or statistical approach to research design. It applies to phenomena that can be exposed in terms of quantity. Quantitative research emphasizes objective (impartial or unbiased) measurements. It uses statistical, mathematical, or numerical analysis of data collected through polls (ballots), questionnaires, and surveys by manipulating pre-existing statistical data using computational techniques. Quantitative research begins with a problem statement and involves the formation of a hypothesis, a literature review, and a quantitative data analysis. Creswell (2003) states, quantitative research "employ strategies of inquiry such as experiments and surveys, and collect data on predetermined instruments that yield statistical data". The findings from quantitative research can be predictive, explanatory, and confirming.

Quantitative research designs are either descriptive or experimental. A descriptive study establishes an only association between variables; an experimental study establishes causality (Both Cause and Effect). Creswell, (2002) asserts that quantitative research originated in the physical sciences, particularly in chemistry and physics. The researcher uses mathematical models as the methodology of data analysis. Quantitative research is the numerical representation and manipulation of observations to describe and explain a phenomenon. It is used in a wide variety of natural and social sciences, including physics, biology, psychology, sociology and geology.

Characteristics of Quantitative Research

- Quantitative research aims to test hypotheses & make predictions.
- The variables are randomly selected. But specific variables are studied.
- For data collection numbers and statistics are used.
- Data collected based on precise measurements using structured & validated data-collection instruments.
- Method of analysis is the identification of statistical relationships
- In quantitative research objectivity is critical.
- Researcher & his biases are not known to the participants in the study.
- Quantitative research focuses on verifiable observation as opposed to theory or logic.
- Most often this type of research is expressed in numbers.
- The researcher manipulates certain observations that he is studying.
- The researcher determines what changes may reflect.
- Based on the study, the researcher will reach specific and observable conclusions.
- The researcher analyses numerical data and generalizes it.
- The researcher has a clearly defined research question to which objective answers are sought

- All aspects are carefully and precisely designed before data collection/ data is usually gathered using structured research instruments.
- Data are in the form of numbers and statistics
- The results are based on larger sample sizes that are representative of the population.
- The research study can usually be repeated.
- The researcher has a clearly defined research question to which objective answers are sought.
- The researcher uses tools, such as questionnaires or computer software, to collect numerical data.
- The researcher classifies features, count them, and construct statistical models in an attempt to explain what is observed.

Types of Quantitative research

Quantitative research designs are either experimental or non-experimental (descriptive)

The four types of quantitative research are

1. Descriptive research
2. Correlational research
3. Causal-comparative research
4. Experimental Research
5. Survey research

WHAT IS SURVEY RESEARCH?

Survey research is carried out to investigate and describe the current state-of-the-art of a situation, group of people, or institution. The answers to the queries what, when, and where are sought once the facts and verbal data have been gathered. It can also be used to collect large amounts of data that can be used for a variety of purposes later. Decennial census of India is one such example. It requires collection of primary data from the whole

field. It could also be collection of data by a sample survey to solve a research problem, study relations between two variables by statistical methods, or to provide scientifically collected

Normative Survey Research plays an important role in educational research. The term Normative Survey Research refers to the type of research question, design, and data analysis that will be applied to a given topic. It tell what is, while inferential statistics try to determine cause and effect

Characteristics of survey research

The following are some of the characteristics of descriptive method of research:

- It involves the gathering of data from a large group.
- It deals mainly with what exists at present.
- It is concerned chiefly with the general population rather than with the individuals.
- It includes description of events or establishing of relationships among events.
- It covers physical, behavioural and attitudinal aspects of individuals or abilities of pupils.
- It serves as a kind of exploration of the field of study.
- A survey might be broad or narrow in scope. It could be purely utilitarian or scholarly in nature.
- Its significance aimed at proving a well-known theory or one of its corollaries.

Procedure/steps of descriptive method.

The procedure of descriptive method is as following:

Selection of problem.

The first step is to choose an appropriate problem to investigate. The issue should be taken seriously by the educational or school administration immediately away. Both societal and educational demands should be taken into account. The survey study is more or less institutional research, rather than individual research. As a result, school administrators, educational administrators, instructors, and members of the public involved in education will choose it in the constitution. After you've found the problem, you should clearly identify it and design a solution. It's also important to figure out whether the survey will be longitudinal, cross-sectional, or a hybrid of the two.

Collection of data

Educational surveys and status studies, collect data through a range of research methods. Questionnaires, opinionnaires, attitude measures, timelines, interviews, case-study methodologies, rating scales, observational techniques, and other research tools are frequently used.

Evaluation criteria.

The descriptive research's usefulness in improving educational practice becomes a significant criterion for evaluation. It should provide administrators with a solid foundation from which to make critical decisions.

Analysis of data

The information acquired by using inquiry equipment will be scrutinized. Researchers can utilize data analysis to emphasize the most important aspect of the problem they're looking into, establishing the framework for a more detailed description and classification.

Interpretation of data

The data must be interpreted on the basis of analysis. Interpretation can be done in the following ways:

- Personal interpretation. It is subjective.
- Factual interpretation. This is scientific and objective and is based on facts obtained through the different tools of investigation.
- Comparative interpretation. This is also scientific and objective. The data are compared with other external criteria or internally with the responses given on different parts of the same tool.

Reporting of descriptive research.

It includes six steps in the organization of the matter:

- Introduction. Introducing the topic under investigation, its need, importance and rationale, method of study, tools of research used, review of related research, organization of the study.
- Background of the problem. In the second part, the background of the problem is to be explained in detail.
- Elaboration of the problem. The problem under investigation will be elaborated in its varied aspects in the third part of the report.
- Description of tools, analysis and interpretation. The 4th part refers to survey. It gives the detailed description of the tools of research, collection of data, analysis of responses, interpretation of data, etc.
- Review and recommendations. Finally, the principal findings are enumerated and relevant recommendations are given.
- Appendices. In the end, the bibliography, the tools of investigation used, list of related investigation and problem areas for future research are given under appendices.

Uses/purpose of surveys

- Educational surveys are particularly practical, especially for the administrators because they identify present conditions and point to present needs. Maybe they cannot make the decision for the administrator but they can provide him with information on which to base sound decision. They provide, therefore, the basis for decisions of improvement.
- It serves as a stepping stone to more precise investigation.
- Its purpose is both immediate and long range.
- It secures historical perspective through a series of cross sectional pictures of similar conditions at different times.
- It suggests the course of future developments. It gives pertinent data to the persons who are engaged in planning for the future.
- It contributes to the advancement of knowledge in many ways, e.g., by studying children of different ages we can obtain some picture of the trend of child development.

Problems for conducting survey research

Survey research though easy to design is difficult to conduct due to many factors ranging from non-cooperation, no-response to deliberate wrong information. Some of these are explained below.

Non-cooperation

Many persons are not interested in filling the questionnaire or giving time to the researcher for a meeting or interview. It may be due to many personal or administrative reasons due to: • lack of time;

- lack of interest due to many such requests from all types of academic and market researchers;
- fear of divulging such information which may not make the respondent or the institution any proud of achievements; or
- a political, tactical or business necessity to not to reveal some information asked for.

Getting information from the target population has become a matter of personal obligation. Every survey researcher has a bagful of woeful tales to tell. Usually it requires lot of patience, persuasion and skill to motivate the respondents to make them give the requested information or opinions. Therefore, persons who are not very social or do not have persistent attitude even in face of humiliation are not very suitable for this kind of research.

Outsourcing data collection

If it is vast field to be surveyed then some commercial but professional agency may be employed to collect data on your behalf. This is called outsourcing data. But it has its own problems.

- Data collected may not be reliable even could be cooked.
- You are deprived of the experience of ground realities. In the field apart from collecting raw data the researcher self-experiences and learns many more extraneous realities that helps him/her to see the problems in many unimagined perspectives. Personally, meeting and talking to the respondents is an invaluable experience. It may even change attitude and pre-conceived notions of the researcher.

Low response rate

Apart from delays, excuses, despite many reminders it is always time taking to get and collect data. Often the researchers have to advance

deadlines – as these are not met. Return or response rate may be low. It has obvious negative impact on the validity of the research findings. Forty percent return rate is sufficient, though not high.

Deliberate wrong information

Most of the respondents usually do not give true and frank information. This could be on two accounts:

- Question put may be ambiguous or wrongly interpreted by the respondents. For example, to the question "Is your library automated", many librarians says "yes" even if their computer is being used for clerical purpose only. As another example, many librarians answer it in affirmative that they provide "CAS" services, when in reality they publish a list of new arrivals. Wrong answer may be deliberate though appearing innocent.
- It is a natural human weakness or tendency to show only the ideal or bright side of one self. Many university teachers do not visit the library regularly, but when asked they answer that visit is "often". Some may be more diplomatic. Some may even lie blatantly. They seem to say proverbially "Ask me no questions, I will tell you no lies". It requires a very aware, experienced and mature person to dig out the realities from such wrong or ambiguous answers.

Unclear answer

If the question is open ended then human beings have the habit of answering in an ambiguous way – which may have double meaning. Qualitative answers are always a source of ambiguous results.

Cooked up data

Official record is often manipulated or cooked up. It is to show high performance than the actual one. Performance is sexed up, they say. For example, a library under threat of closure due to low readership may fabricate data and manipulate to show a greater number of users than the real numbers. When officials manipulate record for the media, authorities or the researchers, the researcher using this data uncritically or unchallenged will not reach the right conclusions. Results will be far from reality. Making practical use of such findings will be harmful. However, questioning or cross verification may somewhat correct the situation – one should not be pessimistic about the false or half answers. You need to be alert.

Instruments of Survey Research

The primary objective of a survey is to collect data directly. Direct observation or data from original and credible sources should be used to collect data. The following are the primary methods:

- Observation
- Interview
- Questionnaire or
- Any combination of these.

Observation

In this method the researcher observes an activity and notes down the information/data standing from a close distance. This could be done again in two ways: a) by informing the informants. b) in a hidden or secret way.

Questionnaire

It is a time-honored and ubiquitous method of data collection and recording. It is a systematic and officially written list of questions to be distributed to a large number of respondents. It is easy and handy, and can

be administrated in many ways depending upon the convenience of the researcher and respondent.

Telephonic Surveys

Now a days due to fast and cheaper telecommunication services telephones are being increasingly used to get data and opinions for social surveys form the willing respondents. These are ultimately economic in terms of time and money. If the field of survey is vast and respondents are scattered geographically or live in remote or inaccessible areas, then the telephone has hardly any substitute.

Electronic Surveys

New technology affords to solve problems of conventional instruments of survey research. The Internet and emails have advantages of both the conventional (print) and telephonic surveys. It is still more economic. Above all these can be interactive; detailed and yet very economic. As said earlier the answered data may be easily downloaded into a data process software package (say in SPSS) and processed directly. Even otherwise electronic data is easily collected, classified without any clerical errors in transferring data and information.

Correlational Research

Correlational designs provide an opportunity for researcher to predict scores and explain the relationship among variables. In **correlational research designs,** investigators use the correlation statistical test to describe and measure the degree of association (or relationship) between two or more variables or sets of scores. In this design, the researchers do not attempt to control or manipulate the variables as in an experiment; instead, they relate, using the correlation statistic, two or more scores for each person (e.g., a student motivation and a student achievement score for each individual).

A **correlation** is a statistical test to determine the tendency or pattern for two (or more) variables or two sets of data to vary consistently. In the case of only two variables, this means that two variables share common variance, or they co-vary together. To say that two variables co-vary has a somewhat complicated mathematical basis. **Co-vary** means that we can predict a score on one variable with knowledge about the individual's score on another variable. A simple example might illustrate this point. Assume that scores on a math quiz for fourth-grade students range from 30 to 90. All are interested in whether scores on an in-class exercise in math (one variable) can predict the student's math quiz scores (another variable). If the scores on the exercise do not explain the scores on the math quiz, then we cannot predict anyone's score except to say that it might range from 30 to 90. If the exercise could explain the variance in all of the math quiz scores, then we could predict the math scores perfectly. This situation is seldom achieved; instead, we might find that 40% of the variance in math

quiz scores is explained by scores on the exercise. This narrows our prediction on math quiz scores from 30 to 90 to something less, such as 40 to 60. The idea is that as variance increases, increases, all are better able to predict scores from the independent to the dependent variable (Gall, Borg, & Gall, 1996).

The statistic that expresses a correlation statistic as a linear relationship is the product— moment correlation coefficient. It is also called the bivariate correlation, zero-order correlation, or simply r, and it is indicated by an "r" for its notation. The statistic is calculated for two variables (ray) by multiplying the z scores on X and Y for each case and then dividing by the number of cases minus one. The mathematical calculations are illustrated in many introductory statistics books.

Use of Correlational Research for Researcher

Researcher use this design when researcher seek to relate two or more variables to see if they influence each other, such as the relationship between teachers who endorse developmentally appropriate practices and their use of the whole-language approach to reading instruction. This design allows researcher to predict an outcome, such as the prediction that ability, quality of schooling, student motivation, and academic coursework influence student achievement. Researcher also uses this design when researcher knows and can apply statistical knowledge based on calculating the correlation statistical test.

Development of Correlational Research

The history of correlational research draws on the themes of the origin and development of the correlation statistical test and the procedures for using and interpreting the test. Statisticians first developed the procedures for calculating the correlation statistics in the late 19th century. Although

British biometricians articulated the basic ideas of "corelation" during the last half of the 1800s, Karl Pearson presented the familiar correlation formula we know today in a paper before the Royal Society in England in November 1895. Interestingly, Pearson used illustrations from Darwin's theory of evolution and Sir Francis Galton's ideas on heredity and natural inheritance to advance his ideas about correlation. For example, one idea Pearson explored was to study Galton's idea of the relationship between the left cubit (the distance between the elbow of the bent left arm and the tip of the middle finger) and stature for adult males.

In presenting ideas about correlations, Pearson not only articulated the formula for a correlation, but he also presented concepts familiar to quantitative researchers today, such as the importance of sample size, the value of precise measurement, and the use of unbiased samples. However, Pearson was only one of several British biometricians around the turn of the century who refined and extended ideas about correlations. In 1897, Yule (Pearson's student) developed solutions for correlating two, three, and four variables. With Pearson, Yule also advanced the theory of regression and the ability to predict scores using information based on correlating correlation coefficients. By 1904, Spearman published ideas about a correlation matrix to display the coefficients, and he advanced a formula (Spearman's rho) for data that did not fit a normal, bell-shaped distribution.

Types of Correlational Designs

Years ago, research method writers specified correlational research as one of the quantitative "designs". With the sophisticated applications and explicit procedures of correlations, correlational research can rightfully take its place among our designs in quantitative research. The two primary correlation designs are explanation and prediction.

The Explanatory Design

Various authors refer to explanatory correlational research as -relational" research, "accounting-for-variance studies", or -explanatory" research. Because one basic objective of this form of correlational research is to explain the association between or among variables, we will use the term explanatory research in this discussion. An explanatory research design is a correlational design in which the researcher is interested in the extent to which two variables (or more) co-vary, that is, where changes in one variable are reflected in changes in the other. Explanatory designs consist of a simple association between two variables or more than two variables.

The Prediction Design

Instead of simply relating variables—two variables at a time or a complex set such as in our last example—in a prediction design, researchers seek to anticipate outcomes by using certain variables as predictors. For example, superintendents and principals need to identify teachers who will be successful in their schools. To select teachers who have a good chance of success, the administrators can identify predictors of success using correlational research. Prediction studies, therefore, are useful because they help anticipate or forecast future behavior.

The purpose of a prediction research design is to identify variables that will predict an outcome or criterion. In this form of research, the investigator identifies one or more predictor variable and a criterion (or outcome) variable. A predictor variable is a variable used to make a forecast about an outcome in correlational research. In the case of predicting teacher success in a school, the predictor may be "mentoring" during teacher training or "years of experience teaching." In much prediction research, investigators often use more than one predictor variable.

The Key Characteristics of Correlational Designs

As suggested by the explanatory and prediction desigi correlation research includes specific characteristics:

- ❖ Displays of scores (scatter plots and matrices)
- • Associations between scores (direction, form, a: strength)
- ❖ Multiple variable analysis (partial correlations a multiple regression)

Displays of Scores

If researcher has two scores, in correlation resear researcher can plot these scores on a graph (or scatter plot) present them in a table (or correlation matrix).

Scatterplots

Researchers plot scores for two variables on a graph provide a visual picture of the form of the scores. This alloy researchers to identify the type of association among variable and locate extreme scores. Most importantly, this plot can provides useful information about the form of the association-whether the scores are linear (follow a straight line) curvilinear (follow a U-shaped form). It also indicates t1 direction of the association (e.g., one score goes up and the other goes up as well) and the degree of the association (whether the relationship is perfect, with a correlation of 1.0, or less than perfect). A plot helps to assess this association between tv scores for participants. A scatterplot (or scatter diagram) is pictorial image displayed on a graph of two sets of scores f participants. These scores are typically identified as X and with X values represented on the horizontal axis, and Y value represented on the vertical axis. A single point indicates whet the X and Y scores intersect for one individual.

A Correlation Matrix

Correlation researchers typically display correlation coefficients in a matrix. A correlation matrix presents a visual display of the correlation coefficients for all variables in a study. In this display, researcher lists all variables on both a horizontal row and a vertical column in the table. Correlational researchers present correlation coefficients in a matrix in published research reports.

Steps of Correlational Designs

Step 1. Associating variables or making predictions

Researcher should associate variables or making predictions for easy to correctional analysis.

Step 2. Identify Individuals to Study

Ideally, researcher should randomly select the individuals to generalize results to the population, and seek permissions to collect the data from responsible authorities and from the institutional review board. The group needs to be of adequate size for use of the correlational statistic, such as N = 30; larger sizes contribute to less error variance and better claims of representativeness. For instance, a researcher might study 100 high school athletes to correlate the extent of their participation in different sports and their use of tobacco. A narrow range of scores from a population may influence the strength of the correlation relationships. For example, if researcher looks at the relationship between height of basketball players and number of baskets in a game, researcher might find a strong relationship among K-12th graders. But if researcher is selecting NBA players, this relationship may be significantly weaker.

Step 3. Identify Two or More Measures for Each Individual in the Study

Because the basic idea of correlational research is to compare participants in this single group on two or more characteristics, measures of

variables in the research question need to be identified, and instruments that measure the variables need to be obtained. Ideally, these instruments should have proven validity and reliability. Researcher can obtain permissions from publishers or authors to use the instruments. Typically, one variable is measured on each instrument, but a single instrument might contain both variables being correlated in the study.

Step 4. Collect Data and Monitor Potential Threats

The next step is to administer the instruments and collect at least two sets of data from each individual. The actual research design is quite simple as a visual presentation. Two data scores are collected for each individual until researcher obtains scores from each person in the study.

Step 5. Analyse the Data and Represent the Results

The objective in correlational research is to describe the degree of association between two or more variables. The investigator looks for a pattern of responses and uses statistical procedures to determine the strength of the relationship as well as its direction. A statistically significant relationship, if found, does not imply causation (cause and effect) but merely an association between the variables. More rigorous procedures, such as those used in experiments, can provide better control than those used in a correlational study.

Step 6. Interpret the Results

The final step in conducting a correlational study is interpreting the meaning of the results. This requires discussing the magnitude and the direction of the results in a correlational study, considering the impact of intervening variables in a partial correlation study, interpreting the regression weights of variables in a regression analysis, and developing a predictive equation for use in a prediction study.

In all of these steps, an overall concern is whether their data support the theory, the hypotheses, or questions. Further, the researcher considers whether the results confirm or disconfirm findings from other studies. Also, a reflection is made about tether some of the threats discussed above may have contributed to erroneous coefficients and the steps that might be taken by future researchers to address these concerns.

Evaluate a Correlational Study

To evaluate and assess the quality of a good correlational study, authors consider:

- An adequate sample size for hypothesis testing.
- The display of correlational results in a matrix or graph.
- An interpretation about the direction and magnitude of the association between two (or more) variables.
- An assessment of the magnitude of the relationship based on the coefficient of determination, p values, effect size, or the size of the coefficient.
- The choice of an appropriate statistic for analysis.
- The identification of predictor and the criterion variables.
- If a visual model of the relationships is advanced, the researcher indicates the expected direction of the relationships among variables, or the predicted direction based on observed data.
- The clear identification of the statistical procedures.

EXPERIMENTAL RESEARCH DESIGNS

What is experimental research design?

Research design is a master plan in the hands of a researcher. It contains the methods and procedures for collecting and analyzing the research study. The research design is the overall plan for how to obtain answers to the question

being studied and how to handle some of the difficulties encountered during the research process. In experimental research, the researcher selects the participants and divides them into two or more groups having similar characteristics and applies treatment to one group and measure the effect upon groups.

The experimental research method is commonly used in sciences such as psychology, physics, chemistry, biology and medicine etc. It is a collection of research designs which use manipulation and controlled testing to understand causal processes. Generally, one or more variables are manipulated to determine their effect on a dependent variable. In this method, the researcher makes changes in the independent variable and studies their effects on dependent variables under controlled conditions. According to Riely, experimental design is a powerful design for testing hypotheses of causal relationship among variables.

Characteristics of experimental research

- Experimental research is defined as "observations under controlled conditions".
- In this study, the researcher is an active agent rather than a passive observer.
- Experimental designs are concerned with the examination of the effect of an independent variable on the dependent variable, where the independent variable is manipulated through treatment or intervention(s).
- The researcher manipulates the independent variable
- The researcher decides the nature and extent of the treatment
- After the treatment, the researcher observes the effects of the treatment.

- Experimental research enables the researcher to go beyond description and prediction and measure the effects.
- True experimental designs consist of three cardinal features: randomization, control & manipulation or trial.
- Manipulation refers to conscious control of the independent variable by the researcher through treatment or intervention to observe its effect on the dependent variable.
- Control refers to the use of a control group and controlling the effects of extraneous variables on the dependent variable.
- Matching - It is a weak but a common method of control over the extraneous variables. In matching the researcher identifies one or more extraneous variables to be controlled which are supposed to affect the dependent variable.

Classification of Experimental Research

Experimental research design is further classified as

- True experimental design,
- Quasi-experimental design
- Pre experimental design

True experimental designs

In true experimental designs, the researchers have complete control over the extraneous variables and can predict confidently that the observed effect on the dependent variable is only due to the manipulation of an independent variable.

Advantages of true experimental design

- Most powerful design to establish the causal relationship between the independent and dependent variable.

- The study is conducted under a controlled environment. So a greater degree of purity is possible in observation.
- Conditions that are not found in a natural setting can be created in an experimental setting in a short period.
- The experiment is carried out in an experimental setting. So the problems of real-life situations and the personal problems of the researcher are eliminated.
- The researcher can manipulate independent variables to easily determine the cause-and-effect relationship.
- Due to the control set up by experimenter and the strict conditions, better results can be achieved.
- Disadvantages of true experimental design
- The experimental study cannot be replicated due to ethical or practical reasons.
- Many of the human variables neither have valid measurable criteria nor instruments to measure them.
- In experimental studies conducted in natural settings like a school, hospital or community, it is not possible to impose control over extraneous variables.
- Experiments are often more impractical.
- It is very difficult to obtain permission from the participants.
- Because the size of the sample is kept small, the representativeness of the findings of such study is questionable.

Steps in Scientific Research

Step 1: State the research problem

Identification of the research problem.

Here the researcher attempts to know whether the particular problem is suited to experimental study or not

Step 2: formation of hypothesis

The researcher forms a reasonable hypothesis to test cause-effect relationships

Step 3: Develop a standardized procedure

This involves setting up the experimental and control conditions.

Step 4: Identify the population, select the participants and assign them to conditions

This involves identifying the type of people and ensuring that the participants are representative of the population.

Step 5: Treatment

Here the researcher observes and manipulates the group to see change

Step 6 Apply statistical techniques to the data

This involves using statistics to describe the meaningful patterns of data

Step 6: Conclude from the data

This involves evaluating, whether or not the data supports the research hypothesis, clearly staying the practical uses of the results, theoretical implications, and suggesting future studies to address the limitations of the study.

Experimental research includes –

1. Pre-test/post-test control group design
2. Solomon four-group design
3. Two groups of random sample design

4. Matching sample design
5. Factorial designs

Pre-test/post-test control group design

In experimental designs, pre-test- post-test designs are the preferred method to compare participant groups and measure the degree of change occurring as a result of treatments or interventions. It is a measurement of the learning received during the class (period/time) as a result of comparing what the student knew before in a pre-test and after the class experience in a post-test. This study is generally significant than all other study designs. Because it generally produces the most accurate results in comparison to all other study designs. Experimental designs consist of two main types of study participants – an experimental or treatment group and a comparison or control group.

Experimental or treatment group

An experimental (treatment group) is a group of participants to whom an intervention is delivered and whose outcome measures are compared with those of the control group.

The control group (comparison group)

A control group refers to a group of "untreated" study participants (people who do not receive the intervention) that are generally similar to the treatment group in all other respects except for the fact that they do not receive the intervention.

This study has two important component – a pre-test and a post-test.

Pre-test-

It aims to quantify the knowledge attained by the students in the class with traditional learning style and educational backgrounds. Pre-tests help to

measure true learning. By comparing pre- and post-tests, teachers can see what students learned from the lessons that were developed. Pre-tests can give students a preview of what will be expected of them.

Pre-tests can help generate ideas for preparing post-tests.

Reasons for using a pre-test:

- To measure a starting point or the amount of pre-existing knowledge
- To compare with the starting point of a post-test
- To measure the learning level students.

Control group can be made up of the same group of the pupil or other units with identical composition. This avoids bias and is particularly important for behaviour-related studies. Reasons for using a post-test:

- To measure the learning as a result of the experiment
- To analyses the appropriateness of the learning objectives
- To recognize students who need additional help
- To target any instructional needs to improve the course

For many true experimental designs, pre-test-post-test designs are the preferred method to compare participant groups and measure the degree of change occurring as a result of treatments or interventions.

Solomon Four Group Design

In this experiment, the investigator randomly divides the sample into four separate groups- two experimental groups and two control groups. The first experimental group would receive the same procedure as in the pre-test /post-test design -that is random selection, pre-test, treatment and post-test. The first of the Treatment group is given the pre-test, no treatment and then the post-test. The second experimental group should not be given pre-

test but given treatment and post-test. The second treatment group nothing is to be given until the post-test.

Experimental Group 1	Pre-test	Treatment	Post -test
Treatment Group - 1	Pre-test	---------	Post- test
Experimental Group 2	----------	Treatment	Post-test
Treatment Group - 2	----------	----------	Post -test

Two Group Random sample design

In this design, the experimenter may choose to use only the last two groups of the Solomon four-group design. Here the Experimental group is given treatment and post-tested without conducting pre-test. The Treatment group is given only post-test.

Experimental Group	----------	Treatment	Post -test
Treatment Group	----------	----------	Post -test

The matching samples design/matched pairs design

It is more vigorous than other experimental researches. In this design, the researcher attempts to match or pair characteristics/ traits of control and experimental groups. For example, a study to compare the effectiveness two methods of teaching. The researchers want to compare two methods, the current method and a modern method. They select two groups of children and match pairs of children across the two groups according to writing ability, marks in the last exam, reading comprehension and efficiency.

Writing ability			
Experimental Group	Pre-test	Treatment	Post -test
Treatment Group	Pre-test	----------	Post -test

Marks in the last exam			
Experimental Group	Pre-test	Treatment	Post -test
Treatment Group	Pre-test	----------	Post -test

Reading comprehension			
Experimental Group	Pre-test	Treatment	Post -test
Treatment Group	Pre-test	----------	Post -test

Efficiency			
Experimental Group	Pre-test	Treatment	Post -test
Treatment Group	Pre-test	----------	Post -test

Factorial Design

In this research design, there are two or more independent variables are manipulated to study the observed results. Each independent variable is treated as a factor and study each factor. A factorial design is often used by scientists to understand the effect of two or more independent variables

upon a single dependent variable or more. In this study, independent variables are called factors. When multiple independent variables are there in a single study, it is called factorial design.

Example – "A study on computer use as an instrumental tool to improve the maths performance". In this study the researcher design a 2x2 factorial design. A 2x2 factorial design has two factors (IV) and two levels. Here one factor is Method of Instruction is one factor (IV) and the two levels are No computer Use and Computer Use. Gender is another factor (IV) and Boys and Girls are two levels.

QUALITATIVE RESEARCH METHOD

Meaning of qualitative research

All research ultimately has a qualitative grounding – D.T. Camp Bell

Qualitative research can be defined as a type of scientific research that tries to bridge the gap of incomplete information, systematically collects evidence, produces findings and thereby seeks answer to a problem or question. Research is widely undertaken in collecting and understanding specific information about the behaviour, opinion, values and other social aspects of a particular community, culture or population.

Qualitative research is a type of scientific research which helps in collecting, analysing and interpreting the data of a group, community, culture or a market. It helps in understanding the reasons behind the behaviour experience and attitudes of the people of the group, community, culture or market under study. It is authentic in nature because the researcher takes an active participation in the activities of the population under study. Unlike quantitative research, it does not require a pre-planned framework, objective or interest. The primary interest of the researcher may change according to the community cultural understandings.

Qualitative Research gives emphasis on development of concepts which help us to understand social phenomena in natural (rather than experimental) settings, giving due emphasis to the meanings, experiences and views of the participants." Pope & Mays BMJ

Characteristics of Qualitative Research

- Qualitative Research Seeks to explore phenomena using some structured methods such as in depth interviews, experiences, participant observation.
- Natural setting- Participants are free from any control & data are collected in their natural environment
- The whole is more than the sum, take magnitude of contextual factors in to account.
- It aims to describe variation, explain relationships, describe behaviour, experiences and norms of individuals and groups.
- The questions used for data collection are open ended ones
- Data is represented in form of notes, recordings and video tapes.
- The research design allows some flexibility in certain situational aspects. The questions used for the data collection differs individually and depends upon the response of the participants.
- Qualitative research helps in attaining an in depth knowledge of human nature, attitude, behaviour and experiences.
- Researcher is being involved in every step and is responsive and be a good listener
- It helps in textual description of experiences of people.
- It helps in identifying and explaining social norms, religion, roles of gender and socio economic status.

- It helps in understanding those behavioural phenomena which cannot be quantified.
- It helps in collecting data under more natural situations.
- It helps in determining those factors which are meaningful and are important to the respondents under study.

The open-ended questions used in qualitative research provide a chance to unfold those facts which cannot be done with the help of 'to the point' close ended.

TYPES OF QUALITATIVE RESEARCH

The main approaches of qualitative research are:

Ethnography, Phenomenology, Document or Content Analysis, Case studies, Genetic Studies and Grounded theory

1.ETHNOGRAPHY

Ethnography is a Greek term derived from ethnos meaning "people" and graphein meaning "writing."

Out of the different techniques or types of qualitative research, 'ethnographic research is one the most important and preferred one. The method is also known as 'ethnomethodology' or 'methodology of people'. Ethnographical research is referred to as an anthropological method because historically it has been associated with that particular discipline. Ethnographic techniques have been developed by anthropologists and community-study sociologists. This type of research method basically intends to study culture through close observation and active participation. It focuses on studying socio cultural phenomena of a community. The ethnographer/ researcher collects information regarding the socio-cultural phenomena from a lot of people belonging to the community under study.

Ethnography is the scientific description of peoples and cultures with their customs, habits, and mutual differences. The relationships between researcher and researched are considered to be an essential element of an ethnographic study. Ethnography involves collection of data from a number of respondents following a chain process. That means, the researcher is provided more respondents by the group of respondents who have already given their response. The researcher collects again and again data from the group. Data can be collected through different ways and perspectives as well. So, this method is also known as 'ethnomethodology' or 'methodology of people'. This type of research method basically intends to study culture through close observation and active participation. It focuses on studying socio cultural phenomena of a community. The researcher (ethnographer) collect information regarding the socio- cultural phenomena from a lot of people belonging to the community under study.

On behalf of their community, the participants also identify and provide the researcher some more respondents as a representative of their community (also known as chaining process). The data is therefore collected using a chain sampling in all empirical areas of investigation. The selected samples are re- interviewed in order to elicit deeper responses. The researcher stays within the community for months in order to gain more information through chaining process and collect data in the form of observational transcripts and interview recordings. The analysis of data leads to the development of theories for the socio - cultural phenomena under study.

SOME COMMON TERMS USED BY ETHNOGRAPHERS

i) Symbols: Symbols refers to any tradition or material artefact of a particular culture such as art, clothing, food, technology and rituals. The ethnographer tries to understand the cultural connotations behind the symbols of a

particular culture. Ethnographic research believes that the meaning of symbols cannot be understood until it is paired with one or more symbols.

ii) Cultural patterning: Cultural patterning refers to the study of cultural patterns formed through relationships between two or more than two symbols.

iii) Tacit knowledge: It refers to those cultural beliefs which are firm in nature. They are so deeply embedded in their culture that they rarely need to be discussed by the members in an explicit way. Such knowledge cannot be observed but needs to be inferred by the ethnographer e.g. the prejudices or the orthodox beliefs)

iv) Situational reduction: It refers to the belief of researcher that social structures and social dynamism(vital elements) are a result of interactions of several social situations (e.g criminal acts can be due to the poor economic condition, frustration, parenthood, neighbours and peer group of the criminals)

Characteristics of Ethnography

- The main objective of this research is the interpretation of community cultural understandings.
- Chances for overestimate the role of cultural perception and underestimate the role of causal reasons.
- It is difficult to identify the target community.
- Nature and size of the community as well as individuals' perception may play an important role in the study.
- Researcher should be expert in this study. The researcher should be an expert in the language spoken in the community.
- Chances for biasness.
- It helps in cross cultural analysis.
- It helps in analysing the past events or the history of the culture

- It helps in studying the behaviour, experiences and attitudes of individuals in a more natural environment.
- Close observation increases the chances of validity in the reports and theory formulated
- Researcher tries best to avoid theoretical preconceptions
- They formulates theory on the basis of the perspectives of the members of the culture and from observation.
- The respondents and their responses should be respected by the researcher.
- The researcher must show respect and belongingness to the community he or she is studying.
- The respondents must be made aware of what is being analysed by the researcher.
- Researcher must ensure and maintain the confidentialities of the respondent.
- Researcher should be aware of the expected risks and benefits including the psychological and social aspects while performing the research.

Types of ethnographic research

i) Macro ethnography: It is the study of broadly defined cultural groupings such as – "the Indians", "the Turkish". The common perspectives are studied at a more larger level, which are found to be common under a more broader strata.

ii) Micro ethnography: It is the study of more specific cultural groupings such as the "local government", the "terrorists".

iii) Emic perspectives: It is the ethnographic approach under which the view points and responses of the 'in-group' or the members of the culture under study are noted down.

iv) Etic perspective: It is the ethnographic approach under which the view points and responses of the 'out groups' or the members who do not belong to the culture under study are noted down.

Steps of ethnographic method

1) Selection of a problem/ culture

The ethnographic method begins with selection of a culture. The researcher selects the culture/ community or population according to his or her interest.

2) Determine Location(s) for Research

Identify the best place to conduct the participatory research. The researcher may choose more than one location if the research question/problem demands it. Select a location that will provide the best opportunity to observe, participate, take field notes, and understand how the people in that environment act, communicate, and think.

3) Identification of variables:

The researcher then identifies variables which interests him or her as well as the members of the culture and needs to be explored.

4) Entry:

The Researcher then tries to enter the culture and gain the acceptance of the members of the culture.

5) Cultural Immersion (involvement):

Ethnographers live in the culture for months or even years which they have chosen to study. The middle stages of the ethnographic method involve gaining informants, using them to gain yet more informants in a chaining process.

6) Data Collection:

Ethnography requires more than just observation. To research effectively, participate in the culture. Determine the types of things you are looking for

in regards to your question and problem and determine the most effective ways to collect notes. Be as objective as possible when observing and participating. After gaining the confidence of the respondents, the researcher collects information in form of observational transcripts and interview recordings and tapings. Write running descriptions, things you remember, impressions and feelings, ideas that come to mind, and so forth. To increase your understanding of behaviours and actions, interviews may be necessary.

Collect Archival Data

Many organizations, communities, and cultures have other artifacts and information that the researcher can use to assist in data collection. Review things like papers, emails, physical artifacts, phone conversations, marketing collateral, websites, and other information-rich sources to enhance your understanding of the environment.Then the researcher reviews the literature pertaining to the culture to get a brief idea and historical sketch of the culture selected for study.

7) Code and Analyse Data / Development of theory:

Code the data in a way that makes the most sense for the observations. Consider the following methods for analysing and summarizing data:

- code and label things the researcher saw and heard
- sort for patterns
- identify outliers (a person or thing situated away or detached from the main body or system.)
- compare with theories
- take note of reflective remarks

(After analysing the data, the researcher formulates theory on the basis of interpretation of the results and reports achieved.)

2 Grounded theory Research

Grounded theory is one of the basic approach and most prominently used technique in qualitative research. Grounded theory is one of the best ways of systematically generating a theory on the basis of a corpus (that is a collected mass) of data. The data collected by the theorists is analysed systematically and their interpretation leads to formation of reports, which ultimately leads to creation of theories. Grounded theory refers to 'the process of generation of theory which is based on collection of data from multiple sources'. It is the only method of qualitative research which uses quantitative data also, as and when required. The grounded theory approach aims to collect data and interpret the data from the textual(written) base (for example, a collection of field notes or video recordings). After the process of interpretation, the data base is categorised in to different variables and then the interrelationship between these variables are analysed and studied. Anyhow, the process of dividing and forming variables requires a thorough knowledge of the literature as well as the selection of the technique for creating the variables is equally important.

The ability to analyse and interpret variables is termed as "theoretical sensitivity". The theorist needs to emphasise and enhance this sensitivity. The approach of grounded theory was developed by Glaser and Strauss in 1960's.

Goals and perspectives of grounded theory

Grounded theory provides a direction to the researcher and directs them to generate new theories or modify the existing ones. The interpretation and conclusion of the grounded theory approach is more reliable as it is based on data collected from multiple sources. The theory takes similar cases for analysis rather than variable perspective. The researcher takes many cases and compare them to analyse the causes and

reasons behind the different outcomes of similar variables of the selected cases.

Characteristcics

- It involves a series of systematic steps
- data may be collected from more than one source
- It may provide a 'good theory' as the output.
- Process is important in this study. Process determines the quality of the theory.
- It may contribute something to the existing theory.
- It formulates hypotheses based on conceptual ideas.
- It generates new concepts / theories and ideas.
- The ground theorists prepare report on the basis of information collected with the help of various sources which increases the chances of reliability and validity of the theory.
- The ground theory approach gives an opportunity for exploring the facts and analysing the causal reasons behind those facts.
- It is an inductive type of research which is 'grounded' on the basis of observations and data collected.
- The grounded theory approach also provides a base to specify how a knowledge base should be changed in the light of new information.
- The grounded theory data often categorises data which further forms a basis for organising and reporting results.

In the words of Glaser (1998), "GT (grounded theory) is multivariate. It happens sequentially, subsequently, simultaneously, serendipitously, and scheduled". However, the results of grounded theories are not a reporting of facts but a set of probability statements about the relationship between

concepts, or an integrated set of conceptual hypotheses developed from empirical data (Glaser 1998).

Methods of grounded theory

Unlike other methods of qualitative research, the grounded theorists do not believe in collecting data through taping and recording interviews. They believed that all these are waste of time. The process of grounded theories is far quick and faster. The researcher delimits study, collects data by field-noting interviews and generates concepts to fit with data. This study oppose discussion.

Data is a fundamental property of the grounded theory. Not only interviews or observations but informal interviews, lectures, seminars, expert group meetings, newspaper articles, Internet mail lists, even television shows, conversations with friends etc.

Steps of grounded theory

Grounded theory approach helps in generating theories on the basis of the following systematic steps –

1. Memoing

The first objective of the researcher is to collect data in form of memos. Memos are a form of short notes that the researcher writes and prepares. These memos act as a source of data which is further put in other processes of analysis and interpretation. These short notes or memos can be prepared in three ways:

a) Theoretical note

This form of note contains the details regarding how a textual data base is related to the existing literature of the concerned study. The note consists of about one to five pages. Anyhow, the final theory and report consists of an integration of several such theoretical notes.

b) Field note

Field note consists of the notes prepared when the researcher actively participates with the population/ culture or the community under study. It can be the observations of behaviours, interactions, events or situations that occurs on the spot and it also contains the causal notes behind such actions.

c) Code notes

The researcher may prepare notes by naming, labelling or categorising things, properties and events. The code notes are those notes which discuss the codes of such labelling. These code notes further acts as a source of formation of final reports. Further, these code notes also acts as a guide to the ground theorists while analysing a text or a case.

2. Sorting in Grounded Theory

Once the short notes or the memos are prepared, the collected information (or the data) is sorted in order to organise them in proper order. Sorting helps in putting all the data in proper order which leads to proper linkage of information and ideas. The researcher may also get an insight of some more relevant information and ideas which were not revealed during the preparation of memos.

3 Writing in Grounded Theory

After the memos are sorted, the next stage towards preparation of theory is "writing". The researcher arranges, relates and puts the collected information in to words. Therefore, in this step the researcher tries to give a shape as well as meaning to the relevant data. This may be said to be a crucial stage, as it is this stage in which the researcher interprets the information on the basis of his own perspectives. The collected information is also linked with the existing relevant literature in order to put the theory in a scholarly context.

Types of coding in grounded theory

Ground theorists analyse and categorise events and try to identify the meaning of the manuscript with the help of the prepared code notes. Preparation of the code notes can be done in three ways-

1. Selective Coding

In this type the researcher selects one category (event) to be the center and then tries to relate the other categories with the selected major category. In this way, the ground theorist tries to analyse how other categories are affecting the major category or how the major category is having an effect on the other related categories.

2. Open Coding

It is the process of identifying, libelling and analysing the phenomena found in the manuscript. The ground theorist on the basis of generalisation categorises names, events or properties in to more general categories or dimensions.

3 Axial Coding

It is the process of relating one variable with others to arrive at deductive and inductive thinking. The ground theorists try to analyse the causal relations between these variables, that is, which of the code (variable) is the 'cause' which has led to the occurrence of other codes- the 'context'. The ground theorist analyses and interprets the 'cause' codes and the 'context' codes without showing much interest on the 'consequences' of the phenomenon itself.

Implications of grounded theory

Grounded theory is often used in formulation of policies and program evaluation research, since it can more effectively help in solving the unanswered questions,

Grounded theory approach can also be used to analyse the consumers' demands and preferences in the existing market.

The approach can also be used to analyse product positioning and advertising opportunities.

It is one of the best theoretical approaches that can be used in the field of education, management, women's studies, information studies, politics and communities, etc.

v) It helps in understanding, analysing and describing human psychology and experience.

Criticism of grounded theory

- Chance for preconceptions and chance for biasness in data collection and analysis.
- The content validity is questionable in this approach.
- It has a tendency to systematically generate theories.

3 Discourse analysis or Document or Content Analysis

Discourse analysis is one of the technique which uses language in the form of talks and texts to analyse human behaviour and social situations. Discourse analysis is applicable to every situation and every subject. The method does not requires any set guidelines or framework. Rather it can help in bringing about fundamental changes in the practices of an institution, the profession, and society as a whole. However, Discourse Analysis does not provide definite answers; it is not a "hard" science, but an insight/knowledge based on content analysis and critical thinking. It can also be defined as an analysis of speech units larger than the sentence and of their relationship to the contexts in which they are used. Discourse analysis can be applied to any kind of text, i.e. to anything that has meaning (Parker,

2002), although most studies analyse written or spoken language. Discourse analysis has been used to analyse both naturally occurring and research generated texts.

Discourse analysis is a broad and diverse field, including a variety of approaches to the study of language, which derive from different scientific disciplines and utilize various analytical practices (Wetherell, Taylor, & Yates, 2001ab).

Characteristics of Discourses analysis

- Discourse analysis is a social constructionist approach
- Discourses analysis aims to study the meaning of words that are used in interaction and sociocultural context.
- Discourse analysis examines language in use.
- In discourse analysis language is examined in terms of construction and function.
- Language is considered a means of constructing, rather than mirroring
- Language is also considered a form of social action.
- People use language to achieve certain interpersonal goals.
- Discourse analysis identifies the linguistic dependencies which exist between sentences.
- One of the creative ways of approaching and thinking about a problem.
- It helps in unveiling the hidden motivations behind a text or behind the choice of a particular method of research to interpret that text.
- Discourse Analysis is nothing more than a deconstructive (a method of critical analysis of philosophical and literary language) reading and interpretation of a problem or text.

Steps in discourse analysis

The method of discourse analysis evaluates the patterns of speech, such as how people talk about a particular subject, what metaphors (a figure of speech in which a word or phrase is applied to an object or action to which it is not literally applicable) they use, how they take turns in conversation, and so on. These analysts see speech as a performance. The analysts or the researchers of the discourse analysis believe that the speech performs an action instead of describing a specific state of affairs or specific state of mind. Much of this analysis is intuitive (instinctive) and reflective. It may also involve some form of counting, such as counting instances of turn-taking and their influence on the conversation and the way in which people speak to others.

The researchers collect and interpret information in the following steps:

Target orientation: First of all, the analysts identifies the target or focus of study. Data analysis and interpretation depends upon target.

Significance of data: Once the relevant information is collected, the Discourse Analysis researchers need to judge or examine the value of the collected data, especially those which may have come from more than one source.

Interpretation of the data: As the research progresses the researcher try to understand and interpret the data so that the researchers as well as others can gain an understanding of what is going on.

Analysis of the findings: Finally, the researcher needs to undertake the mechanical process of analysing, interpreting and summarising the data collected. On basis of the analysis of the information, the findings can be summarised and concluded. There are many qualitative analysis programs available to social researchers that can be used for a variety of different tasks.

Relevance/ implications/ significance of the discourse analysis

- With the usage of talks, languages and texts the researchers can easily understand the connotations (meaning) behind historical events as well as current social practices.
- Discourse analysis enable us to understand the conditions behind a specific "problem" and make us realise that the essence of that "problem"
- Discourse Analysis helps us in gaining a comprehensive view of the "problem" and helps ourselves to relate with that "problem".
- It helps the researcher in understanding hidden motivations and enable to solve concrete problems.
- It helps in meaningful interpretation of the people and the world.
- It also aids in "deconstructing" (a method of critical analysis of philosophical and literary language) concepts, belief-systems, or generally held social values and assumptions.
- Discourse Analysis can be applied to any text

Disadvantages in discourse analysis

- No doubt the method of discourse analysis has been well appreciated and it is being used by several disciplines.
- The approach or the methodology of this analysis lacks reliability and validity on certain grounds
- The method of discourse analysis lacks a proper format or guideline.
- The processing of data through this approach is controversial.
- The interpretation of the information collected through this data is questionable, as it may involve the subjectivity or biasness of the researcher or the analysts.
- The reliability and the validity of research findings depends on arguments.

Despite of the above controversies and arguments, the method is well appreciated and withholds a good position and has certain concrete applications.

Critical discourse analysis (CDA)

The emergence of television, broadcastings and media has given a way to the outgrowth of the implications of discourse analysis. The method of critical discourse analysis (CDA) is a type of discourse based research. It tries to study the current social and political activities like, corruption, exploitation, and inequality .All these are resisted by text and are discussed in the social and political context. With the help of this research, the researcher explicitly (that is, overtly) tries to realise, experience, and ultimately overcome social inequality and injustice occurring within the society. The researcher focuses on the powerful groups of the society, especially the leaders, social groups and institutions who have a good control over one or more types of public discourse. Thus, professors control scholarly discourse, teachers educational discourse, journalists media discourse, lawyers legal discourse, and politicians policy and other public political discourse.

CONCEPT OF CONTENT ANALYSIS

Another form of discourse analysis is content analysis. It is one of the method which is used in summarising any form of content only after having a deep study of the actual content. This enables the researcher to more objectively evaluate and understand the situations. For example, an impressionistic summary of a TV program, cannot help in analysing the over all aspects of the content of the program. Content analysis, tries to analyse written words. The results of content analysis are measured in numbers and percentages. It starts with the process of selecting content for analysis, then preparing the content for coding. After the content is coded, it is counted

and weighed. Later, conclusions are drawn on the basis of the weighing. After doing a content analysis, the researcher can make a statement such as "27% of programs on FM Radio in November 2009 mentioned at least one aspect of antiterrorism, compared with only 3% of the programs in 2006". The content analysis therefore serves two basic purposes:

- It helps in removing much of the subjectivity from summaries
- It also helps in detection of trends in an easier and simpler manner

Examples of content analysis

Content analysis can be done with the help of media content (when the sources of media) is being used or audience content (when individual feedbacks are being used). Few of the examples of media content are: print media, broadcasts, and recordings. While, the audience content is analysed with the help of questionnaire, interviews, group discussions and letters to the editors.

Implications of content analysis

Content analysis has several implications:

- Content analysis enables the researcher to make links between causes (e.g. program content) and effect (e.g. audience size).
- The content analysis is used to evaluate and improve the programming of the media world.
- It also helps in increasing awareness and summarising the various notes or documentaries which focus on a specific issue.
- It also helps in making inferences of the causes.

DOCUMENTARY ANALYSIS:

Documentary Analysis is closely related to historical research. In historical research emphasis is on the study of the past while in the descriptive research we emphasise on the study of the present. Documentary analysis today is a widely used research tool aimed at determining the

presence of certain words or concepts within texts or sets of texts. Researchers quantify and analyse the presence, meanings and relationships of such words and concepts, then make inferences about the messages within the texts, the writer, the audience and even the culture and time of which these are a part.

Documentary analysis could be defined as a research technique for the objective, systematic, and quantitative description of manifest content of communications. It is a technique for making inferences by objectively and systematically identifying specified characteristics of messages. The technique of documentary analysis is not restricted to the domain of textual analysis, but may be applied to other areas such as coding student drawings or coding of actions observed in videotaped studies, analysing past documents such as memos, minutes of the meetings, legal and policy statements and so on. In order to allow for replication, however, the technique can only be applied to data that are durable in nature. Texts in documentary analysis can be defined broadly as books, book chapters, essays, interviews, discussions, newspaper headlines and articles, historical documents, speeches, conversations, advertising, theatre, informal conversation, or really any occurrence of communicative language. Texts in a single study may also represent a variety of different types of occurrences.

Documentary analysis enables researchers to sift through large amount of data with comparative ease in a systematic fashion. It can be a useful technique for allowing one to discover and describe the focus of individual, group, institutional or social attention. It also allows inferences to be made which can then be corroborated using other methods of data collection.

Why analyse documents?

Documents are an essential element of day-to-day work in education. They include: Student essays, Exam papers, Minutes of meetings, Module outlines, Policy documents etc.

In some pedagogic research, analysis of relevant documents will help the investigation. For example, policy documents in an institution may be analysed and interviews with staff or students and observation of classes may suggest whether or not new policies are being implemented. A set of data from documents, interviews and observations could contribute to a case study of a particular aspect of pedagogy.

4 CASE STUDY

Case study method is one of the most common methods of teaching in west and in many premier institutes in India. The instructor gives a case document to the participants to study, analyse and discuss. This helps the participants in enhancing their reading, analytical, strategic planning and implementation skills and application of learning of domain knowledge in real life situations.

Case study provides a systematic and scientific way of examining events, collect data, analyse information, and prepare a report. As a result the researcher may gain a sharpened understanding of why the instance happened as it did, and what might become important to look at more extensively in future research. Case study is defined as a research strategy (an empirical inquiry) that investigates a phenomenon within its real-life context. Case study research includes single or multiple case studies. According to Lamnek (2005) "The case study is a research approach, situated between concrete data taking techniques and methodological paradigms."

In the past years, case study method was used in the field of clinical psychology to examine the patient's previous history regarding the person's

mental health status. To know about the patient's physical and mental health, and to make an accurate diagnosis, it is very important to know about the patient's past and present health related and environmental problems and issues. Psychoanalyst Sigmund Freud used case study method to assist his subjects in solving personality problems. The detailed accounts of interviews with subjects and his interpretations of their thoughts, dreams and action provide excellent examples of case studies. Guidance counsellors, social workers and other practitioners conduct case studies for diagnosing particular condition or problem and recommending remedial measures. They collect data from a particular individual and confine their interest to the individual as a unique case or collect data from a small group of individuals, which form a unit for depth study.

The case study approach is based on reality. Some of these studies have been conducted in school environment, which have mostly centered on behavioural problems of children. Observation, interviews, psychological tests and inventories have been used for collecting relevant data about the case or cases. However, subjective bias is a constant threat to objective data gathering and analysis techniques. The researcher must be thoroughly familiar with the skills which are associated with the conduct of case-studies. The Case study is also useful in psychology. It refers to the use of a descriptive research approach to obtain an in-depth analysis of a person and group. The various techniques may be applied on the subject such as personal interviews, observation, psychometric tests, and archival records. We can use the case study method in clinical psychology to describe rare events and conditions. Generally case study is a single-case design, but it can be a multiple-case design. One thing we must remember about the case study is that it must provide valid and reliable results for the development of future research.

TYPES OF CASE STUDY

There are four types of case studies which are (i) illustrative case studies (ii) exploratory case studies (iii) cumulative case studies and (iv) critical instance case studies.

1) Illustrative Case Studies: These are primarily descriptive studies. They typically utilise one or two instances of an event to show what a situation is like. Illustrative case studies serve primarily to make the unfamiliar familiar and to give readers a common language about the topic in question.

2) Exploratory (or pilot) Case Studies: This type of case studies performed before implementing a large scale investigation. Their basic function is to help identify questions and select types of measurement prior to the main investigation. The primary pit fall of this type of study is that initial findings may seem convincing enough to be released prematurely as conclusions.

3) Cumulative Case Studies: These serve to aggregate information from several sites collected at different times. The idea behind these studies is the collection of past studies will allow for greater generalisation without additional cost or time being expended on new, possibly repetitive studies.

4) Critical Instance Case Studies: These examine one or more sites for either the purpose of examining a situation of unique interest with little to no interest in generalisability, or to call into question or challenge a highly generalised or universal assertion. This method is useful for answering cause and effect questions.

UNIT - II

MIXED METHOD AND ACTION RESEARCH

Meaning- Purpose- Types of Mixed methods design - Key Characteristics of Mixed Method designs- Steps in conducting a mixed methods study - Values added in 51 conducting mixed method research - challenges in conducting the mixed mode research. Action Research : Meaning and definition – Purpose - Types : individual, collaborative, school wide and district wide - Key Characteristics of Action Research- Steps in conducting Action Research.

MIXED METHODS DESIGN

Mixed Method Design

If research has access to both quantitative and qualitative data, they can use both forms of data to understand their research problem and answer their research question. With qualitative research now accepted by educational researchers, and with quantitative research long established as an approach, mixed methods research has become popular as the newest development in research methods and in approaches to "mixing" quantitative and qualitative research.

Meaning of mixed methods research

A mixed methods research design is a procedure for collecting, and analyzing, and a "mixing both quantitative and qualitative methods in a single study or a series of studies to understand a research problem. The basic assumption is that the uses of both quantitative and qualitative methods, in combination, provide a better understanding of the research problem and question then either method by itself. If researcher uses this design, researcher needs to understand both quantitative and qualitative research. This makes this type of design an advanced methods procedure. The procedures are time

consuming, requiring extensive data collection and analysis, and such time requirements may require that researcher participate in a researcher team when using it. Also, mixed methods research is not simply collecting two distinct "strands" of research qualitative and quantitative. It consists of merging, integrating, linking, or embedding the two "strands". In short, the date are "mixed" in a mixed methods study.

Purpose of a mixed methods study

There are several reasons for using a mixed methods design to conduct a study. In general, researcher conduct a mixed methods study when researcher have both quantitative and qualitative data and both types of data, together, provide a better understanding of their research problem than either type by itself. Mixed methods research is a good design to use if a researcher seeks to build on the strengths of both quantitative and qualitative data. Quantitative data, such as scores on instruments, yield specific numbers that can be statistically analysed, can produce results to access the frequency and magnitude of trends, and can provide useful information if researcher need to describe trends about a large number of people. However, qualitative data, such as open-ended interviews that provide actual words of people in the study, offer many different perspectives on the study topic and provide a complex picture of this situation.

Researcher also conducts a mixed methods study when one type of research (qualitative or quantitative) is not enough to address the research problem or answer the research questions. More data is needed to extend, elaborate on, or explain the first database. For example, researcher may want to first explore the data qualitatively to develop and instrument or to identify variables to test in a later quantitative study. Researcher engage in a mixed

methods study when researcher want to follow up a quantitative study with a qualitative one to obtain more detailed, specific information than can be gained from the results of statistical tests. Researcher use mixed-methods when researcher wants to provide an alternative perspective in a study. An example of this would be an experimental study in which the experiment yields useful information about outcomes, but the additional collection of qualitative data develops a more in-depth understanding of how the experimental intervention actually worked. Another example would be when a policy maker wants both the "numbers" and the "stories" about an issue. These different sources of information provide both a condensed understanding of a problem as well as the detail. On a practical level, researcher use mixed methods research for studies in graduate programs in which qualitative research has yet to be fully accepted and in which quantitative approaches are the norm. Although individuals in these programs may recognise the value of qualitative research, a mixed methods study is more acceptable than a "pure" qualitative study because there is still a component of quantitative research in the study. Also on a practical level, mixed-methods studies are increasingly being published in the scholarly literature. Graduate students use mixed methods research in order to learn and experience this form of research design so that they are well informed about the latest research approaches.

The types of mixed methods design

Although work has begin on identifying types of mixed methods designs, many models and approaches have been advanced in the literature. The strategy authors have taken is to review published studies and classify them by type of design. Before examining the types of designs, it might be helpful to reflect on useful strategies for identifying a mixed methods study reported in

the published literature. One strategy is to ask the following questions to help researcher identify a study as mixed methods research.

- **Is there evidence in the title?** Loot at the title to determine if it includes words such as quantitative and qualitative, mixed methods, or other related terms to signify the collection of both quantitative and qualitative data. Related terms might be integrated, combined, triangulation, multimethod, or mixed methodology.
- **Is there evidence in the data collections section?** Examine the "Methods" or "Procedure" section where the author addresses data collection and identify if researches discuss forms of quantitative data (that is a numbers reported) and the qualitative data (that is words or images) as part of the data collection.
- **Is there evidence in the purpose statement or the research questions?** Examine the abstract or the introduction of the study to identify the purpose or research questions. **Do these statements indicate that the researcher intends to collect to both quantitative and qualitative data during this study?**

Using these 4 questions, a researcher can locate and identify most mixed methods designs commonly used in educational research. There are 6 mixed methods designs, with the first 4 as the basic designs in use today and the last two as complex designs that are becoming increasingly popular (Creswell and Plano Clack, 2011).

The designs are

- The convergent parallel design
- The explanatory sequential design
- The exploratory sequential design

- The embedded design
- The transformative design
- Multiphase design

THE CONVERGENT PARALLEL DESIGN

The purpose of a convergent (or parallel or concurrent) mixed methods design is to simultaneously collect both quantitative and qualitative data, merge the data, and use the results to understand a research problem. A basic rationale for this design is that one data collection form supplies strengths to offset the weaknesses of the other form, and that a more complete understanding of a search problem results from collecting both quantitative and qualitative data. For example, quantitative scores on an instrument from many individuals provide strengths to offset the weaknesses of qualitative documents from a few people. Alternatively, qualitative, in depth observation of a few people offers strength to quantitative data that does not adequately provide detailed information about the context in which individuals provide information. How does the process of a convergent study work? The researcher gathers both quantitative and qualitative data, analysis both datasets separately, compares the results from the analysis of both datasets and makes an interpretation as to whether the results support or contradict each other. The direct comparison of the two datasets by the researcher provides a "convergence" of data sources.

THE EXPLANATORY SEQUENTIAL DESIGN

Instead of collecting data at the same time and merging the results, a mixed methods researcher might collect quantitative and qualitative information sequentially in two phases, with one form of data collection following and informing the other. An explanatory sequential mixed methods

design consists of first collecting quantitative data and then collecting qualitative data to help explain or elaborate on the quantitative results. The rationale for this approach is that the quantitative data and results provide a general picture of the research problem more analysis, specifically through qualitative data collection, is needed to refine, extent, or explain the general picture.

This edition has the advantage of clearly identified quantitative and qualitative parts, an advantage for readers as well as for those designing and conducting the study. Unlike the convergent design, the researcher does not have to converge or integrate two different forms of data. This design also captures the best of both quantitative and qualitative data to obtain quantitative results from a population in the first phase, and then refine or elaborate these findings through an indepth qualitative exploration in the second phase. The difficulty in using this design, however, is that the researcher needs to determine what aspect of the quantitative results to follow up on. This follow up means a deciding on the participants to sample in the second qualitative phase as well as the questions to ask in this follow-up phase that builds on the initial quantitative phase. Also, this design is labor intensive, and it requires both expertise and time to collect both quantitative and qualitative data.

THE EXPLORATORY SEQUENTIAL DESIGN

Rather than first analysing or collecting quantitative data as is done in the explanatory design, the mixed methods researcher begins with qualitative data and then collect quantitative information. The purpose of an exploratory sequential mixed-methods design involves the procedure of first gathering qualitative data to explore a phenomenon and then collecting quantitative data to explain relationships found in the qualitative data. A popular application of this design is to explore a phenomenon, identify themes, design and instrument,

and subsequently test it. Researches use this design when existing instruments, variables, and the measures may not be known or available for the population under study.

THE EMBEDDED DESIGN

A second form of mixed methods design is similar to both the parallel and the sequential design, with some important differences. The purpose of the embedded design is to collect quantitative and qualitative data simultaneously or sequentially, but to have one form of data play a supportive role to the other form of data. The reason for collecting the second form of data is that it augments or supports the primary form of data.

The supportive data may be either qualitative or quantitative, but most examples in the literature support adding qualitative data into a quantitative design. For example, during a quantitative experiment, the researcher may collect the qualitative data to examine how participants in the treatment condition are experiencing the intervention. Also, the researcher may collect qualitative data either before or after the experiment to help support the experimental study. Collecting data before the experiment can help to design an intervention that is tailored to the participants. Collecting data after the experiment can help to explain and follow up on the quantitative outcome results. As another example, during a correlational study, the researcher may gather secondary qualitative data to help understand the reasons for the correlational results. In some embedded designs, the procedures are sequential, with the secondary form of data gathered before the experiment begins after it concludes.

How does the process of an embedded study work? The researcher collects both quantitative and qualitative data during a single study, the two

datasets are analysed separately, and they address different research questions. For example, the quantitative data will address whether the intervention had an impact on the outcomes,whereas the qualitative data will assess how the participants experienced the intervention.

THE TRANSFORMATIVE DESIGN

At a more complex level than the 4 previous designs, we have the transformative mixed-methods design. The intent of the transformative mixed methods design is to use one of the four designs, but to encase the design within a transformative framework or lens. This framework provides an orienting lens for the mixed methods design. It informs the overall purpose of the study, the research questions, the data collection, and the outcome of the study. The intent of the framework is to address a social issue for a marginalised or underrepresented population and engage in research that brings about change. Thus, strength of this design is that it is value based and ideological. The typical frameworks found in mixed methods are feminist, racial, ethnic, disability, and gay or lesbian perspectives. A challenge in using this design is that we are still learning about how to best integrate the framework into a mixed method study.

MULTIPHASE DESIGN

Like the transformative design, the multiphase design in a complex design that builds on the basic convergent, explanatory, exploratory, and embedded designs. **Multiphase mixed method designs** occur when researchers or a team of researchers examine a problem or topic through a series of phases or separate studies. The groups of phases or studies are considered to be a mixed methods design and the intent of the design is to address a set of incremental research questions that all advance one programmatic research

objective. The phases or studies may employ a combination of concurrent or sequential design and this form of design is popular in large-scale health research and in evaluation research. The strength of this design lies in the use of multiple projects to best understand an overall program objective. Challenges include forming a research team that can work comfortably together given diverse method orientations, making sure that the phases or studies link together, and having all of the studies provide insight into an overall project objective.

THE KEY CHARACTERISTICS OF MIXED METHOD DESIGN

Mixed method designs can be distinguished from other types of design in several ways. In reviewing the following six characteristics, consider incorporating them into their plan for a study if researcher intend to conduct a mixed methods study. Also, look for them in a mixed methods study researcher might be reviewing or reading. They are:

- Provide a rationale for the design
- Include collecting quantitative and qualitative data
- Consider priority
- Consider sequence
- Match the data analysis is to a design
- Diagram the procedures

Provide Rationale for the Design

Reader and those who review mixed methods studies need to know why researcher is mixed method. Mixed methods researcher include a justification or rationale for the use of both quantitative and qualitative data. One justification is that collecting data in a second phase is important to test the qualitative exploration of the first phase of the study.

Alternatively, a reason for conducting a mixed methods study might be that researcher seek to explain in more detail through qualitative research the initial quantitative statistical results (i.e., explanatory design) or one from of data plays a supporting role to the other database (i.e., embedded design). Another justification results from combining the "best" of both quantitative and qualitative research (i.e., convergent design). Quantitative provides the opportunity to gather data from a large number of people and generalize result, whereas qualitative permits an in-depth exploration of a few individuals. Whatever the rationale, mention this rationale early in a study, such as in the introduction.

Include collecting quantitative and Qualitative Data

Include any mixed methods study, researcher should clearly indicate that researcher is collecting both quantitative and qualitative data. Methods of data collection are typically associated with either numbers or numerical data and words or text and image data. Mixed methods researchers collect both quantitative and qualitative data.

Consider Priority

Mixed methods researchers often advance a priority for the collection of qualitative and quantitative data. Three options are available to the researcher for prioritizing data:

- Quantitative and qualitative data are of equal weight
- Quantitative data is of greater weight than qualitative data.
- Qualitative data is of greater weight than quantitative data.

Priority means that in a mixed methods design, the researcher place more emphasis on one type of data than on other types of data in the research and the writer report. This emphasis may result from personal experience with data

collection, the need to understand one form data before proceeding to the next, or the audience reading the research. Whatever the reason, in examining a mixed methods study for priority, ask the following question:

- What do researcher emphasize more in the purpose statement-exploration or prediction of outcomes?
- Which data collection process-quantitative or qualitative-do researchers give the most attention to (e.g., number of pages in a report) in the "Result" section?
- Which data collection process do researchers examine in the most depth?

Consider Sequence

Mixed methods researchers advance the sequence of data collection using concurrent or sequential approaches or some combination. Again, several options exist for the sequencing of data collection.

- Researcher collects both quantitative and qualitative data at the same time.
- Researcher collects quantitative data first, followed by qualitative data.
- Researcher collects qualitative data first, followed by quantitative data.
- Researcher collects both quantitative and qualitative at the same time as well as in sequence.

If the purpose of the study is to explain quantitative results further with qualitative data (i.e., explanatory design) or to develop an instrument from qualitative data (i.e., exploratory design), the procedures should clearly indicate this sequence. The data collection procedures are independent of each other and typically presented as phases. If the intent of the study is to converge the findings (i.e., convergent design), then the data are collected at the same

time, and the researcher is explicit about this process. This process involves two data collection efforts that proceed simultaneously and are related to each other. Some mixed methods studies involve both the concurrent and the sequential processes of data collection.

Match the Data Analysis to a Design

One of the most difficult challenges for the mixed methods researcher is how to analyses data collected from qualitative and quantitative research.

This is more than simply being able to link or intersect data and numbers, although this connection does present some challenges. Several authors have begun the discussion about data analysis in mixed methods research. To examine options for data analysis, reflect back on the type of design and the options for analysis within each design. This list is not comprehensive and should not limit the creative potential of a mixed methods researchers; it is largely to focus the discussion and present typical analytic procedures discussed by writers and illustrated in mixed methods studies.

Convergent design analysis

Of all of the designs, this analysis is perhaps the most difficult and controversial. The standard approach seems to converge or compare in some way quantitative data (e.g., scores) and qualitative data (e.g., text). One way is to provide a discussion in a side by-side analysis about the them emerging from the data and how they support or refute the statistical analysis. In a study conducted about controversial art on College campus (e.g., a painting or novel), the researcher might collect questionnaires from campus constitutions as well as interview date from administrators, faculty, and students. The researcher might then compare the two Sources of data to determine if the interviews supported the questionnaire results.

Another approach is to combine the qualitative and quantitative data to arrive at new variables or new themes for further testing or exploration. In the controversial art case, the interview data and questionnaires' scores combine to produce a new variable, such as the sensitivity of campus constitutions to some forms of art. This variable becomes information for further exploration.

Some mixed methods researchers quantify qualitative data to compare the data directly with statistical results. For instance, researcher could reduce interview data from campus personnel to themes and make counts of the occurrences of each them. Researcher could compare the frequency of these themes with the descriptive statistics about information from scales. Alternatively, the researcher might analyze the questionnaires, develope thems (or scales) that reflect issues surrounding campus art , and compare the themes to those generated by campus personal during the qualitative interviews.

A final approach is to directly compare quantitative results and the qualitative findings in a table, a joint display. This, was one of the analytic procedures used by Lee and Greene (2007) in which they arrayed quotes that showed both convergent and divergent findings from their quantitative data.

Explanatory Design Analysis

Because researcher collect data in distinct phases, the analysis of an explanatory design is easier to see and conduct than in a convergent design. A popular approach is to collect quantitative data and look for extreme cases to follow up in a qualitative phase. In a mixed methods study about the transition of adults from school to work, Blustein et al. (1997) first conducted a quantitative correlational analysis of transition measures (i.e., job satisfaction and congruence) and then employed the results to provide an "in-depth and

focused approach to analyze the corresponding qualitative narratives". Specifically, they identified individuals with high and low scores (i.e., extreme cases) on the dependent measures and then conducted a qualitative, thematic analysis using interviews with these
individuals.

Exploratory Design Analysis

In this design, the substantial qualitative data collection becomes a means for developing or locating quantitative instruments; forming categorical information for later quantitative data collection; or developing generalizations from a few initial qualitative cases. Perhaps, the most popular use is to generate an instrument well grounded in the qualitative data from participants in a study. In the case of a researcher who studied first - year teachers in reservation - based, Native American elementary schools, the existing instruments were not sensitive enough to identify the cultural factors that affected this first - year experience.

Embedded Design Analysis

In the embedded design analysis, the analyses of the quantitative and qualitative data are kept separate because the two datasets often reflect different questions. Thus, in an experiment, the outcome analysis is conducted for the quantitative data and the process qualitative data is analyses for them. In an embedded design for a correlational study, the analyses also proceed independently of each other. In both the experimental and the correlational examples, results of the two databases can be interpreted together - how one reinforce the other or complements the other. When a sequential design is used with the embedded design, researchers will use one form of analysis to inform the quantitative phase or qualitative phase of the study.

Diagram the Procedures

Mixed methods researchers often provide a visualization or diagram of their design depicting the procedures. It consists of labelling the quantitative and qualitative data, indicating the sequence of activities (using arrows or plus signs), and emphasizing the priority (using lowercase or uppercase letters). By including this visualization, the researcher helps readers identify the sequence of data collection, an important aid when collecting multiple forms of data.

STEPS IN CONDUCTING MIXED METHODS STUDY

Step1. Determine if a Mixed Methods Study is Feasible

The audiences such as graduate committees, publishers, other researchers, and practitioners in educational settings will appreciate the complexity of their mixed methods study.

Step 2. Identify a Rationale for Mixing Methods

Assuming that a study is feasible, researchers needs to consider why researcher is collecting both quantitative and qualitative data. The rationale for the four designs should provide a good starting point. Be explicit in this rationale, and include it early in their research plan or report. See the reasons for conducting mixed methods studies advanced earlier in this chapter.

Step 3. Identify a Data Collection Strategy

Identifying their rationale for the study will lead to planning their procedures for collecting data. Researcher need to know:

- The priority researcher will give to quantitative and qualitative data.
- The sequence of their data collection, if researcher do not plan to collect the data concurrently
- The specific forms of quantitative data (e.g.' attendance records) and qualitative data (e.g; pictures) researcher will collect.

Step 4. Develop Quantitative, Qualitative, and Mixed Methods Questions

With the specific design in mind, next develop their research questions. Depending on the type of design, researcher can identify these questions prior to a study or they may emerge during the study. For instance, in a two-phase design, the questions for their second phase cannot be specifically identified early in the study-they will emerge as the study progresses. Alternatively, for a convergent design, researcher can present the questions before data collection and specify them in detail.

Step 5. Collect Quantitative and Qualitative Data

Collecting data in a mixed methods study follows rigorous quantitative procedures and persuasive qualitative procedures. For a mixed methods study, the sequence in which researcher collect the data will depend on the type od design. However, in all designs, this phase of the research will be lengthy and requires god organization of the information. Statistical programs and text analysis programs can provide useful systems for storing, managing, and recording the data.

Step 6. Analyze Data Separately, Concurrently, or Both

The data analysis will also relate to the specific type of mixed methods designs researcher is using. Researcher can analyse quantitative data separately from qualitative data, as in the explanatory and exploratory designs, or integrate the date analysis, as in the convergent design.

Step 7. Write the Report as a One- or Two- Phase Study or a Multiple-Phase Study

The final step in a mixed study is to write a scholarly report of the project. Some variations are seen in the writing structure of mixed methods studies, as outlined here:

- The report is written in two phases. The report contains one section to specify the problem and the literature. Then, the sections of data collection, analysis, and interpretation, two-phases-one quantitative and one qualitative – are used for each section.
- The report integrates the quantitative and qualitative phases of the study in each section. The problem statement, for example, contains a need to explore (qualitative) and to predict or explain outcomes (quantitative). The research questions are posed as both quantitative and qualitative questions and the data collection is in one section displaying an integration of quantitative and qualitative forms. The data analysis is an attempt to converge the two databases, and researcher form the results and interpretation into problem. This structure results in a convergent design.

EVALUATE A MIXED METHODS STUDY

As a form of qualitative and quantitative research, mixed methods research needs to be consistent criteria for a good qualitative and quantitative study. In addition, there are specific aspects that people reading, evaluating, and conducting a study might consider. In a high-quality mixed methods study, the researcher (Plano Clark & Creswell, 2010):

- Describes those mixed methods is the best approach to answer the research questions because neither qualitative nor quantitative is adequate as an approach.
- Incorporates both qualitative and quantitative data collection and analysis.
- Explicitly combines or mixes the two datasets.

- Uses rigorous quantitative and persuasive qualitative procedures of data collection and analysis.
- Frames the study within one of the mixed methods research designs.
- Provides a diagram of the procedures to clarify the timing, priority, and mixing within the study.
- Signals to the reader that the study is using mixed methods (e.g., in the title, purpose statement, and methods sections) to indicate their awareness of this research design.

ACTION RESEARCH

WHAT IS ACTION RESEARCH?

A teacher is an important person in the life of data students and can help them to become better human beings. Therefore, it becomes all the more important for him to keep improving the teaching process and practices for the all round development of your students. There is one such tool in the hands of teachers about which we hear quite often in education i.e. action research. Researchers have defined the term "action research" differently. In this unit, we will discuss the meaning of action research. In order to understand the meaning of the action research, let us first understand, from where the term has originated. The history of the concept of action research can be traced back to the early works of John Dewey in the 1920s but the idea of using research in a "natural" setting can be also linked to Kurt Lewin, a social psychologist in 1940s in the United States. But the credit of using the action research in the education goes to Stephen Corey and others at Teachers College of Columbia University in 1949. Corey observed 'the need for teachers and researchers to work together improve the practices

rather than reading about what someone else has discovered of his teaching'. As a teacher of you think about your role in the classroom, you will find yourself as a knowledge disseminator, solving problems of your students and also providing your students a better learning environment. But, what happens when you come across the problem of discipline in your class? Then, your role will change to an inquirer who is capable to bring changes in the classroom environment leading to better learning. You can make changes in your classroom, if you use action research. Therefore, it is important to you as a teacher to be familiar with these practices. In this unit, you will be familiarized with the concept of the action research and how to carry out action research in your classrooms. But, before starting you must understand that this type of research is not very rigorous or difficult and time consuming. Action research is an approach that can empower you to over come problems and innovative in tackling the problems of access, enrolment, retention and learning among your students relating to your day to day classroom activities.

MEANING OF ACTION RESEARCH

You would agree that when teachers find answers to the problems in their school or classrooms then their decisions bring about improvement and positive changes with school environment. Teachers are generally interested in making their profession productive by developing all round personality of their students. All their activities in and around school focus on the achievement of this objective. For this they attempt to make teaching-learning process more interesting and attractive. By undertaking various activities in the school, the teachers try to know how effective they are through many direct or indirect sources. The identification of deficiencies by the teachers and their desire to

improve help them to perform better and better. This type of systematic effort by the teachers by reflecting on their own practices and making needed changes is called 'Action Research'. While undertaking the action research a teacher may work alone on his own specific problem. For example if a language teacher may find a pronunciation problem in his/her class, then problem is specific which needs immediate solution by the teacher. It is also possible to work collaborately on the same problem with the support and guidance from his colleagues, administrators, university scholars, and others. At times, whole school may decide to undertake a school-wide study to address a common issue, or join with others to look at district-wide issue. This will be discussed later in this unit. By, now it may be noted that action research can be undertaken individually or with the help of others.

Thus, action research is defined as a collaborative activity among colleagues who are searching for solutions to everyday, real problems such as low attendance in the classroom, poor reading habits among the students mostly experienced in their schools. Action research allows a teacher to deal with the problems practically aspect in order to address those concerns, which can exhibit some influence and make change. Suppose a teacher tries a new activity in the class to help students understand a concept they are being taught. After the class the teacher reflects on how well the activity helped the students' understanding of the concept. On the basis of feed back, the teacher modifies the activity for the next time so as to make it more effective. Therefore, action research helps a teacher to become the practitioner of the knowledge to improve instruction and increase student achievement.

Stephen Corey (1953) defined action research as the process through which practitioners study their problems scientifically in order to guide, correct

and evaluate their decisions and actions. In the educational setting i.e. school, the practitioners are the teachers and his other colleagues who work to improve instruction. Thus, action research is very much a needed component for the quality education and is not separate activity beyond his duties.

Borg (1965) has also emphasized that teachers should be aware of their problems in their own classrooms and get involved in this solutions for the improvement of teaching – learning and evaluation processes. This is through, action research the teachers examine their own educational practices systematically and carefully, using the techniques of research. When we say it is systematic and scientific, it means there are some logical steps to be followed while conducting action research. Action research helps a teacher or a practitioner to perceive understand and assess a problem in a class or school, and they help in working out a desirable solution. It is diagnostic and remedial. Action research can be used for improving local school practices, and for teacher growth and professional improvement. It is a decision oriented research in which the researcher is the same person as the practitioner who will make and live with decisions.

Who are involved in Action research?

It has been highlighted in the earlier discussions that action research can be useful for all those practitioners who are interested to improve their practices. Therefore, action research can be conducted by: 1. Workers in community development 2. Practitioners in any field who wish to improve their own practices 3. Teachers in the school setting who wish to improve instruction and motivate learners 4. Researchers who wish to conduct the applied research for solving local specific problems.

Practitioners in educational set up could be classroom teachers, heads (headmasters or principals) of schools, block education officers, district education officers, inspectors of schools or teacher educators. These functionaries may be interested to bring change for improvement in those operational areas where they has any functional responsibility. For example, teachers are expected to interact with students in classrooms in a planned way to bring desirable changes in their behaviour (cognitive, affective and psycho meter). Teachers help students to learn identified competencies in the subjects like mathematics and languages. In the non-formal and distance education mode, instructors/counselors are expected to understand the needs of the distance learners and provide those functional competencies with which they can face problems in a social set-up. A block education officer may be interested to bring certain amount of change in the form of enhanced achievement in a village primary school. He may introduce some interventions (through some programmes) with the help of teachers.

How Action Research differs?

Whenever one has to understand the concept, it is important to find the commonalities and differences with the existing data. Keeping this in mind, in the following section, we will discuss the difference between action research and other researches and how action research differs from everyday actions.

Difference between action research and other researches

The difference between action research and other researches is in emphasis, not in the method or spirit. However, there is a need to understand how dies it differs from other researchers. Action research is the research undertake practitioners so that they may improve their practices. It has most

of the characteristics of fundamental or applied research. But its methodology is not a rigorous as that of fundamental or applied research. The findings of action research are evaluated in terms of local applicability. The application of findings is 'here' and 'now'. Action research is not a library project in which you learn about a particular topic by collecting information from either the books available in the library or by using the Internet. For example, if you want to undertake a project about finding out the 'life during the Indus valley civilization', then you would go to the library, collect the relevant data and write the report in the narrative form. Action research also does not aim at finding solution to the problem in the sense of trying to find out what is wrong, but rather its aim is to suggest the measures about how to improve one's own situation.

Action research is not just doing research on or about people, but it aims at finding all available information on a topic of immediate concern so as to arrive at correct answers. For example, when you as a teacher face indiscipline problem in your classroom, you may come across a lot of studies conducted on improving the discipline problems but those results cannot be applied to your situation of specific nature as they have been conducted in different situations. Therefore, in action research, people work to improve their skills, techniques, and strategies for applying them in their own situation by understanding their own needs. Since, while conducting the action research, a practitioner is solving his/her own problem, the results cannot be generalized i.e. can't be used in the others situation, which makes it different from other researches. But in action research we follow the same systematic methodology as is used in all other researches. This means that in action research the same steps as in the other researches are followed which include identification and

statement of the problem, statement of objectives, data collection, analysis and interpretation of data and finally writing the report of the study. These steps will be discussed in detail in the proceeding part of the unit.

Difference between action research and everyday actions

If we say that the action research is not as rigorous as other researches then it does not mean that action research is just an everyday activity. Kemmis and McTaggart (1992) distinguished action research from every day actions of the teachers in the following manner:

- It is not the usual thinking when you think about your teaching i.e. what are you going to teach in your class or which teaching aids should be used? Rather, action research is more systematic and collaborative in collecting evidence on which to base rigorous group reflection about the problem faced by the teacher in the classroom.
- Action research also involves problem posing, not just problem solving.
- Action research is not research done on other people. It is research by particular people on their own work, to help them to improve what they do, including how they work with and for others.

Characteristics of action research:

Action research has the following characteristics:

- It enhances the competencies of the practitioners. Action research enables them to have a clear vision of the problematic situation, which is helpful in identifying ways and means to tackle the problem.
- It is collaborative, i.e. everyone's view is taken as a contribution in understanding the situation. Moreover, if a problem is faced by a

practitioner in a particular situation (say a school), action research can be collaborative where practitioners facing similar problems in nearby schools can collaborate to find solutions of a problem.

- Action research seeks to understand particular complex social situations whether it is a class, school or community.
- It requires reflective critique, which is a process of becoming aware of our own perceptual biases and own practices.
- Action research seeks to improve the quality of human relationships.
- It is a systematic and scientific process but not very rigorous.
- Action research allows us to identify remedial measures for improvement. It is specific in nature, i.e. specific to a particular class, school or situation. Therefore, results cannot be generalized.
- Action research helps a teacher to bring about desired changes on specific aspects of their curriculum and in their transactional strategies.
- It helps in the professional development of the teachers by enabling them to engage in intellectual pursuits and become continuous learners.
- Action research helps in systems planning and restructuring. For example, if a primary teacher finds that in his/her class the students are not able to concentrate. The teacher starts finding the reasons for the same. After, analyzing the situation, the teacher finds that the classroom window is open towards in the playground and hence most of the children often observe the other children playing in the playground and so they not able to concentrate in their studies in the class. Now, what do you think a teacher should do? Well, in such a case a teacher can change the seating plan of the classroom. This a way a teacher gets involved in restructuring the class.

- Action research is a small-scale intervention. Its objective is to bring out changes in the functioning of the practitioner himself/herself. It may or may not have applicability for others. Action research is narrowly focused research undertaken by teachers and other practitioners in a given specific situation and context.
- "Contextual nature" is an important characteristics of action research. For example, a teacher of a particular school may face a particular problem in the form errors committed by third grade students' multiplication in a school but the same problem may not be observed by him/her in other schools.
- In action research, teachers make use of quantitative and qualitative methodologies to know their students well, interact with them, observe them, and collect relevant data for analysis and interpretation.

Types of Action Research

It has been discussed in the introduction of this unit that there could be involvement of one or many participant (s) in the conduct of action research. A plan of action research can involve a single teacher investigating an issue in his or her classroom, a group of teachers working on a common problem, or a team of teachers and others focusing on a school- or district-wide issue. Therefore, based upon the nature and focus of the problem, action research may take any one of the following types:

Individual Action Research

As the name suggests the focus would be on a single issue in the classroom. For example, any teacher may be seeking solutions to various problems of classroom management, such as discipline, students' involvement instructional

strategies, use of materials, or student learning in his own classroom. These problems can be addressed on an individual basis but the teacher may have to seek support of the school administrators or external agencies. The teacher collects data either quantitatively or qualitatively or both. The results after analyzing and interpreting the data lead the teacher to implement changes in the classroom at his own level which determine the success and usefulness of the research in improving the area of focus in the classroom.

Major drawbacks of the individual research are:

Results may not be shared with others unless a teacher / practitioner makes formal presentation of his research findings at a faculty meeting or publish them in a journal or newsletter. 2. It is possible for several teachers working concurrently on the same problem with no knowledge of the work of others.

School-Wide Action Research

The school wide action research focuses on issues, which are common to all i.e. teachers, principle of the concerned school. Since the problem is common, a team of staff members work together to help each other. The members of the research team may vary from as few as two people to several teachers and administrators working with parents and students. This type of research is more in-depth than individual teacher research, since it investigates different dimensions or aspects of a research problem. The team would collaboratively narrow down the research question, gather and analyze the data, and decide on a plan of action. You might be thinking that in individual action research also, you can take help from your colleagues then what is the difference in two approaches. The difference lies in the

nature of the approach. In an individual action research, the problem is individualistic in nature but in the school-wide action research the problem is school based. For example, a school may be concerned about the lack of parental involvement in school activities. Team members including teachers, administrators will make contributions to develop a process to involve parents in the school. Here, when the problem is solved, there will be a sense of ownership and involvement in the results, which would be owned collect by all the team members.

District-Wide Action Research

As the area of the research increases the focus of the problem chosen also becomes wider in nature. The resources utilized in such type of the research are far more complex. The issues chosen are based on the organization or community. In a district wide action research a problem may be common to several schools or one organizational management. For example, a district may be facing the problem of high drop out rate in the primary schools. Since the number of schools and number of people involved are large, the data collection from all participants requires more time and great effort. The main advantage of such research is that it can bring real school reform based on a common understanding through inquiry. Because of involvement large number of people in this research, there is a genuine stake holding of the results.

Steps in conducting Action Research

As it has been discussed earlier that action research is a systematic process for finding the solution of the problem. It can be conducted either by you individually alone or you can collaborate with others. In order to carry out

the research plan, you need to understand following steps which are involved in the process:

Identification of the Problem Area and Developing a Focus:

As a teacher you may have several questions, which you wish to investigate such as poor reading ability in your students, pronunciation problem among your students, effective monitoring of the various programs and many more. Therefore, the focus of action research is on what students are experiencing or have experienced? For example, a teacher can study how to improve problem-solving skills in mathematics among the students or increase reading ability among students; or to improve the quality of student writing. It will become very difficult for you, if you select your problem, which is very vast. Therefore, it important to choose the problem which is meaningful and limit the same so that can be solved in the stipulated time of your daily work. It may be noted that careful planning at this first stage will limit false starts and frustrations. The need for action research is a result of perceived dissatisfaction with an existing situation. It is followed with the idea of bringing out improvement in the situation. The focus is on the following: (i) what is the cause of problem? (ii) Why is it happening? (iii) As a practitioner or teacher, what can I do about it? (iv) What steps can I take to solve the problem? The answers to all such questions are helpful in perceiving a problem as it exists which is a pre-requisite for undertaking any action research problem.

Formulating the problem

Once, the problem is identified, the next step is to formulate it. The practitioner tries to find causes underlying that problem along with various issues that are related to causes. These probable causes need to be stated in

concise and unambiguous terms. At this stage the practitioner also need to identify and spell out various factors and suggest possible strategies with which the problem can be solved in an effective way.

Stating the Research Questions and Development of Propositions

After formulating the problem, the practitioner need to state the research questions and develop a tentative theory in the form of propositions keeping in view the genesis of the problem. It is necessary to develop a conceptual and functional relationships, tentatively to understand and explain the given situation. This step is helpful in facilitating the conduct of action research.

Data Collection

The collection of data is the most important step in deciding what action is needed for solving the problem. In the school, there could be multiple sources of data, which a practitioner can use to identify causes and developing, and implementation remediation measures. The sources that a practitioner can use for collecting various data are under:

Videotapes and audio tapes • Report cards, • Attendance, samples of student work, projects, performances • Interviews with he parents, students etc • Cumulative records and Anecdotal records • School Diaries • Photos • Questionnaires • Focus groups discussions • Checklists • Observation schedules

Select the data that are most appropriate for the study. But, use at least three sources of data for making the basis for actions; this process is called data triangulation. Data triangulation allows developing comprehensive perspective about the knowledge and understanding of the learner and the learning

environment. By using multiple sources, we can strengthen the clarity and depth of our understanding while we minimize the weaknesses of any single source. After collecting the data, these are arranged on the basis of gender, classroom, grade level, school, etc. The practitioner may use purposive samples of students or teachers from each grade level in case of larger groups.

Analysis and Interpretation of Data

After the data has been gathered, the next step is to analyze the data in order to identify trends and themes. The qualitative data obtained on the basis of the interviews taken, or from the cumulative records of the students, opinions, attitudes, or checklists can be reviewed to take out the common elements or themes and may be summarized in the suitable table formats. The quantitative data can be analyzed with the use of simple statistics such as percentages, simple frequency tables, or by calculating simple, descriptive statistics. A teacher can also take the assistance from the technical staff. Thus, the information from these analyses directs immediate and long-term action and allows determining if there are group differences among learners in the school (i.e. gender, race/ethnicity, socioeconomic, etc.).

At this step, the data is turned into information, which can help the practitioner or the faculty in making decisions. Therefore, this stage requires maximum time. A teacher either discusses the analysis with his/her colleagues to determine priority area(s) for action; and to decide what can be done or he/she can do at his/her own level. After the analysis, it becomes clear that what important points do these data reveal and which important patterns or trends are emerging.

Discussions and Evaluating Actions

After the careful analysis of the data review of current literature is done for taking decisions and necessary actions. Following points should be kept in mind while conducting the literature review: i. Identifying topics that relate to the area of the study and would most likely yield useful information. ii. Gather or collect research reports, research, books and videotapes relating to the problem. iii. Organise these materials for drawing inferences in the light of result of the action research study. iv. Determine the most promising actions schools can employ for improving classroom and school practices.

Suggesting a plan of action that will allow the practitioner to make a change. This is well informed decision – making. The actions/innovations selected ultimately improves student learning. Also, a practitioner may select one to three innovative strategies focusing primarily on the improvement of instruction, curriculum and the administrative set up that need to be integrated for the improved health of the organization. For example, after the careful analysis a practitioner may find the ways to control the indiscipline in his class which include: changing the teaching style, by encouraging more student's participation, by becoming more audible to the students etc. Here, it may be noted that there are many suggestive actions but it is important to mention that if several changes are made at once, it will be difficult to determine which action is responsible for better outcome. Hence it is advisable to suggest one action at a time and then observe its outcome in improving the situation. A practitioner will get report on each action, which he/she has taken but to choose one of thee the practitioner has to judge the better action on the basis of the effects of the intervention and improvement that has occurred. If there is improvement, do the data clearly provide the supporting evidence? If no,

then think further about what changes can be made to the actions to elicit better results.

Uses of Action Research

Action Research can be a worthwhile pursuit for educators for a number of reasons. Foremost among these is simply the desire to know more. Good teachers are, after all, themselves students, and often look for ways to update their existing knowledge. Let us discuss some benefits of action research.

1. Professional development

Action Research influences thinking skills, level of efficacy, willingness to share and communicate, and attitudes toward the process of change. Through, action research teachers learn about themselves, their students, their colleagues, and can determine ways to continually improve.

Interactions and sharing of thoughts

Through, action research the teachers team up together that allows them to talk with others about teaching and teaching strategies. During their discussions the teachers describe their own teaching styles and strategies and share their thoughts with others, which in turn develops a stronger relationships. It is through action research, we see increased sharing and collaboration across departments, disciplines, grade levels, and schools.

Potential to Impact School Change

Most researches are often criticized that one away from the ground realities. When teachers conduct action research, they look at questions that mostly address school and district contexts and concerns. This develops better communication, and sharing among the teachers and thus teachers learns from

their own and others experiences, which can create a positive impact on the school culture.

Reflect on own Practice

Action research provide a chance to practitioners to evaluate themselves in schools in an informal manner. It is conducted to investigate what effects their teaching have on the students learning, how they could work better with other teachers, on the whole how can they work to change the whole school for the better.

Improved Communications

Teamwork within the school or district brings individuals together for a shared purpose. Educators involved in action research become more flexible in their thinking and more open to new ideas (Pine, 1981). Studies by Little (1981) suggest that interactions and sharing of information bring positive changes in patterns of collegiality, communication, and networking.

UNIT - III

COLLECTING, ANALYZING, INTERPRETING QUANTITATIVE AND QUALITATIVE DATA

Quantitative Data: Administering the data collected - Steps in the process of quantitative data analysis - Preparing master chart - Analyzing the data: Descriptive analysis and inferential analysis - Preparing and interpreting the results. Qualitative Data: Types of qualitative data to be collected: Observation, Interview, Documents, Audio-Visual materials - Procedures to be used to record data - Steps in analyzing, interpreting qualitative data: Organizing data, transcribing data, coding the data, using codes and themes - Representing and reporting findings, summarizing findings. Mixed Method Data: Data analysing methods: inductive, deductive, writing theoretical notes, Quantification, Shaping metaphors, Critical methods: testing the findings and communicative validation.

Qualitative data collection is more than simply deciding on whether researcher will observe or interview people. Five steps comprise the process of collecting qualitative data. Researcher need to identify their participants and sites, gain access, determine the types of data to collect, develop data collection forms, and administer the process in an ethical manner.

THE STEPS IN THE PROCESS OF QUALITATIVE DATA COLLECTION

There are five interrelated steps in the process of qualitative data collection. These steps should not be seen as linear approaches, but often one step in the process does follow another. The five steps are first to identify participants and sites to be studied and to engage in a sampling strategy that will best help researcher understand their central phenomenon and the research question researcher are asking. Second, the next phase is to gain access to these individuals and sites by obtaining permissions. Third, once permissions are in place, researcher need to consider what types of information will best answer their research questions. Fourth, at the same time, researcher need to design protocols or instruments for collecting and

recording the information. Finally and fifth, researcher needs to administer the data collection with special attention to potential ethical issues that may arise. Some basic differences between quantitative and qualitative data collection are helpful to know at this point. Based on the general characteristics of qualitative research, qualitative data collection consists of collecting data using forms with general, emerging questions to permit the participant to generate responses; gathering word (text) or image (picture) data; and collecting information from a small number of individuals or sites. Thinking more specifically now,

- In quantitative research, we systematically identify our participants and sites through random sampling; in qualitative research, researcher identify our participants and sites on purposeful sampling, based on places and people that can best help us understand our central phenomenon.
- In both quantitative and qualitative research, researcher need permissions to begin our study, but in qualitative research, researcher needs greater access to the site because researcher will typically go to the site and interview people or observe them. This process requires a greater level of participation from the site than does the quantitative research process.
- In both approaches, researcher collects data such as interviews, observations, and documents. In qualitative research, our approach relies on general interviews or observations so that researcher does not restrict the views of participants. Researcher will not use someone else's instrument as in quantitative research and gather closed-ended information; researcher will instead collect data with a few open-ended questions that we design.
- In both approaches, researcher needs to record the information supplied by the participants. Rather than using predesigned instruments from someone else or instruments that researcher design, in qualitative research researcher will record information on self-designed protocols that help us organize information reported by participants to each question.

- Finally, researcher will administer our procedures of qualitative data collection with sensitivity to the challenges and ethical issues of gathering information face-to-face and often in people's homes or workplaces. Studying people in their own environment creates challenges for the qualitative researcher that may not be present in quantitative research when investigators mail out anonymous questionnaires or bring individuals into the experimental laboratory.

DIFFERENT SAMPLING APPROACHES

In qualitative inquiry, the intent is not to generalize to a population, but to develop an in-depth exploration of a central phenomenon. Thus, to best understand this phenomenon, the qualitative researcher purposefully or intentionally selects individuals and sites. This distinction between quantitative "random sampling" and qualitative "purposeful sampling".

In quantitative research, the focus is on randu n sampling, selecting representative individuals, and then generalizing from these individuals to a population. Often this process results in testing "theories" that explain the population. However, in qualitative research, researcher select people or sites that can best help researcher understand the central phenomenon. This understanding emerges through a detailed understanding of the people or site. It can lead to information that allows individuals to "learn" about the phenomenon, or to an understanding that provides voice to individuals who may not be heard otherwise.

Purposeful Sampling

The research term used for qualitative sampling is purposeful sampling. In purposeful sampling, researchers intentionally select individuals and sites to learn or understand the central phenomenon. The standard used in choosing participants and sites is whether they are "information rich". In any given qualitative study, researcher may decide to study a site (e.g., one college campus), several sites (three small liberal arts campuses), individuals or groups (freshman students), or some combination (two liberal arts

campuses and several freshman students on those campuses). Purposeful sampling thus applies to both individuals and sites.

Maximal Variation Sampling

One characteristic of qualitative research is to present multiple perspectives of individuals to represent the complexity of our world. Thus, one sampling strategy is to build that complexity into the research when sampling participants or sites. Maximal variation sampling is a purposeful sampling strategy in which the researcher samples cases or individuals that differ on some characteristic or trait (e.g., different age groups). This procedure requires that researcher identify the characteristic and then find sites or individuals that display different dimensions of that characteristic. For example, a researcher might first identify the characteristic of racial composition of high schools, and then purposefully sample three high schools that differ on this characteristic, such as a primarily Hispanic high school, a predominantly white high school, and a racially diverse high school.

Extreme Case Sampling

Sometimes researcher is more interested in learning about a case that is particularly troublesome or enlightening, or a case that is noticeable for its success or failure. Extreme case sampling is a form of purposeful sampling in which researcher study an outlier case or one that displays extreme characteristics. Researchers identify these cases by locating persons or organizations that others have cited for achievements or distinguishing characteristics. An autistic education program in elementary education that has received awards may be an outstanding case to purposefully sample.

Typical Sampling

Some research questions address "What is normal?" or "What is typical?" Typical sampling is a form of purposeful sampling in which the researcher studies a person or site that is "typical" to those unfamiliar with the situation. What constitutes typical, of course, is open to interpretation. However, researcher might ask persons at a research site or even select a

typical case by collecting demographic data or survey data about all cases. Researcher could study a typical faculty member at a small liberal arts college because that individual has worked at the institution for 20 years and has embodied the cultural norms of the school.

Theory or Concept Sampling

Researcher might select individuals or sites because they help researcher understand a concept or a theory. Theory or concept sampling is a purposeful sampling strategy in which the researcher samples individuals or sites because they can help the researcher generate or discover a theory or specific concepts within the theory. To use this method, researcher need a clear understanding of the concept or larger theory expected to emerge during the research. In a study of five sites that have experienced distance education, for example, researcher have chosen these sites because study of them can help generate a theory of student attitudes toward distance learning.

Homogeneous Sampling

Researcher might select certain sites or people because they possess a similar trait or characteristic. In homogeneous sampling the researcher purposefully samples individuals or sites based on membership in a subgroup that has defining characteristics. To use this procedure, researcher needs to identify the characteristics and find individuals or sites that possess it. For example, in a rural community, all parents who have children in school participate in a parent program. Researcher chooses members of this parent program to study because they belong to a common subgroup in the community.

Critical Sampling

Sometimes individuals or research sites represent the central phenomenon in dramatic terms (Patton, 1990). The sampling strategy here is to study a critical sample because it is an exceptional case and the researcher can learn much about the phenomenon. For example, researcher

studies teenage violence in a high school where a student with a gun threatened a teacher. This situation represents a dramatic incident that portrays the extent to which some adolescents may engage in school violence.

Opportunistic Sampling

After data collection begins, researcher may find that researcher needs to collect new information to best answer their research questions. Opportunistic sampling is purposeful sampling undertaken after the research begins, to take advantage of unfolding events that will help answer research questions. In this process, the sample emerges during the inquiry. Researchers need to be cautious about engaging in this form of sampling because it might divert attention away from the original aims of the research. However, it captures the developing or emerging nature of qualitative research nicely and can lead to novel ideas and surprising findings. For example, researcher begins a study with maximal variation sampling of different pregnant teenagers in high schools. During this process researcher find a pregnant teenager who plans to bring her baby to school each day. Because a study of this teenager would provide new insights about balancing children and school, researcher study her activities during her pregnancy at the school and in the months after the birth of her child.

Snowball Sampling

In certain research situations, researcher may not know the best people to study because of the unfamiliarity of the topic or the complexity of events. As in quantitative research, qualitative snowball sampling is a form of purposeful sampling that typically proceeds after a study begins and occurs when the researcher asks participants to recommend other individuals to be sampled. Researchers may pose this request as a question during an interview or through informal conversations with individuals at a research site.

Confirming and Disconfirming Sampling

A final form of purposeful sampling, also used after studies begin, is to sample individuals or sites to confirm or disconfirm preliminary findings. Confirming and disconfirming sampling is a purposeful strategy used during a study to follow up on specific cases to test or explore further specific findings. Although this sampling serves to verify the accuracy of the findings throughout a study, it also represents a sampling procedure used during a study. For example, researcher finds out that academic department chairs support faculty in their development as teachers by serving as mentors. After initially interviewing chairs, researcher further confirm the mentoring role by sampling and studying chairs that have received praise from faculty as "good" mentors.

Sample Size or Number of Research Sites

The number of people and sites sampled vary from one qualitative study to the next. Researcher might examine some published qualitative studies and see what numbers of sites or participants researchers used. Here are some general guidelines:

❖ It is typical in qualitative research to study a few individuals or a few cases. This is because the overall ability of a researcher to provide an in-depth picture diminishes with the addition of each new individual or site. One objective of qualitative research is to present the complexity of a site or of the information provided by individuals.

• In some cases, researcher might study a single individual or a single site. In other cases, the number may be several, ranging from 1 or 2 to 30 or 40. Because of the need to report details about each individual or site, the larger number of cases can become unwieldy and result in superficial perspectives. Moreover, collecting qualitative data and analyzing it takes considerable time, and the addition of each individual or site only lengthens that time.

Let's look at some specific examples to see how many individuals and sites were used. Qualitative researchers may collect data from single

individuals. For example, in the qualitative case study of Basil McGee, a second-year middle school science teacher, Brickhouse and Bodner (1992) explored his beliefs about science and science teaching and how his beliefs shaped classroom instruction. Elsewhere, several individuals participated in a qualitative grounded theory study. The researchers examined 20 parents of children labelled as ADHD. More extensive data collection was used in a qualitative ethnographic study of the culture of fraternity life and the exploitation and victimization of women. Rhoads (1995) conducted 12 formal interviews and 18 informal interviews, made observations, and collected numerous documents.

TYPES OF QUALITATIVE DATA TO BE COLLECTED

Another aspect of qualitative data collection is to identify the types of data that will address their research questions. Thus, it is important to become familiar with their questions and topics, and to review them prior to deciding upon the types of qualitative data that researcher will collect. In qualitative research researcher pose general, broad questions to participants and allow them to share their views relatively unconstrained by their perspective. In addition, researcher collects multiple types of information, and researcher may add new forms of data during the study to answer their questions. Further, researcher engages in extensive data collection, spending a great deal of time at the site where people work, play, or engages in the phenomenon researcher wish to study. At the site, researcher will gather detailed information to establish the complexity of the central phenomenon. Researcher can see the varied nature of qualitative forms of data when they are placed into the following categories:

- Observations
- Interviews and questionnaires
- Documents
- Audiovisual materials

Specific examples of types of data in these four categories. Variations on data collection in all four areas are emerging continuously. Most recently, videotapes, student classroom portfolios, and the use of e-mails are attracting increasing attention as forms of data. Now let's take a closer look at each of the four categories and their strengths and weaknesses.

OBSERVATIONS

When educators think about qualitative research, they often have in mind the process of collecting observational data in a specific school setting. Unquestionably, observations represent a frequently used form of data collection, with the researcher able to assume different roles in the process.

Observation is the process of gathering open-ended, firsthand information by observing people and places at a research site. As a form of data collection, observation has both advantages and disadvantages. Advantages include the opportunity to record information as it occurs in a setting, to study actual behavior, and to study individuals who have difficulty verbalizing their ideas (e.g., preschool children). Some of the disadvantages of observations are that researcher will be limited to those sites and situations where researcher can gain access, and in those sites, researcher may have difficulty developing rapport with individuals. This can occur if the individuals are unaccustomed to formal research. Observing in a setting requires good listening skills and careful attention to visual detail. It also requires management of issues such as the potential deception by people being observed and the initial awkwardness of being an "outsider" without initial personal support in a setting.

Observational Roles

Despite these potential difficulties, observation continues to be a well-accepted form of qualitative data collection. Using it requires that researcher adopt a particular role as an observer. No one role is suited for all situations; observational roles vary depending on their comfort at the site, their rapport with participants, and how best researcher can collect data to understand

the central phenomenon. Although many roles exist, researcher might consider one of three popular roles.

Role of a Participant Observer

To truly learn about a situation, researcher can become involved in activities at the research site. This offers excellent opportunities to see experiences from the views of participants. A participant observer is an observational role adopted by researchers when they take part in activities in the setting they observe. As a participant, researcher assumes the role of an "inside" observer who actually engages in activities at the study site. At the same time that researcher are participating in activities, researcher record information. This role requires seeking permission to participate in activities and assuming a comfortable role as observer in the setting. It is difficult to take notes while participating and researcher may need to wait to write down observations until after researcher has left the research site.

Role of a Nonparticipant Observer

In some situations, researcher may not be familiar enough with the site and people to participate in the activities. A nonparticipant observer is an observer who visits a site and records notes without becoming involved in the activities of the participants. The nonparticipant observer is an "outsider" who sits on the periphery or some advantageous place (e.g., the back of the classroom) to watch and record the phenomenon under study. This role requires less access than the participant role, and gatekeepers and individuals at a research site may be more comfortable with it. However, by not actively participating, researcher will remove their self from actual experiences, and the observations researcher make may not be as concrete as if researcher had participated in the activities.

Changing Observational Roles

In many observational situations, it is advantageous to shift or change roles, making it difficult to classify their role as strictly participatory or non-participatory. A changing observational role is one where researchers adapt

their role to the situation. For example, researcher might first enter a site and observe as a nonparticipant, simply needing to "look around" in the early phases of research. Then researcher slowly becomes involved as a participant. Sometimes the reverse happens, and a participant becomes a nonparticipant. However, entering a site as a nonparticipant is a frequently used approach. After a short time, when rapport is developed, researcher switches to being a participant in the setting. Engaging in both roles permits researcher to be subjectively involved in the setting as well as to see the setting more objectively. Here is an illustration in which a researcher began as a nonparticipant and changed into a participant during the process of observing:

One researcher studying the use of wireless laptop computers in a multicultural education methods class spent the first three visits to the class observing from the back row. He sought to learn the process involved in teaching the course, the instructor's interaction with students, and the instructor's overall approach to teaching. Then, on his fourth visit, students began using the laptop computers and the observer became a participant by teaming with a student who used the laptop from her desk to interact with the instructor's Web site.

The Process of Observing

As researcher just saw in the discussion of different observational roles, the qualitative inquirer engages in a process of observing, regardless of the role. This general process is outlined in the following steps:

1. Select a site to be observed that can help researcher best understand the central phenomenon. Obtain the required permissions needed to gain access to the site.

2. Ease into the site slowly by looking around; getting a general sense of the site; and taking limited notes, at least initially. Conduct brief observations at fi rst, because researcher will likely be overwhelmed with all of the activities taking place. This slow entry helps to build rapport with

individuals at the site and helps researcher assimilate the large amount of information.

3. At the site, identify who or what to observe, when to observe, and how long to observe. Gatekeepers can provide guidance as researcher makes these decisions. The practical requirements of the situation, such as the length of a class period or the duration of the activity, will limit their participation.

4. Determine, initially, their role as an observer. Select from the roles of participant or nonparticipant during their first few observations. Consider whether it would be advantageous to change roles during the process to learn best about the individuals or site. Regardless of whether researcher change roles, consider what role researcher will use and their reasons for it.

5. Conduct multiple observations over time to obtain the best understanding of the site and the individuals. Engage in broad observation at first, noting the general landscape of activities and events. As researcher become familiar with the setting, researcher can begin to narrow their observations to specific aspects (e.g., a small group of children interacting during reading time). A broad-to-narrow perspective is a useful strategy because of the amount of information available in an observation.

6. Design some means for recording notes during an observation. The data recorded during an observation are called fieldnotes. Fieldnotes are text (words) recorded by the researcher during an observation in a qualitative study. In this example, the student-observer engaged in participant observation when the instructor asked the class to spend 20 minutes observing an art object that had been brought into the classroom. This object was not familiar to the students in the class. It was from Indonesia and had a square, bamboo base and a horsehair top. It was probably used for some religious activities. This was a good object to use for an observational activity because it could not be easily recognized or described. The instructor asked students to observe the object and record fieldnotes describing the object

and reflecting on their insights, hunches, and themes that emerged during the observation. Students in the class are reacting to the object. The heading at the top of the fieldnotes records essential information about the time, place, and activities observed.

Consider what information researcher will record during an observation.

For example, this information might include portraits of the participants, the physical setting, particular events and activities, and personal reactions. In observing a classroom, for example, researcher may record activities by the teacher, the students, the interactions between the students and teacher, and the student-to-student conversations.

Record descriptive and reflective fieldnotes.

Descriptive fieldnotes record a description of the events, activities, and people (e.g., what happened). Reflective fieldnotes record personal thoughts that researchers have that relate to their insights, hunches, or broad ideas or themes that emerge during the observation (e.g., what sense researcher made of the site, people, and situation).

Make their self known, but remain unobtrusive.

During the observation, be introduced by someone if researcher is an "outsider" or new to the setting or people. Be passive, be friendly, and be respectful of the people and site.

After observing, slowly withdraw from the site.

Thank the participants and inform them of the use of the data and the availability of a summary of results when researcher complete the study.

INTERVIEW

Equally popular to observation in qualitative research is interviewing. A qualitative interview occurs when researchers sk one or more participants general, open-ended questions and record their answers. The researcher then transcribes and types he data into a computer file for analysis.

In qualitative research, researcher asks open-ended questions so that the participants can best voice their experiences unconstrained by any perspectives of the researcher or past research findings. An open-ended response to a question allows the participant to create the options for responding. For example, in a qualitative interview of athletes in high schools, researcher might ask, "How does researcher balance participation in athletics with their schoolwork?" The athlete then creates a response to this question without being forced into response possibilities. The researcher often audiotapes the conversation and transcribes the information into words for analysis.

Interviews in qualitative research have both advantages and disadvantages. Some advantages are that they provide useful information when researcher cannot directly observe participants, and they permit participants to describe detailed personal information. Compared to the observer, the interviewer also has better control over the types of information received, because the interviewer can ask specific questions to elicit this information. Some disadvantages are that interviews provide only information "filtered" through the views of the interviewers. Also, similar to observations, interview data may be deceptive and provide the perspective the interviewee wants the researcher to hear. Another disadvantage is that the presence of the researcher may affect how the interviewee responds. Interviewee responses also may not be articulate, perceptive, or clear. In addition, equipment issues may be a problem, and researcher needs to organize recording and transcribing equipment in advance of the interview. Also during the interview, researcher needs to give some attention to the conversation with the participants. This attention may require saying little, handling emotional outbursts, and using icebreakers to encourage individuals to talk. With all of these issues to balance, it is little wonder inexperienced researchers express surprise about the difficulty of conducting interviews.

Types of Interviews and Open-Ended Questions on Questionnaires

Once researcher decides to collect qualitative interviews, researcher next considers what form of interviewing will best help researcher understand the central phenomenon and answer the questions in their study. There are a number of approaches to interviewing and using open-ended questions on questionnaires. Few interview approaches to use will ultimately depend on the accessibility of individuals, the cost, and the amount of time available.

One-on-One Interviews The most time-consuming and costly approach is to conduct individual interviews. A popular approach in educational research, the one-on-one interview is a data collection process in which the researcher asks questions to and records answers from only one participant in the study at a time. In a qualitative project, researcher may use several one-on-one interviews. One-on-one interviews are ideal for interviewing participants who are not hesitant to speak, who are articulate, and who can share ideas comfortably.

Focus Group Interviews Focus groups can be used to collect shared understanding from several individuals as well as to get views from specific people. A focus group interview is the process of collecting data through interviews with a group of people, typically four to six. The researcher asks a small number of general questions and elicits responses from all individuals in the group. Focus groups are advantageous when the interaction among interviewees will likely yield the best information and when interviewees are similar to and cooperative with each other. They are also useful when the time to collect information is limited and individuals are hesitant to provide information. When conducting a focus group interview, encourage all participants to talk and to take their turns talking. A focus group can be challenging for the interviewer who lacks control over the interview discussion.

Telephone Interviews

It may not be possible for researcher to gather groups of individuals for an interview or to visit one-on-one with single individuals. The participants in a study may be geographically dispersed and unable to come to a central location for an interview. In this situation, researcher can conduct telephone interviews. Conducting a telephone interview is the process of gathering data using the telephone and asking a small number of general questions. A telephone interview requires that the researcher use a telephone adaptor that plugs into both the phone and a tape recorder for a clear recording of the interview. One drawback of this kind of interviewing is that the researcher does not have direct contact with the participant. This causes limited communication that may affect the researcher's ability to understand the interviewee's perceptions of the phenomenon. Also, the process may involve substantial costs for telephone expenses.

E-Mail Interviews

Another type of interview useful in collecting qualitative data quickly from a geographically dispersed group of people. E-mail interviews consist of collecting open-ended data through interviews with individuals using computers and the Internet to do so. If researcher can obtain e-mail lists or addresses, this form of interviewing provides rapid access to large numbers of people and a detailed, rich text database for qualitative analysis. It can also promote a conversation between their self as the researcher and the participants, so that through follow-up conversations, researcher can extend their understanding of the topic or central phenomenon being studied.

Open-Ended Questions on Questionnaires

On questionnaires, researcher may ask some questions that are closed ended and some that are open ended. The advantage of this type of questioning is that their predetermined closed-ended responses can net useful information to support theories and concepts in the literature. The open-ended responses, however, permit researcher to explore reasons for the closed-ended responses and identify any comments people might have

that are beyond the responses to the closed-ended questions. The drawback of this approach is that researcher will have many responses—some short and some long—to analyse. Also, the responses are detached from the context—the setting in which people work, play, and interact. This means that the responses may not represent a fully developed database with rich detail as is often gathered in qualitative research. To analyse open-ended responses, qualitative researchers look for overlapping themes in the open-ended data and some researchers count the number of themes or the number of times that the participants mention the themes.

Documents

A valuable source of information in qualitative research can be documents. Documents consist of public and private records that qualitative researchers obtain about a site or participants in a study, and they can include newspapers, minutes of meetings, personal journals, and letters. These sources provide valuable information in helping researchers understand central phenomena in qualitative studies. They represent public and private documents. Examples of public documents are minutes from meetings, official memos, records in the public domain, and archival material in libraries. Private documents consist of personal journals and diaries, letters, personal notes, and jottings individuals write to themselves. Materials such as e-mail comments and Web site data illustrate both public and private documents, and they represent a growing data source for qualitative researchers. Documents represent a good source for text (word) data for a qualitative study.

They provide the advantage of being in the language and words of the participants, who have usually given thoughtful attention to them. They are also ready for analysis without the necessary transcription that is required with observational or interview data. On the negative side, documents are sometimes difficult to locate and obtain. Information may not be available to the public. Information may be located in distant archives, requiring the researcher to travel, which takes time and can be expensive. Further, the

documents may be incomplete, inauthentic, or inaccurate. For example, not all minutes from school board meetings are accurate, because board members may not review them for accuracy. In personal documents such as diaries or letters, the handwriting may be hard to read, making it difficult to decipher the information.

Collecting Documents

With so much variation in the types of documents, there are many procedures for collecting them. Here are several useful guidelines for collecting documents in qualitative research:

1. Identify the types of documents that can provide useful information to answer their qualitative research questions.

2. Consider both public (e.g., school board minutes) and private documents (e.g., personal diaries) as sources of information for their research.

3. Once the documents are located, seek permission to use them from the appropriate individuals in charge of the materials.

4. If researcher asks participants to keep a journal, provide specific instructions about the procedure. These guidelines might include what topics and format to use, the length of journal entries, and the importance of writing their thoughts legibly.

5. Once researcher has permission to use documents, examine them for accuracy, completeness, and usefulness in answering the research questions in their study.

6. Record information from the documents. This process can take several forms, including taking notes about the documents or, if possible, optically scanning them so a text (or word) file is created for each document. Researcher can easily scan newspaper stories (e.g., on speeches by presidential candidates) to form a qualitative text database.

Collecting personal documents can provide a researcher with a rich source of information. For example, consider a study that used journals prepared by several women: An important source for learning about women in superintendent positions is for them to keep a personal journal or diary of their experiences. A researcher asked three women superintendents to keep a diary for 6 months and record their reactions to being a woman in their capacity of conducting official meetings comprised primarily of men.

Audio visual Materials

The final type of qualitative data to collect is visual images. Audio visual materials consist of images or sounds that researchers collect to help them understand the central phenomenon under study. Used with increasing frequency in qualitative research, images or visual materials such as photographs, videotapes, digital images, paintings and pictures, and unobtrusive measures are all sources of information for qualitative inquiry. One approach in using photography is the technique of photo elicitation. In this approach, participants are shown pictures and asked to discuss the contents. These pictures might be personal photographs or albums of historical photographs.

The advantage of using visual materials is that people easily relate to images because they are so pervasive in our society. Images provide an opportunity for the participants to share directly their perceptions of reality. Images such as videotapes and films, for example, provide extensive data about real life as people visualize it. A potential disadvantage of using images is that they are difficult to analyze because of the rich information. Also, researcher as a researcher may influence the data collected. In selecting the photo album to examine or requesting that a certain type of drawing be sketched, researcher may impose their meaning of the phenomenon on participants, rather than obtain the participants' views. When videotaping, researcher face the issues of what to tape, where to place the camera, and the need to be sensitive with camera-shy individuals.

Collecting Audio visual Materials

Despite these potential problems, visual material is becoming more popular in qualitative research, especially with recent advances in technology. The steps involved in collecting visual material are similar to the steps involved in collecting documents:

Determine what visual material can provide information to answer research questions and how that material might augment existing forms of data, such as interviews and observations.

2. Identify the visual material available and obtain permission to use it. This permission might require asking all students in a classroom, for example, to sign informed consent forms and to have their , rents sign them also.

3. Check the accuracy d authenticity of the visual material if researcher do not record it their self. One way to heck for accuracy is to contact the interview the photographer or the individuals represented in the pictures.

4. Collect the data and organize it. Researcher can opt, 'ly scan the data for easy storage and retries

To illustrate the use of visual material, look at an example in which the researcher distributed cameras to obtain photographs:

A researcher gives Polaroid cameras to 40 male and 40 female fourth graders in a science unit to record their meaning of the environment. The participants are asked to take pictures of images that represent attempts to preserve the environment our society. As a result, the researcher obtains 24 pictures ,11 each child that can be used to undersi ' how Young people look at the environment. Understandably, 'Los of squirrels au, outside pets dominate the collection of pictures in this database.

PROCEDURES TO BE USED TO RECORD DATA

An essential process in qualitative research is recording data. This process involves recording information through research protocols, administering data collection so that researcher can anticipate potential

problems in data collection, and bringing sensitivity to ethical issues that may affect the quality of the data.

Using Protocols

As already discussed, for documents and visual materials, the process of recording information may be informal (taking notes) or formal. For observations and interviews, qualitative inquirers use specially designed protocols. Data recording protocols are forms designed and used by qualitative researchers to record information during observations and interviews.

An Interview Protocol

During interviewing, it is important to have some means for structuring the interview and taking careful notes. As already mentioned, audio taping of interviews provides a detailed record of the interview. As a backup, researcher needs to take notes during the interview and have the questions ready to be asked. An interview protocol serves the purpose of reminding researcher of the questions and it provides a means for recording notes. An interview protocol is a form designed by the researcher that contains instructions for the process of the interview, the questions to be asked, and space to take notes of responses from the interviewee.

Development and Design of an Interview Protocol

To best understand the design and appearance of this form, examine the qualitative interview protocol used during a study of the campus reaction to a gunman who threatened students in a classroom.

❖ It contains a header to record essential information about the interview, statements about the purpose of the study, a reminder that participants need to sign the consent form, and a suggestion to make preliminary tests of the recording equipment. Other information researcher might include in the header would be the organization or work affiliation of the interviewees; their educational background and position; the number of

years they have been in the position; and the date, time, and location of the interview.

❖ Following this header are five brief open-ended questions that allow participants maximum flexibility for responding to the questions. The first question serves the purpose of an icebreaker, to relax the interviewees and motivate them to talk. This question should be easy to understand and cause the participants to reflect on experiences that they can easily discuss,

ANALYZING AND INTERPRETING QUALITATIVE DATA

Analysing qualitative data requires understanding how to make sense of text and images so that researcher can form answers to their research questions. In this section, researcher will learn about the six steps involved in analysing and interpreting qualitative data: preparing and organizing the data, exploring and coding the database, describing findings and forming themes, representing and reporting findings, interpreting the meaning of the findings, and validating the accuracy of the findings.

STEPS IN ANALYZING AND INTERPRETING QUALITATIVE DATA

The six steps commonly used in analysing qualitative data. These steps are not always taken in sequence, but they represent preparing and organizing the data for analysis; engaging in an initial exploration of the data through the process of coding it; using the codes to develop a more general picture of the data descriptions and themes; representing the findings through narratives and visuals; making an interpretation of the meaning of the results by reflecting personally on the impact of the findings and on the literature that might inform the findings; and finally, conducting strategies to validate the accuracy of the findings.

Researcher can visualize the first major steps in this process by examining the "bottom-up" approach to analysis. Qualitative researchers first collect data and then prepare it for data analysis. This analysis initially consists of developing a general sense of the data, and then coding description and themes about the central phenomenon. Let's look at some

of the features of this process in more detail. It is inductive in form, going from the particular or the detailed data to the general codes and themes. Keeping this in mind helps researcher understand how qualitative researchers produce broad themes or categories from diverse detailed databases. Although the initial analysis consists of subdividing the data, the final goal is to generate a larger, consolidated picture.

- It involves a simultaneous process of analysing while researcher is also collecting data. In qualitative research, the data collection and analysis are simultaneous activities. When researcher is collecting data, researcher may also be analysing other information previously collected, looking for major ideas. This procedure differs from traditional approaches in quantitative research, in which data collection occurs first, followed by data analysis.
- The phases are also iterative, meaning researcher cycle back and forth between data collection and analysis. In qualitative research, researcher might collect stories from individuals and return for more information to fill in gaps in their stories as their analysis of their stories proceeds.
- Qualitative researchers analyse their data by reading it several times and conducting an analysis each time. Each time researcher read their database, researcher develops a deeper understanding about the information supplied by their participants.
- There is no single, accepted approach to analysing qualitative data, although several guidelines exist for this process. It is an eclectic process.
- Qualitative research is "interpretive" research, in which researcher make a personal assessment as to a description that fits the situation or themes that capture the major categories of information. The interpretation that researcher make of a transcript, for example, differs from the interpretation that someone else makes. This does not mean

that their interpretation is better or more accurate; it simply means that researcher bring their own perspective to their interpretation.

RESEARCHER PREPARE AND ORGANIZE THE DATA FOR ANALYSIS

Initial preparation of the data for analysis requires organizing the vast amount of information, transferring it from spoken or written words to a typed file and making decisions about whether to analyse the data by hand or by computer.

Organize Data

At an early stage in qualitative analysis, researcher organizes data into file folders or computer files. Organization of data is critical in qualitative research because of the large amount of information gathered during a study. The extensive data that an interview yields often surprises new researchers. For example, a 30-minute interview will often result in about 20 pages of single-spaced transcription. With this sizable amount of data, the transcribing and organizing of information requires a system of organization, which could take several forms, such as:

- Developing a matrix or a table of sources that can be used to help organize the material
- Organizing the materials by type: all interviews, all observations, all documents, and all photographs or other visual materials; as an alternative, researcher might consider organizing the materials by participant, site, location, or some combination of these approaches
- Keeping duplicate copies of all forms of data

TRANSCRIBING DATA

During qualitative data collection, researcher will collect text or words through interviewing participants or by writing field notes during observations. This necessitates a need to convert these words to a computer document for analysis. Alternatively, researcher might listen to the tapes or

read their field notes to begin the process of analysis. When time is short or funds are scarce, researcher may be able to have only a few interviews or a few observational notes transcribed. The most complete procedure, however, is to have all interviews and all observational notes transcribed. As a general rule of thumb, it takes approximately 4 hours to transcribe 1 hour of tape. Hence, the process of transcription is labor intensive and researcher will need to allow adequate time for it.

Transcription is the process of converting audiotape recordings or field notes into text data. Researcher may use a transcriptionist to type their text files or researcher can transcribe the information their self. In either case, for interview data, transcriptionists need special equipment to help create the transcript. This equipment consists of a machine that enables the transcriber to start and stop tape recordings or to play them at a speed so that the transcriber can easily follow them. Here are a few more guidelines to facilitate transcription:

- ❖ Create 2-inch margins on each side of the text document so that researcher can jot down notes in the margins during data analysis.
- Leave extra space on the page between the interviewer's comments and the interviewee's comments. This enables researcher to distinguish clearly between speakers during data analysis.
- Highlight or mark in some way the questions asked by the interviewer. Researcher will not analyze their questions, but identifying them clearly indicates where one question ends and another begins. Often, researcher will analyze all answers to a single question.
- Use complete, detailed headers that contain information about the interview or observational session. Examine interview and observational protocols to see the type of content to be included in a transcription.
- Transcribe all words, and type the word "[pause]" to indicate when interviewees take a lengthy break in their comments. These pauses may provide useful information about times when interviewees cannot or will not respond to a question. Researcher can also record other actions

occurring during an interview. For example, type "[laughter]" when the interviewee laughs, "[telephone rings]" to indicate a phone call that interrupts the interview, or "[inaudible]" to mark when the transcriptionist cannot determine what is being said. As a general approach, transcribing all words will provide data that captures the details of an interview.

ANALYZE BY HAND OR COMPUTER

With the popularity of computers, researchers have a choice about whether to hand analyse data or to use a computer. The hand analysis of qualitative data means that researchers read the data, mark it by hand, and divide it into parts. Traditionally, analysing text data involves using color coding to mark parts of the text or cutting and pasting text sentences onto cards. Some qualitative researchers like to hand analyse all of their data. A hand analysis may be preferred when researcher:

- Are analysing a small database and can easily keep track of files and locate text passages
- Are not comfortable using computers or have not learned a qualitative computer software program
- Want to be close to the data and have a hands-on feel for it without the intrusion of a machine
- Have time to commit to a hand analysis, since it is a labour-intensive activity to manually sort, organize, and locate words in a text database For others with a greater interest in technology and with the time to learn a computer program, a computer analysis is ideal.

A computer analysis of qualitative data means that researchers use a qualitative computer program to facilitate the process of storing, analysing, sorting, and representing or visualizing the data. With the development of these computer programs, researcher has a choice as to whether to use hand coding or a computer analysis. Researcher might base their decision on several factors. Use a computer program when researcher:

- Are analysing a large database and need to organize and keep track of extensive information
- Are adequately trained in using the program and are comfortable using computers
- Have resources to purchase a program or can locate one to use
- Need a close inspection of every word and sentence to capture specific quotes or meanings of passages

USE OF QUALITATIVE COMPUTER PROGRAMS

Qualitative computer programs do not analyse the data for researcher. However, they do provide several convenient features that facilitate their data analysis. A qualitative data analysis computer program is a program that stores data, organizes their data, enables researcher to assign labels or codes to their data, and facilitates searching through their data and locating specific text or words.

Procedures for Using Software Programs

The general procedures for using a software program are as follows:

- Convert a word processing file into a text file or import the word processing file directly into the computer program. The word processing file will be a transcribed interview, a set of field notes, or other text, such as a scanned document.
- Select a computer program to use. This program should have the features of storing data, organizing data, assigning labels or codes, and searching the data.
- Enter a file into the program and give it a name.
- Go through the file and mark sentences or paragraphs of ideas that pertain to what the participant is saying in the text.
- Provide a code label for the blocked text. Continue this process of marking text and providing code labels for the entire text file.
- After blocking and assigning labels to text, search for all text matching each code, and print out a file of these text passages.

- Collapse these code labels into a few broad themes, or categories, and include evidence for each category.

BASIC FEATURES OF SOFTWARE PROGRAMS

Many commercial, qualitative data analysis software programs are available today. A recent review of software programs analysed their features based on eight major dimensions. The basic considerations are to find a program that is easy to use, that will accept both their text files (from transcripts) and their images (from pictures), that allows researcher to read and review text and categorize it, and that sorts and finds text or image passages easily for their qualitative report. Less frequently, researcher may be interested in merging analyses compiled by different researchers or importing or exporting their analyses to other software programs.

RESEARCHER EXPLORE AND CODE THE DATA

After researcher have organized and transcribed their data and decided whether to hand or computer analyzes it, it is time to begin data analysis. This consists of exploring the data and developing codes as first steps in analysis.

EXPLORE THE GENERAL SENSE OF THE DATA

The first step in data analysis is to explore the data. A preliminary exploratory analysis in qualitative research consists of exploring the data to obtain a general sense of the data, memoing ideas, thinking about the organization of the data, and considering whether researcher need more data.

CODE THE DATA

The further process of analysing text (or images) in qualitative research begins when researcher code the data. Coding is the process of segmenting and labeling text to form descriptions and broad themes in the data. Although there are no set guidelines for coding data, some general procedures exist.

The object of the coding process is to make sense out of text data, divide it into text or image segments, label the segments with codes, examine codes for overlap and redundancy, and collapse these codes into broad themes. Thus, this is an inductive process of narrowing data into a few themes. Also, in this process researcher will select specific data to use and disregard other data that do not specifically provide evidence for their themes.

RESEARCHER USE CODES TO BUILD DESCRIPTION AND THEMES

In a qualitative research study, researcher need to analyse the data to form answers to their research questions. This process involves examining the data in detail to describe what researcher learned, and developing themes or broad categories of ideas from the data. Describing and developing themes from the data consists of answering the major research questions and forming an in-depth understanding of the central phenomenon through description and thematic development. Not all qualitative projects include both description and themes, but all studies include at least themes. Beginning with description, we can explore what it attempts to accomplish, how researcher might use it, and how it appears in a research report.

DESCRIPTION

Because description is a detailed rendering of people, places, or events in a setting in qualitative research, it is easiest to start the analysis after the initial reading and coding of the data. In some forms of qualitative research design, such as in ethnography or in case studies, the researcher provides a considerable description of the setting. Developing detail is important, and the researcher analyzes data from all sources to build a portrait of individuals or events. In providing detailed information, description can transport the reader to a research site or help the reader visualize a person. It takes experience and practice to describe the detail in a setting. For example, examine these two illustrations and note the differences in level of detail.

Poor example: The workers built the education building with three floors.

Better example: As the education building developed, iron beams crossed and connected it together. A giant crane lifted these beams into place with a line secured tightly around each beam. A worker underneath the beam fastened it into place. As we watched, the beam tipped back and forth, leading us to wonder if the crane operator had securely fastened it. One slip and disaster would follow, but the beam landed securely in place.

THEMES

In addition to description, the use of themes is another way to analyze qualitative data. Because themes are similar codes aggregated together to form a major idea in the database, they form a core element in qualitative data analysis. Like codes, themes have labels that typically consist of no more than two to four words. Through initial data analyses, researcher may find 30 to 50 codes. In subsequent analyses, researcher reduces these codes to five to seven major themes through the process of eliminating redundancies. There are several types of themes, and authors typically identify them as follows:

- Ordinary themes: themes that a researcher might expect to find.
- Unexpected themes: themes that are surprises and not expected to surface during a study.
- Hard-to-classify themes: themes that contain ideas that do not easily fit into one theme or that overlap with several themes.
- Major and minor themes: themes that represent the major ideas and the minor, secondary ideas in a database.

LAYERING AND INTERRELATING THEMES

Researcher will see many qualitative studies that stop at reporting description and themes. However, researcher can add additional rigor and insight into their study by layering themes or interconnecting them.

LAYERING THEMES

Layering themes builds on the idea of major and minor themes but organizes the themes into layers from basic elementary themes to more sophisticated ones. Layering the analysis means representing the data using interconnected levels of themes. Researcher subsumes minor themes within major themes and includes major themes within broader themes. The entire analysis becomes more and more complex as the researcher works upward toward broader and broader levels of abstraction. The number of layers may vary from two to four or five, and recognizing these layers will help researcher understand the use of themes in layered qualitative analysis. Considering again the gunman incident study, it can be found that layering was used by the authors in this study.

INTERRELATING THEMES

A second thematic analysis approach that inter- connects the themes. Interconnecting themes means that researcher connects the themes to display a chronology or sequence of events, such as when qualitative researchers generate a theoretical and conceptual model. Here we see a sample chart used in a qualitative grounded theory study. The researchers examined the practices used by 33 academic department chairs to enhance the research of faculty in their college or university units. The authors identified numerous themes within each box in the diagram. In addition, arrows show the connection among the boxes. In this sequence, the process of enhancing faculty research performance relates to the type of faculty issue, the signs that this issue is important, the context of stages of the faculty member's career, and the larger institutional context. It also includes the specific strategies employed by the chair, and the outcomes of using that strategy. In short, this process displays an interconnected set of events or activities in the process of chairs enhancing faculty performances.

RESEARCHER REPRESENT AND REPORT FINDINGS

After researcher code the data, analyze it for description and themes, layer and interconnect themes, and report findings to their research

questions. These calls for displaying findings in tables and figures and constructing a narrative to explain what researcher have found in response to their research questions.

Representing Findings

Qualitative researchers often display their findings visually by using figures or pictures that augment the discussion. Different ways to display data are listed here:

Create a comparison table. Create a visual image of the information in the form of a comparison table or a matrix, a table that compares groups on one of the themes. In a qualitative study of the meaning of "professionalism," a researcher collected statements from both women and men teachers in a school.

- Develop a hierarchical tree diagram. This diagram visually represents themes and their interconnections so that the themes are presented in order from the broad themes to the narrow themes.
- Present figures. Figures with boxes show the connections among themes.
- Draw a map. Depict the physical laresearchert of the setting.
- Develop a demographic table. Describe personal or demographic information for each person or site in the research. In a study of the types of technology used by instructors in college classrooms, the researcher described each instructor and his or her primary delivery style in a demographic table. The six individuals studied in this qualitative study displayed different personal characteristics as well as diverse approaches to using technology. This table provides readers with various demographic information for each instructor, such as number of years teaching, gender, class level of instruction, instructional approach used in the class, and his or her primary form of technology use.

REPORTING FINDINGS

The primary form for representing and reporting findings in qualitative research is a narrative discussion. A narrative discussion is a written passage

in a qualitative study in which authors summarize, in detail, the findings from their data analysis. There is no set form for this narrative, which can vary widely from one study to another. However, it is helpful to identify some frequently used forms. Several of these forms have already been discussed, such as developing description, themes, or interconnecting themes. Others are important, too, especially in advocacy and participatory forms of qualitative inquiry, such as raising questions, challenging assumptions based on evidence supplied by participants, or reflecting on how participants changed during the research. Their decision about which form or forms to use depends on the purpose of their research and the type of data researcher has analyzed for their findings.

RESEARCHER INTERPRET FINDINGS

Interpretation involves making sense of the data, or the "lessons learned," as described by Lincoln and Guba (1985). Interpretation in qualitative research means that the researcher steps back and forms some larger meaning about the phenomenon based on personal views, comparisons with past studies, or both. Qualitative research is interpretive research, and researcher will need to make sense of the findings. Researcher will find this interpretation in a fmal section of a study under headings such as "Discussion," "Conclusions," "Interpretations," or "Implications." This section includes:

- A review of the major findings and how the research questions were answered
- Personal reflections of the researcher about the meaning of the data
- Personal views compared or contrasted with the literature
- Limitations of the study
- Suggestions for future research

SUMMARIZING FINDINGS

A typical "Discussion" section begins with a general recap of the major findings. Sometimes researcher will state each individual research question

again and provide findings for each question. The overall intent of this passage is to provide readers with an overview of the findings to complement the more detailed results in the description and theme passages.

CONVEY PERSONAL REFLECTIONS

Because qualitative researchers believe that their personal views can never be kept separate from interpretations, personal reflections about the meaning of the data are included in the research study. Researcher bases these personal interpretations on hunches, insights, and intuition. Because researcher may have been to the field and visited personally at great length with individuals, researcher are in a good position to reflect and remark on the larger meaning of the data. The two examples that follow illustrate the diversity of personal reflections found in qualitative studies.

MAKE COMPARISONS TO THE LITERATURE

Interpretation may also contain references to the literature and past studies. Similar to quantitative research, the qualitative inquirer interprets the data in view of this past research, showing how the findings may support or contradict prior studies, or both. This interpretation may compare qualitative findings with reported views of a social science concept found in the literature, or it may combine personal views with an educational or social science term or idea. In a qualitative study of sibling interaction between a Young man with Down syndrome and his three brothers, the authors Harry, Day, and Quist (1998) concluded with interpretive comments about the inclusion of "Raul" in situations outside of the family setting. They relate their own views to those in the literature:

OFFER LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Also similar to quantitative research, the qualitative researcher suggests possible limitations or weaknesses of the study and makes recommendations for future research. These limitations may address problems in data collection, unanswered questions by participants, or better selection of purposeful sampling of individuals or sites for the study.

Implications for future research may include the use of the findings for practice (e.g., classrooms, schools, or with certain people such as adults or teenagers) or the need for further research (e.g., by gathering more extensive data or by asking additional questions of participants). Researcher might also state implications for decision making, such as planning for new practices (e.g., better campus planning about how to handle violent incidents) or for the audience researcher identified in the introduction to their study.

UNIT-IV

PARAMETRIC TEST

We have already learned that representative values such as mean, median and standard deviation, when calculated directly from the population, are termed *parameters.* However, it is quite a tedious task to approach each and every element or attribute of the entire population and compute the required parameters. The best way is to select an appropriate sample, compute statistics such as mean and median for the elements of this sample and then use these computed statistics for drawing inferences and estimation about the parameters. How for these inferences and estimation are trusts worthy or significant can then be tested with the help of some appropriate tests, called *test of significance*.

When to use parametric and nonparametric tests

Parametric test like 't' and 'F' tests may be used for analysing the data which satisfy the following conditions (Seigel 1956).

1. The population from which the samples have been drawn should be normally distributed. This is known by the term assumption of normality.
2. The variables involved must have been measured in interval or ratio scale.
3. The observations must be independent. The conclusion or exclusion of any case in the sample should not unduly affect the results of the study.
4. These populations must have the same variance or, in special cases, must have a known ratio of variance. This we call homoscedasticity.

Nonparametric test is recommended in the following situations

1. When N is quite small. If the size of the sample is a small as N=5 or N= 6, the only alternative is to make use of non parametric test.
2. When assumptions like normality of the distribution of scores in the population for doubtful. In other words, where the distribution is free the variates under question need not be distributed in a certain specific way in the population. It is the characteristic of the non parametric test which enables them to be called distribution free test.
3. When the measurement of the data is available either in the form of ordinal or nominal scales. That is when it can be expressed in the form of ranks or in the shape of + signs or - signs and classifications like "good-bad".

Differences between parametric and non-parametric statistics

The parametric and non-parametric statistics differ from each other on these various levels

Level of Differences	Parametric	Non Parametric
Assumed Distribution	Normal	Any
Assumed Variance	Homogeneous	Homogenous and Heterogeneous both
Typical data	Ratio or Interval	Ordinal or Nominal
Usual Central measure	Mean	Median
Benefits	Can Draw more conclusions	Simple and less affected By extreme score

ASSUMPTIONS OF PARAMETRIC AND NON-PARAMETRIC STATISTICS

Assumptions to be met for the use of parametric tests are given below:

- Normal distribution of the dependent variable
- A certain level of measurement: Interval data
- Adequate sample size (>30 recommended per group)
- An independence of observations, except with paired data
- Observations for the dependent variable have been randomly drawn
- Equal variance among sample populations
- Hypotheses usually made about numerical values, especially the mean

Assumptions of Non-parametric Statistics test are fewer than that of the parametric tests and these are given below:

- An independence of observations, except with paired data
- Continuity of variable under study Characteristics of non-parametric techniques:
- Fewer assumptions regarding the population distribution
- Sample sizes are often less stringent
- Measurement level may be nominal or ordinal
- Independence of randomly selected observations, except when paired
- Primary focus is on the rank ordering or frequencies of data
- Hypotheses are posed regarding ranks, medians, or frequencies of data

Parametric Tests

Statistical methods which depend on the parameters of populations or probability distributions are referred to as parametric tests. Parametric tests include:

- ‘t’ test
- ‘F’ test
- ANNOVA
- ANCOVA
- MANOVA
- MANCOVA
- Correlation – pearson
- Regression: Linear and Multiple regression
- Factor analysis
- Cohen’s effect size test

‘t’-TEST (Test of Significance)

‘t’ test or test of significance of the difference between means for large independent samples (Garrett, 1969) is used to compare the means between any two groups on any of the variables.

If the ‘t’ value is below a cut-off point (depending on the degrees of freedom), the differences in means is considered not significant, and the null hypothesis is accepted. When the ‘t’ value exceeds a cut-off point, the difference is said to be significant and the null hypothesis is rejected.

The t-test is used to find the significant level of difference between two groups of populations. The t-value is calculated from the mean and standard deviation of the two groups. If the obtained value is 2.58 and above, then the significant level of difference is 0.01 and if the value lies between 1.96 and 2.58, the significant level of difference is 0.05. If the value is below 1.96, the difference is not significant at any level. The t-test is calculated using the formula.

$$t = \frac{\left|M_1 - M_2\right|}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}$$

Where,

M_1 = Mean of the I sample

M_2 = Mean of the II sample

σ_1 = Standard Deviation of the I sample

σ_2 = Standard Deviation of the II sample

N_1 = Total number of frequency of the I sample

N_2 = Total number of frequency of the II sample

F-Ratio (ANOVA single Factor)

Analysis of Variance (ANOVA) is an extremely useful technique, for testing the difference between the means of multiple independent samples. The basic principle for ANOVA is to test the differences among the means of the samples by examining the amount of variation between the samples relative to the amount of variation between the samples. This value is compared with the 'F' value for the given degrees of freedom. If the 'F' value worked out is equal or exceeds the 'F' limit value (from tables) it indicates that there are significant differences among the sample means.

The F-test is an effective way to determine whether the means of more than two samples are too different to attribute to sampling error. It consider the following operations.

1. The sum of scores and the sum of squares of the scores are obtained.
2. The variance of the score of one composite to one composite group known as the total group variance. The formula is,

$$SS_t = \sum x^2 - (\sum x)^2 / N$$

3. The mean value of the variance of each of these group computed separately is known as the between group variance

$$SS_b = (\sum x_1)^2 / N_1 + (\sum x_2)^2 / N_2 + \ldots\ldots + (\sum x_n)^2 / N_n$$

4. Within the group sum of squares

$$SS_w = SS_t - SS_b$$

5. Computation of F-ratio

F – ratio by ANOVA single factor were calculated by dividing the groups of the scores obtained by both the groups.

$$F = \frac{M_{sb}}{M_{sw}} = \frac{SS_{b|df_1}}{SS_{w|df_2}} \text{ where}$$

M_{sb} = Mean square variance between groups

M_{sw} = Mean square variance with in the group

df_1 = Number of groups

df_2 = Total number of student number of group.

ANCOVA

ANCOVA (Analysis of Coefficient of Variation) (correlated variance)

Analysis of covariance is an extension of analysis, of variance to allow for the correlation between initial and the final scores. It is also an improvement over analysis of variance technique. Analysis of covariance is useful for experimental psychologists where for various reasons it is impossible or difficult to equate experimental and control groups at the start a situation which often obtains in actual situations or in experiments. Though analysis of covariance one is able to adjust in final or terminal scores which may allow for differences in some initial variable.

Definition of covariance

The term covariance has been defined, "Statistically the covariance may be defined as the function of two correlated factors and their analysis into corresponding parts".

Practically analysis of covariance is technique to adjust the initial schools to final scores so that net effect can be analysed. Analysis of variance technique is to analyse and test the significance difference among final scores or initials course. The final scores difference may be attributable to treatment effects, while it may be caused due to initial effect. The analysis of covariance technique adjusts the initial performance to final scores to obtain the net effects of the treatments.

Meaning and functions of analysis of variance

In the experiments of psychology and education, the final scores are used to test the effectiveness of treatments. The analysis of variance technique is used for statistical analysis. The initial performance is not considered and groups are not equated. The initial performance is included in the final scores. The difference may be due to initial performance, not due to treatments effect. Thus, the findings through analysis of variance may not be valid. The initial performance should be adjusted to final scores for obtaining the net effect of the treatments. The initial and final scores for correlated to have covariance. Thus analysis of covariance technique has to adjust the final scores.

$$C.V = \frac{\sigma}{\bar{X}} \times 100$$

where, σ = standard deviation

$\bar{X}$ = Mean Value

MANOVA

What is MANOVA?

MANOVA is a member of the General Linear Model a family of statistical procedures that are often used to quantify the strength between variables (Zientek & Thompson).

Many of the procedures in the General Linear Model are hierarchically organized, i.e., more specific procedures are often special cases of general procedures. MANOVA, specifically, is an analysis of variance (ANOVA) that has two or more dependent variables.

In an ANOVA the independent variable is a nominal variable that has two or more values, and the dependent variable is intervally or ratio scaled. The null hypothesis is that the means core on the dependent variable will be statistically equal for every group. As with any null hypothesis statistical significance testing procedure, an observed statistic is calculated and then compared to a sampling distribution. If the observed statistic is found to be a more extreme value in the sampling distribution than the critical value (as shown in Figure 1), then the null hypothesis will be rejected; otherwise, the null hypothesis is retained.

Then the null hypothesis is rejected (as would be thecase for vectors A, C, and D in Figure 2). However, if a vector does not extend into the rejection region (e.g., vector in Figure2) then the null hypothesis is retained.

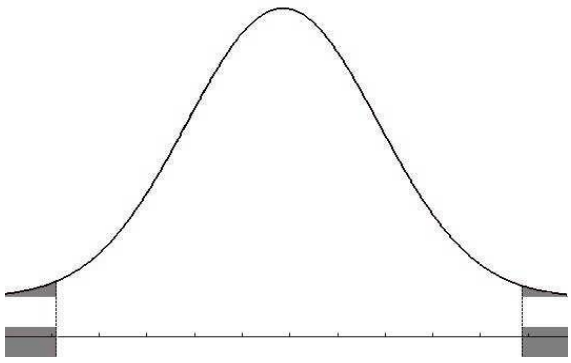
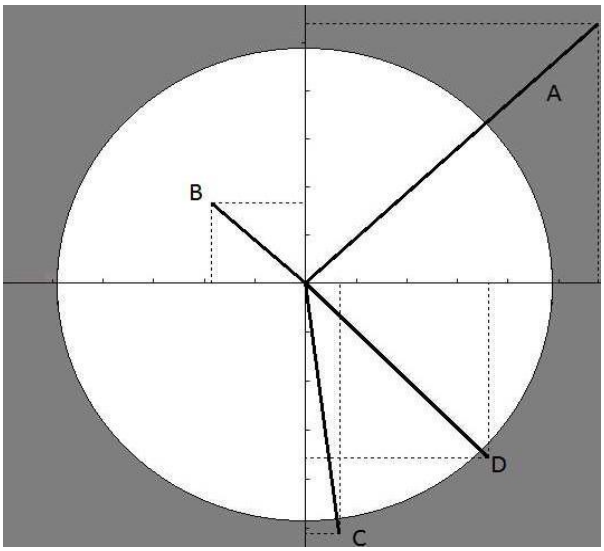


Figure1. Example of the logic of univariate hypothesis testing.

The shaded area is the rejection region. If the test statistics is in the rejection region (shown both on the histogram and on the number line below), then the null hypothesis is rejected.



Why Use MANOVA?

Figure 2 represents an ANOVA with two perfectly uncorrelated dependent variables. However, if dependent variables are correlated, then the MANOVA is better represented in Figure 3.

Although the examples in Figures2 and 3represent MANOVAs with two dependent variables, an extension to three dependent variables can be imagined without difficulty. For three perfectly uncorrelated dependent variables, the graph would be three dimensional, with the unshaded region being a reduces the likelihood of Type I error.

The probability of Type I error at least once in the series of ANOVAs (called experiment-wise error) can be as high as $1 - (1 - .05)^k$, where k is the number of ANOVAs conducted. Therefore, if are searcher chooses the traditional α value of .05 for two ANOVAs, then the experiment-wise Type I error can be as high as .0975—not .05—even though the α for each ANOVA is .05. However, the Type I error for a MANOVA on the Perfect sphere. As the variables became more correlated, the axes would become more oblique, and the sphere would become more distorted and resemble something like a football. If two of the three dependent variables were perfectly correlated (i.e., $r = + 1$), then the graph would collapse into a two-dimensional graph like in Figure3. A MANOVA with four or more dependent variables requires more than three dimensions and axes—something that most people have difficulty imagining visually, but which a computer can easily handle mathematically.

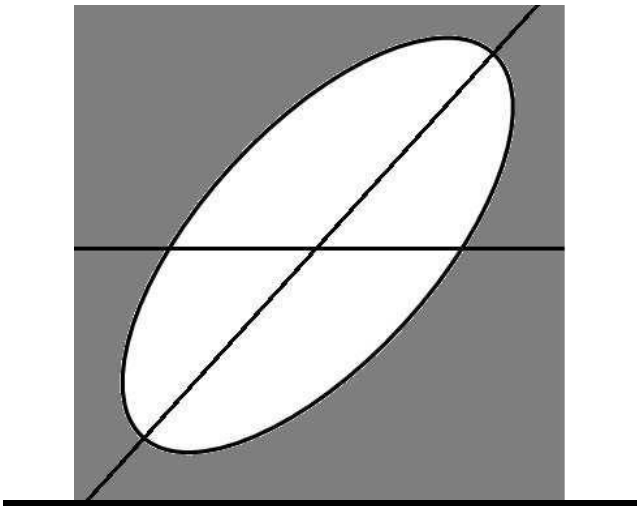


Figure3. Example of the logic of multivariate analysis of variance hypothesis testing for moderately correlated variables.

The shaded area is the rejection region.

Examining Combinations of Variables

ANOVA and MANOVA also differ in that they investigate completely different empirical questions. Zientek and Thompson (2009, p.345) explained that, *"two ANOVAs actually test the differences of the means onthe observed or measured variables . . . whereas the MANOVA actually tests the differences of the mean of the DDA function scores"* of the groups. In other words, MANOVA tests the differences between underlying un observed latent variables (derived from the variables in the dataset), while ANOVA only tests differences among groups on an observed variable. MANOVA is therefore often more useful to social scientists than ANOVA because most topics they research are latent constructs that are not directly observable, such as beliefs and attitudes. Therefore, MANOVA is a statistical procedure that is more inaccordance than ANOVA with behavioral scientists' beliefs about the topics they study.

Post Hoc Procedures

Post hoc procedures are often necessary after the null hypothesis is rejected in an ANOVA. This is becausethe null hypotheses for these procedures often do not provide researchers with all the information that they desire. For example, if the null hypothesis is rejected in an ANOVA with three or more groups, then there searcher knows that at least one group mean statistically differs from at least one other group mean. However, most

researchers will be interested in learning which mean(s) differ from which other group mean(s).

ANOVA, MANOVA has post hoc procedures to determine why the null hypothesis was rejected. For MANOVA this is usually a DDA, which is a statistical procedure which creates a set of perfectly uncorrelated linear equations that together model the differences among groups in the MANOVA (Fish,1988;Stevens,2002). The benefit of having uncorrelated equations from a DDA is that each function will provide unique information about the differences among groups, and the information can be combined in an additive way for easy interpretation.

. This is because ANOVA and MANOVA were developed to answer completely different empirical questions .Indeed, Tonidandel and LeBreton (2013) explained that, *multivariate theories yield multivariate hypotheses which necessitate the use of multivariate statistics and multivariate interpretations of those statistics. By invoking univariate ANOVAs as follow-up tests to a significant MANOVA, researchers are essentially ignoring the multivariate nature of their theory and data*.

Moreover, Fish (1988) and Huberty and Morris(1989) showed that the same data can produce different results when analyzed using a MANOVA or a series of ANOVAs—a situation that could potentially be misleading to researchers who follow MANOVA with a series of post hoc ANOVAs.

CORRELATION

If two variables, say x and y vary or move together in the same or in the opposite directions they are said to be correlated or associated. Thus, correlation refers to the relationship between the variables. Generally, we find the relationship in certain types of variables.

Scatter Diagram

When different sets of data are plotted on a graph, we obtain **scatter diagrams**. A scatter diagram gives two very useful types of information. Firstly,we can observe patterns between variables that indicate whether the variables are related. Secondly, if the variables are related we can get an idea of the type of relationship that exists. The scatter diagram may exhibit different types of relationships.

Y

Y

$r < 0$

If X and Y variables move in the same direction (i.e., either both of them increase or both decrease) the relationship between them is said to be **positivecorrelation.**

On the other hand, if X and Y variables move in the opposite directions (i.e., if variable X increases and variable Y decreases or vice-versa) the relationship between them is said to be **negative correlation.**

If Y is unaffected by any change in X variable, then the relationship between them is said to be **un-correlated.**

If the amount of variations in variable X bears a constant ratio to thecorresponding amount of variations in Y, then the relationship between them issaid to be **linear-correlation,** otherwise it is **non-linear or curvilinear correlation.** Since measuring non-linear correlation for data analysis is far more complicated, we therefore, generally make an assumption that the association between two variables is of the linear type.

If the relationship is confined to two variables only, it is called **simple correlation**.

Karl Pearson's Correlation Coefficient

Karl Pearson's coefficient of correlation (r) is one of the mathematical methodsof measuring the degree of correlation between any two variables X and Y is given as:

$$r = \frac{\sum(X-\bar{X})(Y-\bar{Y})/n}{\sigma x \sigma y}$$

The simplified formulae (which are algebraic equivalent to the above formula)are:

1. $\mathbf{r} = \frac{\sum \mathbf{xy}}{\sqrt{\sum \mathbf{x^2}}\sqrt{\sum \mathbf{y^2}}}$ Where, $x = x - \bar{\mathbf{x}}$, $y = y - \bar{\mathbf{y}}$

Note: This formula is used when $\bar{x}$ and $\bar{y}$ are integers

2. $$r = \frac{N\sum xy - \sum x \sum y}{\sqrt{[N\sum x^2 - \frac{(\sum x)^2}{N}][N\sum y^2 - \frac{(\sum y)^2}{N}]}}$$

Before we proceed to take up an illustration for measuring the degree of correlation, it is worthwhile to note some of the following important points.

i) 'r' is a dimensionless number whose numerical value lies between +1 to –1. Thevalue +1 represents a perfect positive correlation, while the value –1 represents a perfect negative correlation. The value 0 (zero) represents lack of correlation. Figure 10.1 shows a number of scatter plots with corresponding values for correlation coefficient.

ii) The coefficient of correlation is a pure number and is independent of the units of measurement of the variables.

iii) The correlation coefficient is independent of any change in the origin and scaleof X and Y values.

Example 1: Taking as an illustration, the data of advertisement expenditure (X) and sales (Y) of a company for 10 years shown in the following table, we proceed to determinethe correlation coefficient between these variables.

Solution: Calculation of Correlation Coefficient

Advertisement expenditure Rs. (X)	**Sales Rs. (Y)**	**XY**	**X^2**	**Y^2**
	60	360.0	36	3600
	55	275.0	25	3025
	50	250.0	25	2500
	40	160.0	16	1600
	35	105.0	9	1225
	30	60.0	4	900
	20	40.0	4	400

1	15	22.5	2.25	225
1	11	11.0	1	121
0	10	5.0	0.25	100
∑X = 3	∑Y = 326	∑XY = 1288.5	$\sum X^2$=122.50	$\sum Y^2$=13696

We know that,

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\sum X^2 - \frac{(\sum X)^2}{N}}\sqrt{\sum Y^2 - \frac{(\sum Y)^2}{N}}}$$

$$r = \frac{\frac{1288.5-(30)(326)}{10}}{\sqrt{122.5-\frac{(30)^2}{10}}\sqrt{13696-\frac{(326)^2}{10}}}$$

$$r = \frac{310.5}{315.7}$$

$$r = 0.9835$$

The calculated coefficient of correlation r = 0.9835 shows that there is a high degree of association between the sales and advertisement expenditure. For thisparticular problem, it indicates that an increase in advertisement expenditure is likely to yield higher sales. If the results of the calculation show a strong correlation for the data, either negative or positive, then the line of best fit to that data will be useful for forecasting.

Testing for the Significance of the Correlation Coefficient

Once the coefficient of correlation has been obtained from sample data one is normally interested in asking the questions: Is there an association between thetwo variables? Or with what confidence can we make a statement about the association between the two variables? Such questions are best answered statistically by using the following procedure.

Testing of the null hypothesis (testing hypothesis and t-test are discussed in detail in Units 15 and 16 of this course) that population correlation coefficientequals zero (variables in the population are uncorrelated) versus alternative hypothesis that it does not equal zero, is carried out by using t-statistic formula.

$t = r\sqrt{\frac{n-2}{1-r^2}}$ Where, r is the correlation coefficient from sample

Referring to the table of t-distribution for (n–2) degree of freedom, we can findthe critical value for t at any desired level of significance (5% level of significance is commonly used). If the calculated value of t (as obtained by the above formula) is less than or equal to the table value of t, we accept the null hypothesis (H_0), meaning that the correlation between the two variables is not significantly different from zero.

The following example will illustrate the use of this test.

Illustration 1

Suppose, a random sample of 12 pairs of observations from a normal populationgives a correlation coefficient of 0.55. Is it likely that the two variables in the population are uncorrelated?

Solution: Let us take the null hypothesis (H_0) that the variables in thepopulation are uncorrelated.

Applying t-test,

$$t = r\sqrt{\frac{n-2}{1-r^2}} = 0.55\sqrt{\frac{12-2}{1-0.55^2}}$$

$$= 0.55 \times 3.786$$

$$= 2.082$$

From the t-distribution (refer the table given at the end of this unit) with 10 degrees of freedom for a 5% level of significance, we see that the table valueof $t_{0.05/2,\ (10-2)} = 2.228$. The calculated value of t is less than the table value of t. Therefore, we can conclude that this r of 0.55 for n = 12 is not significantly different from zero. Hence our hypothesis (H_0) holds true, i.e., the sample variables in the population are uncorrelated.

Let us take another illustration to test the significance.

Illustration 2

A random sample of 100 pairs of observations from a normal population gives acorrelation coefficient of 0.55. Do you accept that the variables in the population are correlated?

Solution: Let us take the hypothesis that the variables in the population areuncorrelated. Apply the t-test:

$$t = r\sqrt{\frac{n-2}{1-r^2}} = 0.55\sqrt{\frac{100-2}{1-0.55^2}}$$

$$= 6.52$$

Referring to the table of the t-distribution for n–2 = 98 degrees of freedom, the critical value for t at a 5% level of significance $[t_{0.05/2,\ (10-2)}] = 1.99$ (approximately). Since the calculated value of t (6.52)

exceeds the table value of t (1.99), we can conclude that there is statistically significant associationbetween the variables. Hence, our hypothesis does not hold true.

SIMPLE LINEAR REGRESSION

When we identify the fact that the correlation exists between two variables, weshall develop an estimating equation, known as regression equation or estimatingline, i.e., a methodological formula, which helps us to estimate or predict the unknown value of one variable from known value of another variable. In the words of Ya-Lun-Chou, "regression analysis attempts to establish the nature of the relationship between variables, that is, to study the functional relationship between the variables and thereby provide a mechanism for prediction, or forecasting. Thus, the statistical method which is used for prediction is called regression analysis. And, when the relationship between the variables is linear, the technique is called **simple linear regression**.

Hence, the technique of regression goes one step further from correlation andis about relationships that have been true in the past as a guide to what may happen in the future. To do this, we need the regression equation and the correlation coefficient. The latter is used to determine that the variables are really moving together.

The objective of simple linear regression is to represent the relationship betweentwo variables with a model of the form shown below:

$$Y_i = \beta_0 + \beta_1 X_i + e_i$$

Y_i = value of the dependent variable,

β_0 = Y-intercept,

β_{1_1} = slope of the regression line,

X_i = value of the independent variable,

e_i = error term (i.e., the difference between the actual Y value and the valueof Y predicted by the model.

ESTIMATING THE LINEAR REGRESSION

If we consider the two variables (X variable and Y variable), we shall havetwo regression lines. They are:

i) Regression of Y on X
ii) Regression of X on Y.

The first regression line (Y on X) estimates value of Y for given value of X. The second regression line (X on Y) estimates the value of X for given valueof Y. These two regression lines will coincide, if correlation between the variable is either perfect positive or perfect negative.

The best regression line is the one thatminimizes the sum of squared vertical distances between the observed (X, Y) points and the regression line, i.e., $\sum(Y - \hat{Y})^2$ is the least value and the sum of the positive

and negative deviations is zero, i.e., $\sum(Y - \hat{Y}) = 0$. It is important to note that the distance between (X, Y) points and the regression line is calledthe 'error'.

Regression Equation of Y on X

$\hat{Y} = a + bx$

where,

$\hat{Y}$ is the computed values of Y (dependent variable) from the relationship for a given X, 'a' and 'b' are constants (fixed values), 'a' determines the level of the fitted line at Y-axis (Y-intercept), 'b' determines the slope of the regression line, X represents a given value of independent variable.

The alternative simplified expression for the above equation is:

$$\hat{Y} - \bar{Y} = byx\ (X - \bar{X})$$

$$byx = r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sum X^2 - \frac{(\sum X)^2}{N}}$$

Regression equation of X on Y

$$\hat{X} = a + by$$

Alternative simplified expression is :

$$\hat{X} - \bar{X} = bxy\ (Y - \bar{Y})$$

$$bxy = r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sum Y^2 - \frac{(\sum Y)^2}{N}}$$

It is worthwhile to note that the estimated simple regression line always passes through $\bar{X}$ and $\bar{Y}$. The following illustrationshows how the estimated regression equations are obtained, and hence how they are used to estimate the value of Y for given X value.

Illustration

From the following 12 months sample data of a company, estimate the regression lines and also estimate the value of sales when the company decidedto spend Rs. 2,50,000 on advertising during the next quarter. (Rs. in lakh)

Advertisement Expenditure	0.8	1.0	1.6	2.0	2.2	2.6	3.0	3.0	4.0	4.0	4.0	4.6
Sales	22	28	22	26	34	18	30	38	30	40	50	46

Solution:

Table 10.4: Calculations for Least Square Estimates of a Company. (Rs. in lakh)

Advertising (X)	Sales (Y)	X^2	Y^2	XY
0.8	22	0.64	484	17.6
1.0	28	1.00	784	28.0
1.6	22	2.56	484	35.2
2.0	26	4.00	676	52.0
2.2	34	4.84	1156	74.8
2.6	18	6.76	324	46.8
3.0	30	9.00	900	90.0
3.0	38	9.00	1,444	114.0
4.0	30	16.00	900	120.0
4.0	40	16.00	1600	160.0
4.0	50	16.00	2,500	200.0
4.6	46	21.16	2,116	211.6
$\sum X=32.8$	$\sum Y=384$	$\sum X^2=106.96$	$\sum Y^2=13368$	$\sum XY=1,150.0$

Now we establish the best regression line (estimated by the least square method).

We know the regression equation of Y on X is:

$$\hat{Y} - \bar{Y} = byx\ (X - \bar{X})$$

$$\bar{Y} = \frac{384}{12} = 32$$

$$\bar{X} = \frac{32.8}{12} = 2.733$$

$$\hat{Y} - \bar{Y} = byx\ (X - \bar{X})$$

$$byx = r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sum X^2 - \frac{(\sum X)^2}{N}}$$

$$= \frac{1.150 - \frac{(32.8)(384)}{12}}{106.96 - \frac{(32.8)^2}{12}} = 5.801$$

$$\hat{Y} - 32 = 5.801\ (X - 2.733)$$

$$\hat{Y} = 5.801X - 15.854 + 32$$

= 5.801X + 16.146

It is worthwhile to note that the relationship displayed by the scatter diagrammay not be the same if the estimating equation is extended beyond the data points (values) considered in computing the regression equation.

Using Regression for Prediction

Regression, a statistical technique, is used for predictive purposes in applicationsranging from predicting demand sales to predicting production and output levels. In the above illustration 6, we obtained the regression model of the company for predicting sales which is:

$\hat{Y} = 16.146 + 5.801X$

where $\hat{Y}$ = estimated sales for given value of X, and

X = level of advertising expenditure.

To find $\hat{Y}$, the estimate of expected sales,

We substitute t he specified advertising level into the regression model. For example, if we know that the company's marketing department has decided to spend Rs. 2,50,000/- (X = 2.5)on advertisement during the next quarter, the most likely estimate of sales ($\hat{Y}$)

is :$\hat{Y} = 16.1436 + 5.801(2.5) = 30.6455$

= Rs. 30,64,850

Thus, an advertising expenditure of Rs. 2.5 lakh is estimated to generate salesfor the company to the tune of Rs. 30,64,850.

Similarly, we can also establish the best regression line of X on Y as follows:Regression Equation of X on Y

$$\hat{X} - \bar{X} = bxy\,(Y - \bar{Y})$$

$$bxy = r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sum Y^2 - \frac{(\sum Y)^2}{N}}$$

$$= \frac{1.150 - \frac{(32.8)(384)}{12}}{147456 - \frac{(384)^2}{12}} = 0.093$$

$$\hat{X} - 2.733 = 0.093Y - 2.976$$

$$\hat{X} - 2.733 = 0.093(Y - 32)$$

$$\hat{X} = 0.093Y - 0.243$$

The following points about the regression should be noted:

1) The geometric mean of the two regression coefficients (byx and bxy) givescoefficient of correlation.

That is, $r = \pm\sqrt{(bxy)\ (byx)}$

Consider the values of regression coefficients from the previous illustration toknow the degree of correlation between advertising expenditure and sales.

$r = \pm \sqrt{0.093 \times 5.801} = 0.734$

2) Both the regression coefficients will always have the same sign (+ or –).

3) Coefficient of correlation will have the same sign as that of regression coefficients. If both are positive, then r is positive. In case both are negative, ris also negative. For example, bxy = –1.3 and byx = –0.65, then r is:

   $\pm \sqrt{-1.3x - 0.65}$ = -0.919 butnot +0.919

4) Regression coefficients are independent of change of origin, but not of scale.

Standard Error of Estimate

Once the line of best fit is drawn, the next process in the study of regression analysis is how to measure the reliability of the estimated regression equation. Statisticians have developed a technique to measure the reliability of the estimated regression equation called "Standard Error of Estimate (S_e)." This S_e is similar to the standard deviation which we discussed in Unit-9 of this course.We will recall that the standard deviation is used to measure the variability of adistribution about its mean. Similarly, **the standard error of estimate measures the variability, or spread, of the observed values around the regression line.** We would say that both are measures of variability. The larger the value of S_e, the greater the spread of data points around the regression line. If S_e is zero, then all data points would lie exactly on the regression line. In that case the estimated equation is said to be a perfect estimator. The formula to measure S_e is expressed as:

$$S_e = \sqrt{\frac{\sum(Y - \hat{Y})^2}{n}}$$

Where, S_e is standard error of estimate, Y is values of the dependent variable, $\hat{Y}$ is estimated values from the estimating equation that corresponds to each Y value, and n is the number of observations (sample size).

Let us take up an illustration to calculate S_e in a given situation.

Illustration

Consider the following data relating to the relationships between expenditure onresearch and development, and annual profits of a firm during 1998–2004.

Years:	1998	1999	2000	2001	2002	2003	2004
R&D (Rs. lakh):	2.5	3.0	4.2	3.0	5.0	7.8	6.5

Profit (Rs. lakh):	23	26	32	30	38	46	44

The estimated regression equation in this situation is found to be

$\hat{Y} = 14.44 + 4.31x$. Calculate the standard error of estimate.

Note: Before proceeding to compute S_e you may calculate the regression equation of Y on X on your own to ensure whether the given equation for theabove data is correct or not.

Solution: To calculate S_e for this problem, we must first obtain the value of

$\sum (Y - \hat{Y})^2$. We have done this in Table 10.5.

Table 10.5: Calculation of $\sum(Y- \hat{Y})^2$ **(Rs. in lakh)**

Years	**Expendi-ture on R&DX**	**Profit** **Y**	**$\hat{y}$ Estimating values (14.44 + 4.31X)**	**Individualerro** $(y - \hat{y})$	$(y - \hat{y})^2$
1998	2.5	23	14.44 + 4.31(2.5) = 25.21	–2.21	4.88
1999	3.0	26	14.44 + 4.31(3) = 27.37	–1.37	1.88
2000	4.2	32	14.44 + 4.31(4.2) = 32.54	–0.54	0.29
2001	3.0	30	14.44 + 4.31(3) = 27.37	2.63	6.92
2002	5.0	38	14.44 + 4.31(5) = 35.99	2.01	4.04
2003	7.8	46	14.44 + 4.31(7.8) = 48.06	–2.06	4.24
2004	6.5	44	14.44 + 4.31(6.5) = 42.46	1.54	2.37

$\sum (Y - \hat{Y})^2 = 24.62$

We can, now, find the standard error of estimate as follows.

$$S_e = \sqrt{\frac{\sum(Y-\hat{Y})^2}{n}}$$

$$= \sqrt{\frac{24.62}{7}}$$

$$= 1.875$$

Standard error of estimate of annual profit is Rs. 1.875 lakh.

Factor Analysis

Factor analysis is a general label applied to a set of statistical procedures designed to identify the basis dimension or factors that underline the relationship among a large number of variable.

Harman (1960) defines the procedure of factor analysis follows: "The principal concern of factor analysis is the resolution of a set of variables linear by in terms of a smaller number of categories or 'factors'. This resolution can be accomplished by the analysis of the correlation among the variables. A satisfactory solution will yield factors, which convey all the essential information of the original set of variables. Thus, the chief aim is to attain scientific parsimony or economy of description".

Guilford (1956) outlines the different steps in factor analytic study in the following term:

a) Select an appropriate domain for investigation.
b) Develop a hypothesis concerning the factor.
c) Select or construct suitable tests.
d) Select a suitable population.
e) Obtain a sample of adequate size.
f) Extract factors with commonalities in the diagonal cells of the correlation matrix.
g) Rotate the reference axes and
h) Interpret the rotated factors.

The present investigation made use of principal-axes method, as it is one of the satisfactory procedures of factor analysis. Fruchter (1954) explains the superiority of this method in the following terms.

The principal-axes method of factoring the correlation matrix is of interest for several reasons. Each factor extracts the maximum amount of variance, (i.e., the sum of squares of factors loadings is maximized on each factor) and gives the smallest possible residuals. The correlation matrix is condensed into the smallest number of orthogonal factors by this method. The method also has an advantage of giving mathematically unique (least square) solution for a given table of correlations. Harman (1960) points out that this method needs larger number of computations. But this difficulty is overcome with the help of high-speed computers.

Test of Significance of Extracted Factors

The test of significance is applied to the obtained factors and only those, which are significant, are retained for final interpretation.

Interpretations of factors: Principles and Criteria

a) Locate the group of variables in which the factor has the highest loadings.
b) Locate the group of variables in which the factor has the lowest loadings.
c) Examine the possibility of different factors becoming independent and
d) Treat factor loading whose absolute values are greater than 0.30 as significant and neglect others as not significant.

The degree of presence of each variable is a factor determined as follows:

a) Factor loading above 0.900 - extremely high presence of the variable
b) Factor loading above 0.700 to 0.900 – high presence of variable.
c) Factor loading above 0.550 to 0.700 – considerable presences.
d) Factor loading above 0.450 to 0.550 - variable somewhat presence.
e) Factor loading above 0.300 to 0.450 – variable presence but low, and
f) Factor loading below 0.300 – variable not presence.

Non - parametric test

1) Characteristics common to most non-parametric techniques:

- Fewer assumptions regarding the population distribution
- Sample sizes are often less stringent
- Measurement level may be nominal or ordinal
- Independence of randomly selected observations, except when paired
- Primary focus is on the rank ordering or frequencies of data
- Hypotheses are posed regarding ranks, medians, or frequencies of data

2) Conditions when it is appropriate to use a non-parametric Test:

- Nominal or ordinal level of measurement
- Small sample sizes
- Non-normal distribution of dependent variable
- Unequal variances across groups
- Data with not able outliers

3) disadvantages of Non-parametric Tests:

- Methods quick and easy to apply
- Theory fairly simple

- Assumptions for tests easily satisfied
- Accommodate un usual or irregular sample distributions
- Basic data need not be actual measurements
- Use with small sample sizes
- Inherently robust due to lack of stringent assumptions
- Process of collecting data may conserve time and funds
- Often offer a selection of inter change able methods
- Can be used with samples made up of observations from several different populations

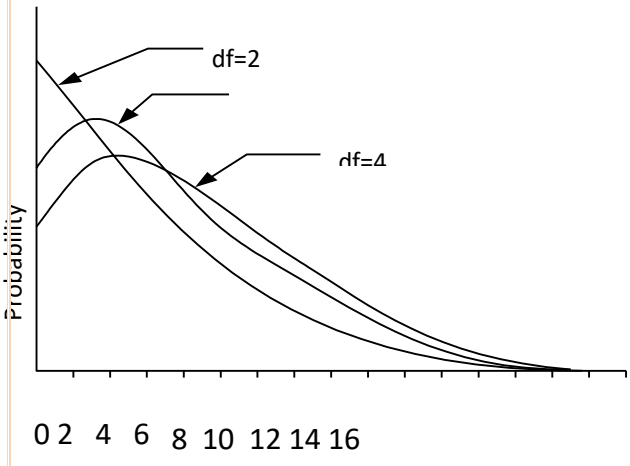
CHI-SQUARE DISTRIBUTION

Chi-square tests enable us to test whether more than two population proportions are equal. Also, if we classify a consumer population into several categories (say high/medium/low income groups and strongly prefer/moderately prefer / indifferent/ do not prefer a product) with respect to two attributes (say consumer income and consumer product preference), we can then use chi-square test to test whether two attributes are independent of each other.

CHI-SQUARE DISTRIBUTION

The chi-square distribution is a probability distribution. Under some proper conditions the chi-square distribution can be used as a sampling distribution of chi-square. The chi-square distribution is known by its only parameter–number of degrees of freedom. The meaning of degrees of freedom is the same as the one you have used in student -distribution. Figure shows the three different chi-square distributions for three different degrees of freedom.

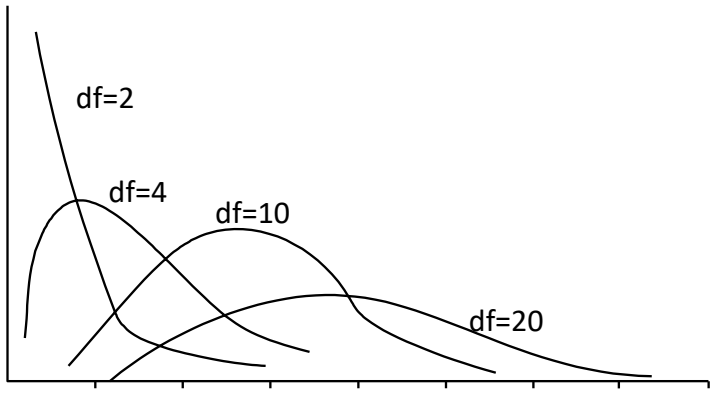
Chi-SquareTest



Chi-Square Sampling Distributions for df=2,3 and 4

It is to be noted that as the degrees of freedom are very small, the chi-square distribution is heavily skewed to the right. As the number of degrees of freedom increases, the curve

rapidly approaches symmetric distribution. You may be aware that when the distribution is symmetric, it can be approximated by normal distribution. Therefore, when the degrees of free do increase sufficiently, the chi-square distribution approximates the normal distribution. This is illustrated *in Figure*.



Chi-Square Sampling Distributions for df = 2,4,10, and 20

Like student t-distribution there is a separate chi-square distribution for each number of degrees of freedom. Table-1 gives the most commonly used tail areas that are used in tests of hypothesis using chi-square distribution.

Region	Consumer preference		Total
	Brand A	Brand B	
South North	64	16	80
East West	24	6	30
Central	23	7	30
North-east	56	44	100
	12	18	30
	12	18	30
Total	191	109	300

llustration2

A sales man has 3 products to sell and there is a 40% chance of selling each product when he meets a customer. The following is the frequency distribution of sales.

No. of products sold per sale:	0	1	2	3
Frequency of the number of sales:	10	40	60	20

At the 0.05 level of significance, do these sales of products follow a binomial distribution?

Solution: In this illustration, the sales process is approximated by a binomial distribution with P=0.40 (with a 40% chance of selling each product).

Ho: The sales of three products has a binomial distribution with P = 0.40.

H_1: The sales of three products do not have a binomial distribution with P = 0.40.

Before we proceed further we must calculate the expected frequencies inorder to determine whether the discrepancies between the observed frequencies and the expected frequencies (based on binomial distribution) should be a scribed to chance. We began determining the binomial probability in each situation

of sales (0,1,2,3 products sold per sale). For three products, we would find the probabilities of success by consulting the binomial probabilities Appendix Table-

1. By looking at the column labeled as n=3 and p=0.40 we obtained the following figures of binomial probabilities of the sales.

No. of products sold per sale(r)	Binomial probabilities of the sales
0	0.216
1	0.432
2	0.288
3	0.064
	1.000

We now calculate the expected frequency of sales for each situation. There are 130 customers visited by the sales man. We multiply each probability by 130 (no. of customers visited) to arrive at there spective expected frequency. For example, 0.216×130 = 28.08.

The following table shows the observed frequencies and the expected frequencies.

No. of products sold per sale	Observed frequency	Binomial probability	Number of customers visited	Expected frequency
(1) (4)	(2)	(3)	(4)	(5)=(3)×
0	10	0.216	130	28.08
1	40	0.432	130	56.16
2	60	0.288	130	37.44
3	20	0.064	130	8.32
Total	130			

Now we use the chi-square test to examine the significance of differences between observed frequencies and expected frequencies. The formula for calculating chi-square

The following table gives the calculation of chi-square.

Observed frequencies(O_i)	Expected frequencies(E_i)	(O_i–E_i)	$(O–E)^2$ i i	$(O –E)^2/E$ i i i
10	28.08	–18.08	326.89	11.64
40	56.16	–16.16	261.15	4.65
60	37.44	22.56	508.95	13.59
20	8.32	11.68	136.42	16.40
130	130			χ^2= 46.28

In order to draw in frequencies about this calculated value of χ^2 we are required to compare this with table value of χ^2. For this we need: (i)degrees of freedom (n-1), and (ii) level of significance. In the problem we are given that the level of significance is 0.05. The number of expected situations is 4. That is (0,1,2,3 products sold per sale) n=4. Therefore, the degrees of freedom will be 3 (i.e.,n-1=4–1=3). The table value from Appendix Table-4 is 7.815 at 3 degrees of free domand 0.05 level of significance. Since the calculated value (χ^2=46.28) is greater than the table value (7.815), we reject the null hypothesis and accept the alternative hypothesis. We conclude that the observed frequencies do not follow the binomial distribution.

Let us take another illustration which relates other normal distribution

CONDITIONS FOR APPLYING CHI-SQUARE TEST

To validate the chi-square test, the data set available, needs to fulfill certain conditions. Sometimes these conditions are also called precautions about using the chi-square test. Therefore, whenever you use the chi-square test the following conditions must be satisfied:

a) **Random Sample**: In chi-square test the data set used is assumed to be a random sample that represents the population. As with all significance tests, if you have a random sample data that represents population data, then any differences in the table values and the calculated values are real and therefore significant. On the other hand, if you have a non-random sample data, significance cannot be established, though the tests are nonetheless sometimes utilized as crude “rules of thumb” any way. For example, we reject the null hypothesis, if the difference between observed and expected frequencies is too large. But if the chi-square value is zero, we should be careful in interpreting that absolutely no difference exists between observed and expected frequencies. Then we should verify the quality of data collected whether the sample data represents the population or not.

b) **Large Sample Size**: To use the chi-square test you must have a large sample size that is enough to guarantee the test, to test the similarity between the theoretical distribution and the chi-square statistic. Applying chi-square test to

small samples exposes their searcher to an unacceptable rate of type-II errors. However, there is no accepted cut off sample size. Many researchers set the minimum sample size at 50. Remember that chi-square test statistic must be calculated on actual count data (nominal, ordinal or interval data) and not substituting percentages which would have the effect of projecting the sample size as100.

c) **Adequate Cell Sizes**: You have seen above that small sample size leads to type-II error. That is, when the expected cell frequencies are too small, the value of chi-square will be overestimated. This in turn will result in too many rejections of the null hypothesis. To avoid making in correct inferences from chi-square tests we follow a general rule that the expected frequency in any cell should be a minimumof5.

d) **Independence**: The sample observations must be independent.

e) **Final values**: Observations must be grouped in categories.

Since the expected frequencies (cell values) in the third row are less than 5 we pool the third row with the second row of both observed frequencies and expected frequencies. The revised observed frequency and expected frequency tables are given below.

Degree of acceptance			Region		
	South	North	East	West	Total
Strong	30	25	20	30	105
Moderate and poor	20	25	20	20	85
Total	50	50	40	50	190

Degree of acceptance			Region		
	South	North	East	West	Total
Strong	27.63	27.63	22.11	27.63	105
Moderate and poor	22.37	22.37	17.89	22.37	85

Total	50

MANN WHITNEY 'U' TEST

The Mann-Whitney (Wilcoxon) rank-sum test is a non-parametric analog of the two-sample *t* test for independent samples. The *Mann-Whitney U test* is a non-parametric test that can be used to analyse data from a two-group independent groups design when measurement is at least ordinal. It analyses the *degree of separation* (or the amount of overlap) between the Experimental (E) and Control(C) groups.

The *null hypothesis* assumes that the two sets of scores (E and C) are samples from the same population; and

therefore, because sampling was random, the two sets of scores *do not differ systematically* from each other.

The *alternative hypothesis*, on the other hand, states that the two sets of scores *do* differ systematically. If the alternative is directional, or one-tailed, it further specifies the direction of the difference (i.e.,Group E scores are systematically higher or lower than Group C scores).

The statistic that is calculated is either UorU'.U1=the number of Es less than Cs
U2=the number of Cs less than Es

U=the smaller of the two values calculated above U'=the larger of the two values calculated above

When you perform these tests, your data should consist of a random sample of observations from two different populations. Your goalis to compare either the location parameters (medians) or the scale parameters of the two populations. For example, suppose your data consist of the number of days in the hospital for two groups of patients: those who received a standard surgical procedure and those who received a new, experimental surgical procedure. These patient's area random sample from the population of patients who have received the two types of surgery. Your goalis to decide whether the median hospital stays differ for the two populations.

RELEVANT BACK GROUND INFORMATION ON 'U' TEST

The Mann-Whitney *U* test is employed with ordinal (rank-order) data in a hypothesis testing situation involving a design with two independent samples. If the result of the Mann-Whitney *U* test is significant, it indicates there is a significant difference between the two sample medians, and as a result of the latter the researcher can conclude there is a high likelihood that the samples represent populations with different median values.

Two versions of the test to be described under the label of the Mann-Whitney *U* test were independently developed by Mann and Whitney (1947) and Wilcoxon (1949).

The version to be described here is commonly identified as the Mann-Whitney *U* test, while the version developed by Wilcoxon (1949) is usually referred to as the Wilcoxon-Mann-Whitney test.' Although they employ different equations and different tables, the two versions of the test yield comparable results.

In employing the Mann-Whitney *U* test, one of the following is true with regard to the rank order data that are evaluated:

a) The data are in a rank order format, since it is the only format in which scores are available ; or

b) The data have been transformed in to a rank order format from an interval ratio format, since there searcher has reason

to believe that the normality assumption (as well as, perhaps, the homogeneity of variance assumption) of the t test for two independent samples (which is the parametric analog of the Mann-Whitney U test) is saliently violated.

It should be noted that when a researcher elects to transform a set of interval / ratio data in to ranks, information is sacrificed. This latter fact accounts for the reluctance among some researchers to employ non-parametric tests such as the Mann-Whitney *U* test, even if there is reason to believe that one or more of the assumptions of the t test for two independent samples have been violated.

The Mann-Whitney U test is based on the following assumptions:

a) Each sample has been randomly selected from the population it represents;

b) The two samples are independent of one another;

c) The original variable observed (which is subsequently ranked) is a continuous random variable. In truth, this assumption, which is common to many non-parametric tests, is often not adhered to,in that such tests are often employed with a dependent variable which represents a discrete random variable; and

d) The underlying distributions from which the samples are derived are identical in shape. The shapes of the underlying population distributions, however, do not have to be normal.

Maxwell and Delaney (1990) pointed out the assumption of identically shaped distributions implies equal dispersion of data with in each distribution. Because of this, they note that like the *t* test for two independent samples, the Mann-Whitney *U* test also assumes homogeneity of variance with respect to the underlying population distributions.

Because the latter assumption is not generally acknowledged for the Mann-Whitney *U* test, it is not uncommon for sources to state that violation of the homogeneity of variance assumption justifies use of the Mann-Whitney *U* test in lieu of the *t* test for two independent samples.

It should be pointed out, however, that there is some empirical evidence which suggests that the sampling distribution for the Mann-Whitney *U* test is not as affected by violation of the homogeneity of variance assumption as is the sampling distribution for *t* test for two independent samples. One reason cited by various sources for employing the Mann-Whitney *U* test is that by virtue of ranking interval/ratio data, a researcher will be able to reduce or eliminate the impact of outliers.

STEP BY STEP PROCEDUR

E FOR 'U' TEST FOR SMALL SAMPLE

Step-by-step procedure

Mann Whitney U Test for Small Sample case (not more than 20 items in each set), use U if the data is

a) In the form of ranks or

b) Not normally distributed

c) There is an obvious difference in the variance of the two groups.

STEP1: Rank the data (taking both groups together) giving rank1 to the lowest score, and the highest rank to the highest score.

STEP2: Find the sum of the ranks for the smaller sample

STEP3: Find the sum of the ranks for the larger sample

STEP4: Find U applying the formula given below:

$U = N_1N_2 + [N_1(N_1+1)/2] - \square R_1$ and

$U\square = N_1N_2 + [N_2(N_2+1)/2] - \square R_2$

STEP5: Look up the smaller of U and U' in Table H. There is a significant difference if the observed value is equal to or more than the table value.

STEP6: Translate the results of the test back in the terms of experiment.

Worke

Team A		Team B	
Score	Rank (R_1)	Score	Rank (R_2)
72	13	97	25
67	10	76	16
87	21	83	19
46	2	69	12
58	6	56	5
63	8	68	11
84	20	92	24
53	3	88	22
62	7	74	15
77	17	73	14
82	18	65	9
89	23	54	4
		43	1
	$\sum R1 = 148$		$\sum R2 = 177$

Step1: Rank the ratings from lowest to highest regardless of assessment team.

Step2: Sum the ranks in either group

$\square(R_1)=148$

$\square(R_2)=177$

Step3: Calculate U

$U = N_1N_2 + [N_1(N_1+1)/2] - \square R_1$

$U=(12)(13)+[12(12+1)/2]-148$

$U=156+78-148=86$ and Calculate U'

$U\square = N_1N_2 + [N_2(N_2+1)/2] - \square R_2$

13)+[13(13+1)/2]-177

U□=156+91–175=70

Step4: Determine the significance of U

Decide whether you are making a one-or a two-tailed decision

Compare the smaller value of U to the appropriate critical table value for N_1 and N_2 .If the observed U is smaller than the table value, the result is significant.

Step5: The critical value of U for N_1= 12 and N_2=13, two-tailed □ =0.05, is 41.

Since the smaller obtained value of U (U□=70) is larger than the table value, the null hypothesis is accepted. And we conclude that there is no significant difference in the ratings given by the two assessment teams.

STEP BY STEP PROCEDURE FOR 'U' TEST FOR LARGE SAMPLE

When both sample sizes are greater than about 20, the sampling distribution of U is for practical purposes, normal. Therefore, under these conditions, one can perform a z-test as follows:

The procedure to obtain U is similar as in small sample case (Step1to3). Then the formula for Z is applied as:

$$Z = [U–(N_1N_2)/2]/ \sqrt{(N_1+N_2+1)/12 \; N_1N_2}$$

If we are dealing with a two-tailed test, then the observed z is significant at the 5 percent level if it exceeds 1.96. For one tailed test, 5 percent significance is attained if z exceeds1.64(Check these in table D in Statistics book original).

The ranking procedure can become quite laborious in large samples. Partly for this reason and partly because violation of the assumptions behind parametric statistics become less important for large sample, the Mann Whitney U test tends to be restricted to use with relatively small samples.

COCHARNS Q TEST

This producer computes the non-parametric Cochrans Q test for related categories where the response is binary. Cochrans Q is used for testing k= 2 or more matched sets, where a binary response (e.g. 0 or 1) is recorded from each category within each subject. Cochrans Q test the null hypothesis that the alternative that the proportion is different in at least one of the groups.

Cochrans Q test is an extension of the McNemar test to a situation where there are more than two matched samples. When Cochrans Q test is computed with only k= 2 groups, the results are equivalent to those obtained from the McNemar test (without continuity correction0. Cocharans Q is also considered to be a special case

of the non-parametric Friedman test, which is similar to repeated measures ANOVA and is used to detect differences in multiple matched sets with numeric responses. when the responses are binary, the Friedman test becomes Cochrans Q test.

This procedure also computes two-sided, pair wise multiple comparision tests that allow you to determine which of the individual groups are different if the null hypothesis in Cochrans Q test is rejected. The individual alpha level is adjusted using the Bonferroni method to control the overall experiment-wise error rate.

This procedure is based on the results and formulas given in chapter 26 of Sheskin (2011). We refer you there for additional information about Cocharans Q test.

Cochrans Q Teast Statistic

For binary responses, Yi, j in k matched groups from N subjects, the Cochrans Q test statistic is computed as

Cochran's Q Test Statistic

For Binary response Y_{ij} in k matched groups from N subjects, the Cochran's Q test statistic is computed as

$$Q = \frac{(k-1)[kC-T]^2}{kT-R}$$

where

$$C = \sum_{j=1}^{k}\left(\sum_{i=1}^{N} y_{ij}\right)^2$$

$$T = \sum_{i=1}^{N}\left(\sum_{u=1}^{k} y_{ij}\right)^2$$

$$R = \sum_{i=1}^{N}\left(\sum_{u=1}^{k} y_{ij}\right)^2$$

For "large" samples, the test statistic Q, is distributed as chi-square k-1 degrees of freedom. As I test, only subjects have same response in all categories contribute to the Q statistic.

Sign Test

Among the non-parametric tests, the Sign test is known for its simplicity. It is used for comparing two correlated samples namely, two parallel sets of measurements which are paired off in some way. For comparison, the difference between each pair

of observations is obtained, and then the significance of such differences is tested by the application of the Sign test. The word "Sign" is attached to this test since it uses plus and minus signs instead of quantitative measures as its data. This test makes useful contribution in situations where:

1. We need not consider any assumption regarding the form of distributions such as normality, homosedasticity and the like except when the variable under consideration has a continuous distribution.
2. We need not assume that all the subjects are drawn from the same population.
3. We are assigned the task of comparing two correlated samples, with the aim of testing the null hypothesis which states that the median difference between the pairs is zero.
4. In the correlated samples to be compared we must have two parallel sets of measurement that are paired off In some way(matched with respect to the relevant extraneous variables).
5. The measurement in two parallel sets is neither on an interval nor on a ratio scale; but is available either in the form of ranking or simply showing the direction of differences in the form of positive or negative signs.

Illustration of the use of Sign test (small samples N≤ 25)

A researcher selected 20 students for a study. he divided them into two groups in terms of their intelligence and socio-economic status. These two groups were given training in table manners and cleanliness in two different settings and were then rated for their behavioural performance by a panel of judges. Although the pooled rating scores were not so objective, they were quite enough to provide direction of differences between each pair. For this data, he wanted to know which one of the training set-ups was better. The pooled rating scores of the 10 matched pairs are given in the table.

Pooled rating scores in two groups

Matched pair	Group 1	Group 2	Sign of difference
(a)	(b)	(c)	(d)
1	25	24	+
2	15	16	-
3	12	12	0
4	22	24	-
5	20	18	+
6	19	15	+
7	8	10	-
8	18	14	+
9	24	20	+
10	17	17	0

Method

Step 1: Determine the signs of differences and enter these as + and – signs in column (d). for zero differences, enter 0.

Step 2: Now, count the number of positive, negative and zero differences. Since the zero differences have neither plus nor minus signs, they can be eliminated from N (total number of pairs). As a result, in the present example we have 9 pairs (N=9), out of which 6 are positive and 3 are negative. Use this

formula for determining N (N=No. of matched pairs showing + and – signs).

Step 3: establish a null hypothesis (H_0), i.e. the hypothesis of no difference

H_o = Median of differences between the pairs is zero

In a one-tailed test we can have

H_1 = Median of difference is positive or negative

In a two-tailed test we have

H_2 = Median of difference is significant (positive or negative)

In this case, we must know which one of the training set-ups is better since there are more positive sings. Thus we can establish H_1, that the first training set-up, is better than the second.

Step 4: Determine whether the sample of study is small or large. If N is smaller than 25, it should be taken as a small sample, but if it is larger than 25, it should be regarded as a large sample.

Step 5: The Sign test is based on the idea that under the null hypothesis, we expect the differences between the paired observations to be half-positive and half-negative. Hence the probability associated with the occurrence of a particular number + (p) and – (q) signs can be determined with reference to binomial distribution (the distribution with equal chances), i.e. p = q = 1/2, and N= p + q. for this purpose we have constructed binomial probabilities distribution table of the appendix which gives the probabilities associated with the occurrence under the H_o of values as small as x for N=25.

Let us illustrate the use of probability table

x= No. of fewer signs (whether +ve or –ve). In the present example.

x = No. of fewer signs = No. of negative signs = 3

From the probability table, N= 9, x = 3

The one-tailed probabilities of occurrence under H_o are P = 0.254.

Step 6: Examine the value of p. if it is equal to or lesser than (the given levels of significance, 0.01 at 1% level or 0.05 at 5% level), then reject H_o. In this example, p is 0.254. This value of p is greater than 0.05 at 5% level of significance. Hence, it does not lie in the area of rejection. It leads us to accept H_o in favour of H_1, and we can safely conclude that the first training method was no better than the second.

Note. In the case of a two-tailed test, the values of p read from the table for the given N and x doubled.

Sign test with large samples (N > 25)

If N (the total of the plus and minus signs) is larger than 25, the normal approximation to the binomial distribution or X^2 may be used, preferably with Yates correlation.

How to use normal approximation for binomial distribution

Step 1: Compute the value of z by using the formula

$$Z = \frac{x - \frac{N}{2}}{\frac{1}{2}\sqrt{N}}$$ (z is approximately normally distributed with zero mean and unit variance)

This approximation becomes excellent when correction for continuity (Yates correction) is employed and the formula is modified as

$$Z = \frac{(x \pm 0.5) - \frac{N}{2}}{\frac{1}{2}\sqrt{N}}$$

Step 2. After computing the value of z, table K in the appendix can be referred to. This table provides one-tailed probabilities (value of p) under H_o of various values of z. If this value of $p \leq 0.05$ (at 5% level of significance) or 0.01 (at 1% level of significance), H_o may be rejected at that level of significance. For a two tailed test, the value of p read from the table is doubled for the required analysis. Let us illustrate this with an example.

Example 16.2: Instead of 10 pairs taken for study, as in example 16.1, the researcher now has taken 50 pairs and analysed the obtained data in terms of signs as follows:

Number of positive signs = 37

Number of negative signs = 12

Number of zero signs = 1

Can you conclude from this data that the first training method was better than the second or vice versa.

Solution:

The null hypothesis in this case is that there exists no difference between the medians of the two treatments. Here, the value of N (the total number of positive and negative signs) is

N = 37 + 12 = 49

which is large and hence we have to consider the Sign tests meant for large samples.

Step 1. calculation of the value of z as

$$Z = \frac{(x \pm 0.5) - N/2}{\frac{1}{2}\sqrt{N}}$$

$$= \frac{(37 - 0.5) - 49/2}{\frac{1}{2}\sqrt{49}}$$

$$= \frac{2(36.5 - 24.5)}{7}$$

$$= \frac{24}{7}$$

$$= 3.43$$

Note. Here we have taken x = 37 (Number of positive signs). If we had taken x = 12 (Number of fewer signs), the calculation would have been

$$z = \frac{(12 + 0.5) - 49/2}{\frac{1}{2}\sqrt{49}}$$

$$= \frac{2(12.5 - 24.5)}{7}$$

$$= \frac{-12 \times 2}{7}$$

$$= \frac{-24}{7}$$

$$= -3.43$$

In both the cases, the numerical

value of z will be 3.43.

Step 2: After consulting table K of the appendix, we can read the one-tailed value of p associated with our computed z value of 3.43 as 0.0003

Conclusion

This value of p = 0.0003 is much smaller than the value of Alpha at 5% level, that is 0.05 or at 1% level or 0.01. Thus, we can reject H_o in favour of H_1 can say that the first training method was better than the second.

Evaluation of Sign Test

The sign test proves to be a quite simple and a practicable test in situations where it is difficult to use parametric tests like 't' test for testing the difference between two related samples. It is a distribution free test, does not require too many assumptions and can be used with small as well as large samples. The limitations of Sign test include the following.

1. It makes merely the use of signs the positive or the negative and, in this way, is unable to make use of all the available information regarding the quantitative values of the data. It takes into account only the direction and not the magnitude.
2. It is considered a less powerful test in comparison to t-test for the same data and therefore its use is recommended in cases where it is not safe for practicable to use ‘t’ or other parametric tests.

Non-parametric procedures are criticized for the following reasons:

Unable to estimate the population: Because non-parametric tests do not make strong assumptions about the population, a researcher could not make an inference that the sample statistic is an estimate of the population parameter.

Losing precision: Edgington (1995) asserted that when more precise measurements are available, it is unwise to degrade the precision by transforming the measurements into ranked data.

Low power: Generally speaking, the statistical power of non-parametric tests is lower than that of their parametric counterpart expect on a few occasions (Hodges & Lehmann, 1956; Tanizaki, 1997; Freidlin & Gastwirth, 2000).

False sense of security: It is generally believed that non-parametric tests are immune to parametric assumption violations and the presence of outliers. However, Zimmerman (2000) found that the significance levels of the WMW test and the KW test are substantially biased by unequal variances even when sample sizes in both groups are equal. In some cases the Type error rate can increase up to40-50%, and sometime 300%. The presence of outliers is also detrimental to non-parametric tests. Zimmerman (1994) outliers modify Type II error rate and power of both parametric and non-parametric tests are not as robust as

what many researchers thought.

Lack of software: Currently very few statistical software applications can produce confidence intervals for nonparametric tests. MINITAB and Stata are a few exceptions.

Testing distributions only: Further, non-parametric tests are criticized for being incapable of answering the focused question. For example, the WMW procedure tests whether the two distributions are different in some way but does not show how they differ in mean, variance, or shape. Based on this limitation, Johnson (1995) preferred robust procedures and data transformation to non-parametric tests (Robust procedures and data transformation will be introduced in the next section)

UNIT 3 REPORTING RESEARCH

Structure

3.0 INTRODUCTION

All research activities go waste unless the findings are recorded and reported for reference by persons other than the researcher(s). Therefore, every research activity is concluded by presenting the results including major and minor recommendations. The reporting of a research study depends on the purpose with which it was undertaken. One might have conducted a study as a personal research, as an institutional project, as a project funded by an outside agency, or towards fulfilling the requirement for the award of a degree. While a personal research may be published in any journal (without being recorded as a research report in a booklet form), projects and researches meant for the award of degrees are usually reported in book form, irrespective of whether they are published or not.

Research studies, when reported, follow certain standard patterns, styles and formats for maintaining parity in reporting and for easy grasp by others who are concerned with those studies. The present Unit is devoted to this aspect of educational research: How to write a research report? It starts with the purposes of writing a research report, followed by the components of the report itself (the beginning, the main body, and the end).

3.1 OBJECTIVES

After the completion of this Unit you should be able to

- State the reasons for writing a research report,
- List the three main components of a research report,
- Describe each component of a research report, and
- Write the final report of any research study, viz., its beginning, the main body, and the end of the report.

3.2 WHY AND HOW TO WRITE A RESEARCH REPORT

Once you complete your research project, you are expected to write the report. A research report is a precise presentation of the work done by a researcher while investigating a particular problem. Whether the study is conducted by an individual researcher or by an institution, the findings of the study should be reported for several reasons. The reasons are:

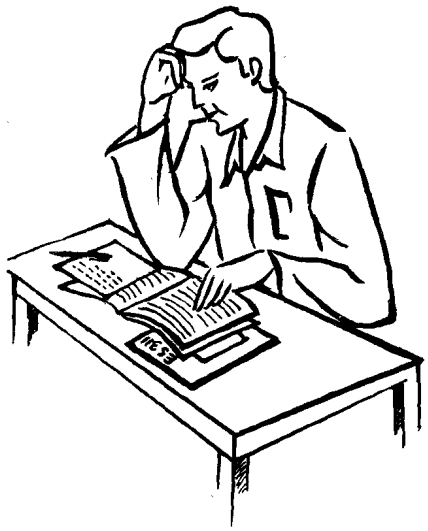


Fig.1: Reading a Research Report

- People learn more about the area of study.
- The discipline gets enriched with new theories.
- Researchers and practitioners in the field can apply, test and retest the findings already arrived at.
- Other researchers can refer to the findings and utilise the findings for further work.
- Findings can be utilized and implemented by the policy makers or those who had sponsored the project.

It is important to understand as to how to write a report. Your final report should be in accordance with the writing style used at your university. Whatever style you adopt, the content of the research report never varies. The final report of a research exercise takes a variety of forms.

- A research report funded by an educational institution may be in the form of a written document.
- A research report may also take the form of an article in a professional journal.

- The research reports of students of M.Sc., M.Ed., M.Phil. or Doctoral programmes take the form of a thesis or dissertation.

In the following sections we shall discuss the main components of a research report. The entire research report is mainly divided into three major divisions: — the beginning, the main body and the end (please see box).

Beginning	Main Body	End
➢ Cover Page ➢ Second Cover ➢ Preface ➢ Contents ➢ List of Table ➢ List of Figures	➢ Introduction ➢ Review of related literature ➢ Design of the study ➢ Analysis and interpretation of data ➢ Main findings and conclusions ➢ Summary	➢ Bibliography and reference ➢ Appendices

3.3 THE BEGINNING

The beginning of a report is crucial to the entire work. The beginning or the preliminary section of the research report contains the following items, more or less in the order given below:

- Cover or Title Page
- Preface including Acknowledgements
- Table of Contents
- List of Tables
- List of Figures and Illustrations
- Glossary

Let us describe in brief each of the above six items of the preliminary section of a report.

i) Cover or Title Page

The cover page (and the second cover page) is the beginning of the report. Though different colleges, universities and sponsoring institutions prescribe their own format for the title page of their project report or thesis, generally, it indicates the following in the downward vertical order:

- title of the topic,
- relationship of the report to a degree, course, or organisational requirement,

- name of the researcher/author,
- name of the supervisor/guide (if required),
- name of the institution where the report is to be submitted, and
- the date of submission.

The title page should carry a concise and adequately descriptive title of the research study. Preferably, it should not contain more than 12 to 15 words. The title should briefly convey what the study is about. Researchers tend to make errors in giving the title by using too many redundant and unimportant words.

Here, we have drawn a list of a few titles of research reports and doctoral theses:

a) A Critical Analysis of Textual Material for Principles of Accounting and its Translation for Distance Education
b) Developing Self-Instructional Material
c) Planning, Design and Development of one Self-Instructional Unit in Print
d) A Study of the Role of Distance Education in Zimbabwe in meeting the Manpower Training needs of the Education System with particular reference to the Bachelor of Education, Educational Administration, Planning and Policy Studies Programme intake II, in ManicaLand Province
e) The Zimbabwe Government Correspondence Primary School: A Case Study

In title (b), it is not clear at which level the researcher is developing self-instructional material. Title (d) has 40 words, whereas we have stated earlier that the title should be brief and concise. On the other hand, the title of the project (e) is comprehensive and precise.

The title should be written either in bold letters or upper-lower case and be placed in the central portion of the top of the cover page. Here, we have reproduced the cover page of a research report in Box. 1.

THE ZIMBABWE GOVERNMENT CORRESPONDENCE PRIMARY SCHOOL: A CASE STUDY

A project submitted in part fulfillment for the Masters of Arts in Distance Education Degree

By
S MANYUCHI

Supervisor
L E DAHWA

STRIDE
IGNOU
NEW DELHI, INDIA

March, 1998

Box. 1: Example of the title page of a research report

Note the other points mentioned on the cover page. Also observe the placement of these points.

ii) Preface including Acknowledgement

Preface is not a synonym for either a Acknowledgement or a Foreword. A preface should include the reasons why the topic was selected by the researcher. It may explain the history, scope, methodology and the researcher's opinion about the study. The preface and acknowledgements can be in continuation or written separately. This page follows the inner title page. It records acknowledgement with sincerity for the unusual help received from others to conduct the study. The acknowledgement should be non-emotional and simple.

iii) Table of Contents

A table of contents indicates the logical division of the report into various sections and subsections. In other words, the table of contents presents in itemized form, the beginning, the main body and the end of the report. It should also indicate the page reference for each chapter or section and sub-section on the right hand side of the table. Two sample tables of contents are given below:

1 Sample

TABLE OF CONTENTS

Box.2 Sample table of the contents

You must have noticed that no chapter is titled as Result or Findings. The alternative chapterization could have been as follows:

Chapter 1	Introduction
Chapter 2	Review of Related Literature
Chapter 3	Design and Methodology of the Study
Chapter 4	Results
Chapter 5	Interpretation of Results
Chapter 6	Summary & Conclusion

II Sample

TABLE OF CONTENTS

Box.3 Sample table of the contents.

iv) List of Tables

The table of contents page is followed by the page containing a list of tables. The list contains the exact title of each table, table number and the page

number on which the table has appeared. We provide you in Box.4 an example of a list of tables.

LIST OF TABLES

Box. 4 Example of a list of tables
Source: National Action Plan: UNESCO, 1996.

Box. 4, you will notice that all the content words start with a capital letter.

v) List of Figures and Illustrations

The page 'List of Figures' comes immediately after the 'List of Tables' page. You will observe in the following example that the list of figures is written in the same way as the list of tables.

LIST OF FIGURES

Box. 5 Example of a list of figures
Source: National Action Plan: UNESCO, 1996.

vi) Glossary

A glossary is a short dictionary, explaining the technical terms and phrases which are used with special connotation by the author. Entries of the technical terms are made in alphabetical order. A glossary may appear in the introductory pages although it usually comes after the bibliography. An exemplar glossary is given below.

GLOSSARY

Algorithm.	A step-by-step procedure consisting of mathematical and/or logical operations for solving a problem.
Artificial Intelligence (AI).	The study of computer techniques that mimic certain functions typically associated with human intelligence.
Back-up.	Duplication of a program or file on to a separate storage medium so that a copy will be preserved against possible loss or damage to the original.
Benchmark.	A measured point of reference from which comparisons of any kind may be made, often used in evaluating hardware and software, in comparing them against one another.
Command.	An instruction to the computer which is not a part of a program.
Cybernetics.	The field of science involved in comparative study of the automatic control or regulation of, and communication between machine and man. These studies include comparisons between information-handling machines and the brains and nervous systems of animals and humans.
Data.	Input to a computer which is processed by mathematical and logical operations so that it can ultimately be output in a sensible form.
Data Processing.	The input, storage, manipulation and dissemination of information using sequences of mathematical and logical operations.

Electronic Spreadsheet.	Software that simulates a worksheet in which the user can indicate data relationships. When data are changed, the program has the ability to instantly recalculate any related factors and to save all the information in memory.
Graphics Package.	A programme that helps draw graphs.
Hard Copy.	Output of information in permanent form, usually on paper, as opposed to temporary display on a CRT screen.
Ink Jet Printer.	A type of printer in which dot matrix characters are formed by ink droplets electrostatically aimed at the paper surface.
Laser Printer.	A printer that uses a laser beam to form images on photo-sensitive drums. Laser printers are now used as output devices for computers.
Megabyte (MB or M-Byte).	1024 kilobytes, or 1024 × 1024 bytes.
Personal Computer.	A moderately priced, general use computer designed principally for a single user in a home or small-office environment.

Source : Balagurusamy E : Selecting and Managing Small Computers.

(vii) List of Abbreviations italics

To avoid repeating long names again and again, a researcher uses abbreviations. Since abbreviations are not universal, it is necessary to provide the full form of the abbreviations in the begining. An exemplar list of abbreviation is given below.

ABBREVIATIONS

AIMA	All India Management Association
AIR	All India Radio
APPEP	Andhra Pradesh Primary Education Project
AVRC	Audio Visual Resource Centre
ATI	Administrative Training Institutes
BEL	Bharat Electronics Limited
BEO	Block Education Officer
BRC	Board Resource Centre
BSE	Board Of Secondary/Senior Secondary Education
CABE	Central Advisory Board of Education
CBT	Computer Based Training
CEO	Circle Education Officer
CIET	Central Institute of Educational Technology
CRC	Cluster Resource Centre
CSS	Centrally Sponsored Scheme
DIET	District Institute of Education and Training
DIT	District Institute of Training
DD	Doordarshan
DOE	Department of Electronics

DoSpace	Department of Space
DOT	Department of Telecommunications
DPEP	District Primary Education Program
DPEPII	District Primary Education Program : Phase II
EFA	Education for All
EMRC	Educational Media Resource Centre

Activity

Take any report which has been prepared by your institution and check whether the title page contains all the essential information. If not, try to fill in the gaps.

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Check Your Progress 1

List the major parts of the 'beginning' of a research report. Describe briefly the importance of each part.

Notes: (a) Space is given below for writing your answer.
(b) Compare your answer with the one given at the end of the unit.

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3.4 THE MAIN BODY

The main body of the report presents the actual work done by an investigator or a researcher. It tells us precisely and clearly about the investigation/study from the beginning to the end. The methodology section of the final report should be written in the past tense because the study has been completed. The report categorically avoids unnecessary details and loose language — we shall examine this point in detail in this section. At

this stage, you may again look at the Box on page 95. You will find that the table of contents for the report outlined of six sections/chapters in the main body. These are:

- Introduction
- Review of Related Literature
- Design of the Study
- Analysis and Interpretation of Data
- Main Findings and Recommendations
- Summary

Besides the logicality of sections/chapters in the main body there are certain other important aspects which need our attention. They are the style of writing, the design and placement of references and footnotes, the typing of the report, and the tables and figures.

Let us elaborate these points in the following sub-sections.

3.4.1 Chapters and their Functions

We will discuss the chapterisation of a thesis or a research report under six heads as noted above. Let us begin with introduction which is usually the first chapter.

Introduction

This is the first chapter of a thesis or a research report. It introduces the topic or problem under investigation and its importance. The introductory chapter :

- gives the theoretical background to the specific area of investigation,
- states the problem under investigation with specific reference to its placement in the broader area under study,
- describes the significance of the present problem,
- defines the important terms used in the investigation and its reporting,
- states precisely the objective(s) of the study,
- states the hypothesis/hypotheses of the study that would be tested through statistical analysis of data, [however, in philosophical and historical research there is no need to formulate and test a hypothesis, (see Block 2 of ES 315)], and
- defines the scope and limitations of the investigations.

Although these sub-sections are common, it is not necessary to follow the given order strictly; there may be variations in the order of the sub-sections. Sometimes the review of literature related to the area under investigation is also presented in the first chapter and is placed immediately after providing the theoretical background to the problem. Many researchers use review to argue the case for their own investigation. In experimental research it becomes essential to review related studies to formulate the hypotheses.

Review of related literature

The second chapter of a research report usually consists of the review of the important literature related to the problem under study. This includes the abstraction of earlier research studies and the theoretical articles and papers of important authorities in the field. This chapter has two functions. As you have read in Block 1, while selecting a problem area or simply a topic for investigation, the researcher goes through many books, journals, research abstracts, encyclopaedia, etc. to finally formulate a problem for investigation. The review of related literature is the first task for a researcher in order to decide on a specific problem for investigation. It also helps in formulating the theoretical frame work for the entire study. Secondly, such a review helps the researcher to formulate the broader assumptions about the factors/variables involved in the problem and later develop the hypothesis/hypotheses for the study.

Besides these, the review also indicates the understanding of the researcher in relation the area under investigation, and thus his/her efficiency to carry out the study. While reviewing literature in the area concerned, you have to keep in mind that the (reviewed) literature has to be critically analysed and summarised in terms of agreements and disagreements among the authors and researchers in order to justify the necessity for conducting your investigation. Researchers may make two types of errors in their review exercises. Many simply report the findings of one study after another in sequential order without showing how the findings are connected with one another. Others report on studies that are at best only marginally related to their own hypothesis.

Design of the study

The design of a study is usually described in the third chapter of the report. Broadly speaking, this chapter provides a detailed overview of "how" the study was conducted. The various sub-sections include:

i) description of the research methodology, i.e., – descriptive, experimental, etc.;
ii) variables: the dependent, independent and intervening variables with their operational definitions;
iii) sample: defining the population, and the sampling procedure followed to select the sample for the present study;
iv) listing and describing various tools and techniques used in the study, like questionnaires, attitude scales, etc., whether these have been adopted or developed by the investigator, their reliability, validity, item description, administration and scoring, etc.;
v) describing the statistical technique used in the analysis of data including the rationale of the use and method of data analysis. In philosophical and historical researches, for example, this type of sub-section may not be there.

Analysis and interpretation of data

This is the fourth chapter of the research report. It is the heart of the whole report, for it includes the outcome of the research. The collected data are presented in tabular form and analysed with the help of statistical techniques — parametric and non-parametric. The tables are interpreted and if necessary, the findings are also presented graphically. The figures do not necessarily repeat the tables, but present data visually for easy understanding and easy comparison. Data may be presented in parts under relevant sections. The analysis of the data not only includes the actual calculations but also the final results. It is essential that at each stage of analysis the objective(s) of the study and their coverage is taken care of. This chapter also presents the details about the testing of each hypothesis and the conclusions arrived at. This gives the reader a clear idea regarding the status of the analysis and coverage of objectives from point to point.

Main findings and conclusion

This is usually the fifth chapter in a research report. The major findings of the study analysed and interpreted in the preceding chapter are precisely and objectively stated in this chapter. The fourth chapter contains such presentations as only a specialist or a trained researcher can understand because of the complexities involved; but in the fifth chapter the major findings are presented in a non-technical language so that even a non-specialist such as a planner or an administrator in the field can make sense out of them.

The main findings are followed by a discussion of the results/findings. The major findings are matched against the findings of other related research works which have already been reviewed in the second chapter of the report. Accordingly, the hypotheses formulated in the first chapter are either confirmed or discarded. In case the null-hypotheses are rejected, alternative hypotheses are accepted. If the findings do have any discrepancy in comparison with those of other researches, or if the findings do not explain sufficiently the situation or problem under study, or if they are inadequate for generalisation, explanations with proper justification and explanation have to be provided.

The next task in this chapter is to provide implications of, the findings and their generalisations. The implications should suggest activities for and provide some directions to the practitioners in the field. Unless these implications are clearly and categorically noted, it becomes difficult for the practitioners to implement them on the one hand, and on the other research findings do not get utilised at all even if they have been recorded in a report.

The implications follow a presentation/listing of the limitations of the study on the basis of which suggestions are made to carry out further investigation or extend the study from where it has reached.

Summary

Some researchers include a summary along with the research report (as the last chapter) or as a pull-out to the report itself. It sums up precisely the whole of the research report right from the theoretical background to the suggestions for further study. Sometimes researchers get tempted to report more than what the data say. It is advisable to check this tendency and be always careful to report within the framework provided by the analysis and interpretation of data, i.e., within the limits of the findings of the study.

Check Your Progress 2

Comment briefly on the uses of (a) review of literature, and (b) conclusion in a research report.

Notes: (a) Space is given below for writing your answer.
(b) Compare your answer with the on given at the end of the Unit.

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3.4.2 Writing Style

The style of writing a research report is different from other writings. The report should be very concise, unambiguous, and creatively presented. The presentation should be simple, direct and in short sentences. Special care should be taken to see that it is not dull and demotivating.

Statements made should be as precise as possible — they should be objective and there should be no room for subjectivity, personal bias and persuasion. Similarly, over generalisation must by avoided. There is no place for hackneyed, slang and flippant phrases and folk expressions. The writing style should be such that the sentences *describe* and *explain* the data, but do not try to *convince* or *pursuade the reader*. Since the report describes what has already been completed, the writing should be in the past tense.

In the case of citations, only the last name of the author is used, and in all cases academic and allied titles like, Dr., Prof., Mr., Mrs., Ms. etc. should be avoided. Some authors recommend that the use of personal pronouns like "I", "We" etc., should be avoided. There is however no hard and fast rule

in this case. Similarly, a large number of research reports use passive voice which is strongly discouraged by the linguists. Similarly, abbreviations of words and phrases—like IGNOU, DDE, NIRD, etc.—should be used to avoid long names repeatedly inside the text, as well as in figures, tables, and footnotes.

Special care should be taken while using quantitative terms in a report, such as *few* for number, *less* for quantity etc. No sentence should begin with numericals like "40 students", instead it should start as "Forty students". Commas should be used when numbers exceed three digits—1,556 or 523,489, etc.

Language, grammar and usage are very important in a research report. The *Roget's Thesaurus, Handbook of Style* by Campbell and Ballon (1974), and a good dictionary would be of much help. MS-Word software provides good support to

- Spelling and Grammar
- Thesaurus
- Auto Correct
- Auto Summarise

A researcher is advised to use these features on the MS-Word to make the report error free. It is always advisable to show the report to learned friends or language experts for correction before it is finally typed. Revision is an important feature of good report writing—even experienced researchers with many publications revise their reports many times before giving them for final typing.

3.4.3 Footnotes / In-text References

Articles, papers, books, monographs, etc. quoted inside the text should always accompany relevant references, i.e., the author and the year of publication e.g., (Mukherjee, 1988). If a few lines or sentences are actually quoted from a source, the page number too should be noted e.g., (Mukherjee, 1988: 120-124). Besides, full reference should be placed in the Reference section of the report (see sub-section 3.5.1 below). The usual, though traditional style of giving references is to place them as the footnotes on the relevant page(s). The footnotes are serialized inside the text and in the footnotes of each chapter. These days, footnotes are usually avoided. However, they perform many functions. They provide ready reference on the page of the text itself to avoid the botheration of consulting the references at the end of the report off and on. In certain cases, footnotes include explanatory statements, full form of the abbreviations, extra justifications with reference to a portion of the text that may be read by a reader if needed, i.e., if the text is not clearly understood. However, precision and necessity should be the main guidelines to bring in these types of footnote.

Footnotes, as noted earlier, may be serialised as 1, 2, 3, 4, etc., within a chapter or be inserted at the end of the sentence concerned in parentheses as (5:23) which implies reference number 5 and page number 23, the full reference of which is given at the end of the chapter or in the reference section at the end of the report. Footnotes are always double-spaced between each other, though each footnote is typed single-spaced. *Ibid.* in the footnote refers to the same work and the reference that precedes it. For example, consider the following references:

[5]John, W. Best, *Research in Education* (New Delhi: Prentice Hall of India, 1993), p.146.
[6]Ibid. P.146 (This indicates *the same work* and the same page as above)
[7]Ibid. P.148 (This indicates *the same work* as above but a different page).

Ibid. in Latin means *the same. op. cit.* (in Latin means *the work cited*) is used in a footnote when another reference to the same work is made on the same page but not consecutively. Consider the following example:

[3]Frend N. Kerlinger, *Foundations of Behavioural Research*, New York: Holt, Rinehart & Winston, 1973, p.256.

[4]William G. Campbell and Stephen V. Ballon, *Form and Style: Theses, Reports, Term Papers,* Boston: Houghton Mifflin Co., 1974, p.15.

[5]Kerlinger, *op.cit.,* p.258.

Reference '5' is the same as reference '3', except that the page references differ in the two cases.

In case there are more references to the text on the same page of the original text which has been listed once, they may be listed/entered by the abbreviation loc. cit.

Example: [6]Campbell and Ballon, *loc. cit.*

Footnote is also a feature of MS-Word 97, under the pull-down menu of 'Insert'. It allows serialisation as well as customised footnote symbols. The menu can be used to make footnotes error free.

In preparing the footnote references, another factor to be considered is the abbreviations of words and expressions and their right placement. While writing a research report, abbreviations may be used to conserve space in references or footnote references. If a researcher is not familiar with the abbreviations, he/she should consult the relevant literature as and when required. In the following table (Table 1) a comprehensive list of abbreviations has been given for ready reference (the Latin abbreviations have been italicised).

Table I List of some important abbreviations used in footnotes and bibliographies

Words	Abbreviations
About (approximate date)	*c. (circa)*
Above	*supra.*
And the following	*et seg.*
And the following	*f., ff.*
And others	*et. al.*
Article, articles	art., arts.
Article, articles	*infra.*
Book, books	bk., bks.
Chapter, chapters	chap., chaps.
Column, columns	Col., Cols.
Compare	*cf.*
Division, divisions	div., divs.
Editor, editors	ed., eds.
Edition, editions	ed., eds.
For example	*e.g.*
Figure, figures	fig., figs.
Here and there (scattered)	*passim*
Illustrated	Ill
Line, lines	l. ll.
Manuscript	ms.
Mimeographed	mimeo.
No date given	n.d.
No name given	n.n.
No place given	n.p.
Number, numbers	no., nos.
Page, pages	p., pp.
Part, parts	pt., pts.
Paragraph in length	(....)
Paragraph, paragraphs	par., pars.
Previously cited	*op. cit.*
Revised	rev.
Same person	*idem.*
Same reference	*ibid.*
Section, sections	sec., secs.
See	*vide.*
The place cited	*loc. cit.*
Thus	*sic.*
Translated	trans.

3.4.4 Typing and Production

Typing of dissertations, research reports, project reports etc. needs greater care than other typed documents. In a research report, one does not expect overwriting, strikeovers, erasures and insertions.

Before typing the report, it is necessary to check whether the handwritten report, i.e., the manuscript is in a proper shape. Whether the manuscript of the report is typed by a typist or by the researcher himself/herself, a clear and comprehensible manuscript makes typing easy. Too many additions and corrections make the manuscript crammed, and a crammed manuscript makes typing difficult and time consuming. Only one side of the paper

should be typed and typing should be double spaced. Space should be left on each side of the paper as follows:

- left side margin
- right side margin
- top margin
- bottom margin

If there is a lengthy quotation, it should be indented and typed in single space. At the end of each line, words should be divided as per convention. A dictionary which shows syllabification should be consulted if words are to be broken at all. Unlike the lengthy quotations, short quotations of three/four lines may be included in the text within quotation marks.

Subject to access to a computer and word processing software, it is better to prepare the report on a computer. It has several advantages, for example, you can

- edit time and again without incorporating new errors which is what happens when you use a manual typewriter,
- define your margin – top, bottom, left and right easily,
- define pages in landscape or portrait size, particularly for tables and diagrams,
- choose out of about 70+ fonts – shapes of letters and type sizes from the smallest 8 point to the large 72 point,
- check spelling, grammar, synonyms and antonyms,
- choose illustrations from the clip-art file, and
- can index (alphabetical order) the references automatically.

If you happen to have access to Excel, it can automatically produce graphs and charts that can be transferred to Word document. For details of the use of Word and Excel for preparing research reports please refer to Units 2 and 3 of Block 5.

Finally, the computer output can be taken out in a Dot Matrix, Ink Jet or Laser printer. The Ink Jet and Laser Printers are the current standard in the market. They produce quality printouts that make reading easy.

3.4.5 Tables and Figures

Tables: Preparation and appropriate placement of tables in the text are equally important. They need careful attention from the researcher. Tables help the readers to get a quick view of the data and comprehend vast data at one go. However, tables should be presented only when they are necessary. Too many tables may confuse the reader, instead of facilitating his/her reading. As such you need to be selective in placing tables in the report.

If data are too complicated to be presented in one table, several tables may be used to give a clear picture of the data in proper sequential order. Tables, if small, may accompany the textual material, and if large, should be put on one full page without mixing them with the text. All the tables should be numbered serially in the text, so that they may be quoted or referred to with the help of those numbers conveniently.

If a table is large, it should continue on the next page with the table title repeated on the top of the next page; otherwise, tables can be typed in smaller fonts like 8pt. or 9pt. The table itself is centred between the two margins of the page, and its title typed in capital letters and is placed in pyramid size and preferably numbered in capital Roman numerals like I, II, III etc. The title of the table should be brief but self-explanatory.

Figures: Figures are necessary when the data is to be presented in the graphic form. They include charts, maps, photographs, drawings, graphs, diagrams, etc. The important function of a figure is to represent the data in a visual form for clear and easy understanding. Textual materials should not be repeated through figures unless very necessary.

Figures should be as simple as possible and the title of each figure should precisely explain the data that has been presented. Usually, a figure is accompanied by a table of numerical data. Again, figures are presented only after textual discussion and not the other way round. The title design of figures should be followed consistently throughout the report. Every first letter of a word of the title should be in capitals, and figures should be numbered in Indian numerals like 1, 2, 3 etc. And the title, unlike for tables, is presented below the figure.

3.5 THE END

The end of the report consists of references and an appendix/appendices. References come at the end after the last chapter of the report. The last section labelled references appears at the top of a new sheet of paper. The reference section is a list of the works that have been cited in the report/thesis. All references quoted in the text are listed alphabetically according to the last name of the authors. The works of the same author should be listed according to the date of publication with the earliest appearing first. It is different from a footnote in the sense that the latter is a specific reference to only one or more citations on a particular page.

3.5.1 Bibliography and References

Research reports present both bibliographies and references. Although many researchers use these terms interchangeably, the two terms have definite and distinct meanings. A bibliography is a list of titles – books, research reports, articles, etc. that may or may not have been referred to in the text of the research report. References include only such studies, books

or papers that have been actually referred to in the text of the research report. Whereas research reports should present references, books meant for larger circulation may be listed in bibliographies that should include all such titles as have been referred to.

There are mainly two style manuals detailing general form and style for research reports. These are:

- American Psychological Association, *Publication Manual*, 3rd ed. Washington, DC: American Psychological Association, 1983.
- *The Chicago Manual of Style*, 13th rev.ed., Chicago University of Chicago Press, 1982.

Style of Referencing

There are mainly two types of referencing:

1. arranging references in alphabetical order where the researcher has cited the name of the author and the year of publication/completion of the work in the text.
2. arranging references in a sequence as they appear in the text of the research report. In this case, related statement in the body of the text is numbered.

However, most research reports use alphabetical listing of references.

For example, entries in a reference section may look like the following:

1. Gannicott, K. and Throsby, D., *Educational Quality and Effective Schooling*, Paris: UNESCO, 1994 (Book).

2. Koul, B.N., Singh, B. and Ansari, M.M., *Studies in Distance Education,* New Delhi: IGNOU & AIU, 1988.

3. Kumar, K. L., *Educational Technology*, New Delhi: New Age Publishers, 1995.

4. Ministry of Human Resource Development, *DPEP: Guidelines*, Department of Education, MHRD, Government of India, New Delhi, 1995.

5. Mukhopadhyay, M. (ed.), *Educational Technology: Challenging Issues*, New Delhi: Sterling Publishers, 1990. (Edited Book)

6. Mukhopadhyay M., "Teacher Education and Distance Education: The Artificial Controversy", in Buch, Piloo M., (ed.) *Contemporary Thoughts on Education*, Baroda: SERD, 1998. (Chapter in Book)

7. Parhar, M., Impact of Media on Student Learning, Unpublished Doctoral Dissertation, New Delhi: Jamia Millia Islamia, 1993. (Thesis)

8. Sachidananda, Tribal Education: New Perspectives and Challenges, *Journal of Indian Education*, New Delhi: NCERT, 1994. (Article in a Journal)

9. Selltiz, Claire et. al., *Research Methods in Social Relations*, New York: Holt, Rinehart & Winston, 1959.

10. Dhanarajan, Gajaraj, "Access to Learning and Asian Open Universities: In Context" in the 12th Annual Conference of Asian Association of Open Universities, "*The Distance Learner*", The Open University of Hong Kong, Hong Kong SAR, China, 4-6 Nov., 1998 (Conference Paper).

You would notice the following:

- All studies are arranged in alphabetical order.
- The names of the authors are recorded by title and initials (not full name).
- To indicate two or three authors, 'and' is used between the first and the second, ',' between first and second and 'and' between second and third author.
- In case of more than three authors, only the name of the first author is mentioned followed by et al. (et allibi) or others.
- In case of a chapter in a book, after the author and chapter title and the name of the author or editor of the book.
- Titles of printed books, names of journals are highlighted by using 'italics' or by underlining (in case of manually typed material).
- Place of publication of a book precedes the name of the publisher separated by a ':' (colon).
- Names of journals are followed by the relevant volume and issue numbers usually in the form 10(3) – Volume 10, Number 2 and page numbers.
- Unpublished thesis or dissertation titles are not highlighted and the word 'unpublished' is mentioned.

The sequential referencing is done in the same way as indicated in the footnote earlier. For your convenience, the footnote example is rearranged in the form of referencing in format given below. However, this form of referencing and footnotes do not go together.

1. John, W. Best, *Research in Education* (New Delhi: Prentice Hall of India, 1993), p.146.
2. Ibid. P.146 (This indicates the same work and the same page as above)
3. Ibid. P.148 (This indicates the same work as above but a different page).
4. *Ibid.* in Latin means the *same. op. cit.* (in Latin means *the work cited*) is used in footnotes when another reference to the same work is made on the same page but not consecutively. Consider the following example:

5. Frend N. Kerlinger, *Foundations of Behavioural Research*, New York: Holt, Rinehart & Winston, 1973, p.256.
6. William G. Campbell and Stephen V. Ballon, *Form and Style: Theses, Reports, Term Papers* Boston: Houghton Mifflin Co., 1974, p.15.
7. Kerlinger, *op.cit.*, p.258.
8. Reference '5' is the same as reference '3', except that the page references differ in the two cases.

In case there are more references to the same page of the original text which has been listed once, they may be listed/entered by the abbreviation loc. cit.

Example: Campbell and Ballon, *loc. cit.*

Referring Web Based Documents

Computers have brought revolution in all sectors of development including education. Computers were conventionally used for data storage, processing and retrieval. Through Internet, information can be accessed from any part of the world.(Refer course ES-318, Block 5, Unit 3 to get more details on Computer and Internet). As researchers, reviewing the relevant literature related to the problem understudy is almost magnum opus. These days Internet is a rich academic and professional resource . World Wide Web (WWW) is the easiest and most popularly used browsing mechanism on the Internet. Here we will very briefly explain as how to write the references when we quote from any Web Site.

Citing E-Mail

E-Mail communications should be citied as personal communications as noted in APA's publication Manual http://www.apa.org/journals/webref.html. Personal Communications are not cited in the reference list. The format in the text should be as:
Sanjaya Mishra (personal communication, November 15, 2000).

Citing a Web Site

When you access the entire Web site (not a specific document on the site), you just give the address of the site in the text. It is not necessary to enter in the reference section.

For example,

http://www.ignou.org (IGNOU's website)
http://www.webct.com/ (This site provides tools for development of web based courses)

Citation of specific document on a web site has a similar format to that for print. Here we give few examples of how to cite documents. The Web information is given at the end of the reference section. The date of retrieval

of the site should be given because documents on the Web can change in content or they may be removed from a site.

Example

Duchier, D. (1996), Hypertext, New York: Intelligent Software Group. [Online] http://www.isg.sfu.ca/~duchier/misc/hypertext_review/chapter4.htm]Accessed on 25/1/99].

Flinn, S. (1996) Exploiting information structure to guide visual browsing and exploratory search in distributed information systems [Online] http://www.cs.ubc.ca/reading-room/[Accessed June 1998].

If you have to cite some specific parts of a web document, indicate the chapter, figure, table as required.

3.5.2 Appendices

Usually, the appendices present the raw data, the true copy of the tools used in the study, important statistical calculations, photographs and charts not used inside the text. These are ordered serially like Appendix-1, Appendix-2, or they can be serialized with capital letters (Appendix A, Appendix B) etc. to facilitate referencing within the text. The appendices provide reference facilities to readers and others interested in that particular field of investigation.

Activity

1. Take any report and check whether the references are written in the standard form. If not, try to rewrite them properly.

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2. Examine the appendices in the same report. Are all of them essential for the report. Comment.

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3.6 LET US SUM UP

In this Unit, we focused on research reporting as a professional activity. The purpose of writing the report depends on the reason behind undertaking the research study. It could be for obtaining a degree, or as a project report to be submitted to the funding agency, etc. Once submitted, the funding agency and the educational managers could utilise the findings and recommendations to achieve their objectives; other researchers may seek guidance from it; and lastly, the findings may be used for developing new theories in the discipline concerned.

A research report has three parts: the beginning, the main body and the end. The beginning includes: cover or the title page, acknowledgements, table of contents, the list of tables, and the list of figures. The main body normally contains an introduction, review of the relevant literature, objectives, hypotheses, research design (research methodology, population and sample, tools, procedure of collecting data), analysis and interpretation of data, the main findings and conclusion (that also includes its educational implications and suggestions for further studies). While discussing the main body, we have talked about the style of writing the report, style and placement of footnotes and references, the typing process and the format and placement of tables and figures. We closed the discussion with notes on the style, arrangement and placement of references and appendices which constitute the end of a research report.

3.7 CHECK YOUR PROGRESS: THE KEY

1. The major parts of the beginning of a research report are: cover/title page, acknowledgements, table of contents, list of tables, list of figures and list of abbreviations.

   The cover page gives us clear information about the subject/theme, author and the year of the research study as well as the organisation for which or where the study has been conducted.

   Acknowledgements are words of appreciation from the researcher for those who have helped him/her while conducting the study. Table of contents indicates the main themes/areas studied, the methodology followed and the outcome of the study.

   List of tables, figures and abbreviations are useful as reference tools.

2. a) Review of literature helps the researcher to specifically define the problem for investigation, decide about the usefulness of the study and formulate his/her hypothesis.

   b) The conclusion of a research report sums up the findings, states what is new in the report concerned and indicates the

direction for future studies as well as implications for implementation of recommendations, if any.

References

Campbell, W.G. and Steven, V. Ballon, Form and Style : Thesis, Reports, Term Pages, Honghtom Migglin C., 1974.

http://www.apa.org/journals/webref.html.