Unit 6 Research in Education

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Part A- Educational research

Research

Research is an art of scientific investigation. It is regarded as a systematic effort to gain new knowledge, so educational research is the way in which one acquires dependable and useful information about the educational process. Research is the voyage of discovery. It is the quest for answers to unsolved problems. Research may be defined as the application of the scientific method in the study of problems. The terms 'Research' and 'Scientific Method' are sometimes used interchangeably. Research is considered to be a more structured and systematic process of carrying on a Scientific Method of Analysis that is directed towards discovery and development of an organised body of knowledge. The only difference which lies between research and Scientific Method is that it is possible to employ Scientific method without research, but it is not possible to conduct any research without employing Scientific method..

Educational research is an application of Scientific method to the study of educational problems

Concept and Definitions of Research

The term ‘research' is a combination of two words ‘re' and 'search'. ‘Re means again and again' and 'search' means 'to explore something new'. Research is a process of observing the phenomenon (i.e. event, anything and process, etc) again and again. Collecting the data and drawing scientific conclusions on the basis of those data. Research is a search for knowledge. It is a systematic effort to gain new knowledge in any kind of discipline.

According to **Advanced Learner's Dictionary of Current English** (**1952**), "Research is a careful investigation or inquiry specially through search for new facts in any branch of knowledge".

According to **Redman and Morey,** "Research is a systematized effort to gain knowledge".

Research is an objective, impartial, empirical, logical analysis and recording of controlled observations that may lead to the development of generalizations, principles or theories, resulting to some extent in prediction and control of events that may be consequences or causes of specific phenomena.

Research is required in any field to come up with new theories or modify, accept or nullify the existing theory, but when it seeks a solution of any educational problems it leads to educational research.

Educational Research

Educational research refers to a systematic attempt to gain a better understanding of the educational process, generally with a view in improving its efficiency. It is an application of Scientific Method to the study of educational problems. The main concerns of educational research are to understand, explain, predict and control human behaviour in individual and social situations, so that events or situations can be improved further.

Educational research primarily aims at conceptualisation and theorisation of the processes and practices so as to understand the educational events and phenomena. In education, growth in knowledge by experience is very slow and accidental. We need

solutions based on research, so that the coming generation is not left with ignorance and prejudice.

"Educational research represents an activity directed towards the development of an organized body of scientific knowledge about the events with which the educators are concerned of central importance are the behavior 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 provide in order to produce desired aspects of learned behavior among young people who attend school (Travers, 1985)".

Definitions of Educational Research

According to Mouly, "Educational research is the systematic application of Scientific Method for solving educational problems".

According to Whitney, "Educational research aims at finding out solutions to educational problems by using the Scientific Philosophical Method".

Monroe states that "The final purpose of educational research is to ascertain principles and develop procedures in the field of education".

Since, education is a behavioural science, the main aim of educational research is to solve educational problems in systematic and scientific manner, to understand, explain, predict and control human behaviour in educational settings. It is a process of development of an organised and useful body of scientific knowledge with which the academicians are concerned. It tries to gather facts about a child's personality, learning process, emotional development, social adjustment and skills. It also tries to study a child's stage of growth and development and the factors influencing these with the aim of improving the teaching-learning process in the classroom.

Characteristics of Educational Research

- It is highly purposeful.
- It attempts to solve educational problems.
- It is based upon observable experience or empirical evidence.

- It involves gathering new data from primary to first hand source or using existing data for new purposes.
- It attempts to organise data quantitatively and qualitatively to arrive at statistical inferences.
- It deals with educational problems regarding students and teachers as well.
- It emphasizes the development of generalisation, principles or theories which will help in understanding, prediction and control.
- It demands subjective interpretation and deductive reasoning in some cases.
- It generally employs carefully designed procedures and rigorous analysis.
- It discovers new facts in a new perspective i.e. it generates new knowledge.

Need and Importance of Educational Research

The importance and need for research in education was acknowledged for the first time in the Government Resolution of the Indian Educational Policy in 1913, but it was only after independence in 1947 that a planned and systematic effort was made to promote educational and/or classroom research by establishing national and state organisations for the development of elementary and secondary education, research in the development of curriculum and textbooks and evaluation procedures. Research in education is essential for providing useful and dependable knowledge through which the process of education can be made more effective.

Education is considered as much a science as an art. As a science, it has a corpus of knowledge which concerns the nature of human mind, its growth and development, theories of administration and supervision, educational programmes, curricula and practices. Since education depends on a corpus of knowledge, there is a need to add new knowledge which has to be scientific, to enrich and improve education with different dimensions.

Research helps in clarification and re-interpretation of existing knowledge which is also necessary in education. Education has strong roots in the field like philosophy, history, economics, psychology and sociology. It is through an intensive process of scientific inquiry about the philosophical, historical, economical, psychological and

sociological impact on various aspects of education that sound educational theories can be established. There is a need for educational research because of the changing conception of education.

The International Commission on the Development of Education in its report 'Learning Be'.

UNESCO (1972) emphasises education from now can no longer be defined in related to a fixed content, which has to be assimilated but must be conceived of as a process in the human being. They can learn to express themselves to communicate and to question the world, through his/her various experiences and increasingly all the time try to fulfil themselves through constant learning. So, the limits of educational research have to be extended from the formal and conventional modes of education to the non-formal and innovative systems based on ecological and cybernetics models.

Purpose of Educational Research

The purpose of educational research is to develop new knowledge about the teaching-learning situation, to improve the educational practice.

Research in education are conducted for fulfilling different purposes, which are

- To solve the immediate local problems in education.
- To ascertain principles and develop procedures for use in the field of education, to determine to what extent we should go in educating children and adults.
- To answer the questions related to education through reflective thinking.
- To discover new applications of principles and laws in the field of education.

***Creswell (2002)** stated the following reasons, describing the various purposes of educational research*

- **Improve Practice** Research can suggest ways of improving practice that have been verified with many applications and by many different types of people which is difficult for practitioners.
- **Expand Knowledge** Research can allow us to extend what we know in ways we were never convinced.

- **Address Gaps in Knowledge** Research can address areas in which we know little, such as the effect of online versus traditional classroom teaching.
- **Replicate Knowledge Research** can act as a test to verify previous findings.
- **Add Voices of Individuals to Knowledge** Research can add important perspectives for different learning types. Much of educational research prior to the 80s was based on middle to upper class males. This is certainly not reflective of our increasingly heterogeneous students and research helps revise theory and practice to reflect different students' needs.

Scope of Educational Research

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

Educational Psychology

Research in this field, helps the teacher to understand the child in the classroom in order to improve the teaching-learning process.

This research provides the following information

- Relative effectiveness of socio-cultural forces on the development of children.
- Usefulness of learning theories in various educational settings.
- Identification of factors conclusive to learning.
- Role of physical/intellectual efficiencies and defects in learning.
- Role of teachers and textbooks in removing delinquency in adults and so on.
- Conditions conducive to effective learning, factors helpful in promoting memory and concept formation.
- Cognitive and non-cognitive factors, like intelligence, aptitudes, attitudes, creativity, interest, motivation, personality traits, needs and adjustment of pupils provide a promising field of research in educational psychology.

Philosophy of Education

- Role of logic in various areas of education from concept formation to theory development.
- Role of knowledge, beliefs and values in developing educational theories.
- Role of ideologies and religion for improving educational practices.

- Development of a practical philosophy in the Indian context.
- Finding new implications of ancient Indian philosophies in the present scenario.
- Re-organisation of social structure and educational system in India.
- Determining the contribution of different philosophers and their implications.

Sociology of Education

- Effects of changes in the demographic structure on education.
- Effects of New Education Policy (1986), on expansion of education and employment.
- Role of educational institutions in bringing about social change and vice-versa.
- Role of social and cultural factors in bringing about social change and vice-versa.
- Role of teachers as agents of social change, modernisation and social equity.
- Minorities and their problems.
- Reservation policy.

Comparative Education

- Administrative and educational policies of different countries and their impact on the society as a whole. Impact of various systems of education in the world on one another.
- Comparison of educational progress in various countries of the world.
- Impact of economic progress on education.
- Allocation of budget on education in different countries and its impact on educational progress and so on.

Guidance and Counselling

- Role of family and neighbourhood in making the children adjusted in the society.
- Construction of tools for diagnosing adjustment problems of students.
- Methodology of vocational guidance for children belonging to different strata of society.
- Adaptation of foreign tests and inventories to Indian situations.

Educational Technology

- Development of new teaching strategies by action research.
- Role of technology in teaching-learning process.
- Application of psychology to solve teaching problems.
- Development of new audio-visual aids and so on.
- Applications of technological equipment and laws in education.

Educational Management and Administration

- Problems of educational administration in India and its impact on performance.
- Impact of educational planning and legislation on performance.
- Techniques to improve the efficiency of school organisation and inspection systems.
- Role of teachers and principals in enhancing performance of students.
- Supervision and performance.
- Contribution of NGOs to education.

Inclusive Education

The inclusive classroom relies on the simultaneous use of differentiated instruction and assessment techniques for maximizing a student's learning potential by tailoring and teaching to every student. Although many educational innovations take shape and undergo testing in the classroom, research is necessary to substantiate these new techniques beyond anecdotal evidence. This helps broaden their exposure, boost their inclusion in professional development programmes for teachers and encourages widespread implementation.

Curriculum Development

- Structure of the curriculum in India from the primary to higher level.
- Analysis and organisation of curriculum in various subjects.
- Analysis of textbooks at different stages of learning.
- Modernisation of curriculum in relation to changing needs.
- Inculcation of national values through curriculum development.

Scientific Methods

Karl Pearson held that "The Scientific method is one and same in the branches (of science) and that method is the method of all logically trained minds the unity of all sciences consists alone in its methods, not its material the man who classifies facts of any kind, who sees their mutual relation and describes their sequences, is applying the scientific method and is a man of science." This method is the pursuit of truth as determined by logical considerations. The ideal of science is to achieve a systematic interrelation of facts. Scientific method attempts to achieve the ideal by experimentation, observation, logical arguments from accepted postulates and combination of these three in varying proportions. This method encourages a rigorous method wherein the researcher is guided by the rules of logical reasoning, a method wherein an investigation proceeds in an orderly manner and a method that implies internal consistency.

Educational research is the application of Scientific method to the study of educational problems. The Scientific method has acquired highly specific meaning in modern science.

Scientific method stands for systematic and acceptable set of procedures, used for generating new knowledge, the validity of which is self-evident because of the logical constructs implied in their ordering. To be termed scientific, a method of inquiry is commonly based on empirical or accessible evidence subject to specific principles of reasoning.

Scientific methods operate primarily at the empirical level of research i.e. how to make observations, analyse and interpret observations. Very little of this method is directly pertinent to the theoretical level, which is really the more challenging part of scientific research.

According to **GA Lundburg,** "Scientific method consists of systematic observation, classification and interpretation of data".

According to **Barry F Anderson,** "Scientific method is a set of rules, comprising operational definition, generally controlled observation, repeated observation, confirmation and consistency".

Characteristics of Scientific Method

Replicability It means research must be replicable or repeated. The research is replicable when an independent group of researchers can copy the same process and arrive at the same results as the original study. When a study cannot be replicated it suggests that our understanding of the study or our methods of testing are currently insufficient.

Precision: It refers to theoretical concepts, which are often hard to measure, these must be defined with such precision that others can use those definitions to measure those concepts and test that theory.

Falsifiability It means a theory must be stated in a way that it can be disproven. Theories that cannot be tested or falsified are not scientific theories, any such knowledge is not scientific knowledge. A theory that is specified in imprecise terms or whose concepts are not accurately measurable cannot be tested and is therefore not scientific.

Parsimony When there are numerous explanations of a phenomena, scientists must always accept the simplest or logically most economic explanation. This concept is called parsimony. Parsimony prevents from pursuing overly complex theories with an endless number of concepts and relationships that may explain a little bit of everything but nothing in particular.

Steps of Scientific Method

Identification and Definition of the Problem A scientific inquirer starts with the identification of a problem that is in need of solution. The problem identified must be defined in such a manner that observation or experimentation in the natural world can provide a solution.

Formulation of a Hypothesis Once the problem is defined, the next step is to formulate the hypothesis, which provides an intelligent guess for the solution of the

problem. It requires a critical review of the knowledge or information related to the problem.

Implication of Hypothesis through Deductive Reasoning The next step after the formulation of a hypothesis is to deduce the implications of the suggested hypothesis t.e. what would be observed if the hypothesis is true.

Collection and Analysis of Evidence The deduced implications of the hypothesis are tested by collecting relevant evidence related to them through observation, testing and experimentation.

Verification, Rejection or Modification of Hypothesis Once the evidence has been collected and analysed, the results are analysed in order to verify whether the evidence supports the hypothesis. It may be noted that the characteristic of Scientific method is not to prove the hypothesis in terms of absolute truth but to conclude that the evidence does or does not support the hypothesis.

Types of Scientific Method

Exploratory

Exploratory research method is defined as a research, used to investigate a problem which is not clearly defined. It is conducted to have a better understanding of the existing problem, but will not provide conclusive results. In this, a researcher starts with a general idea and uses this research as a medium to identify issues that can be the focus for future research. Such research is usually carried out when the problem is at a preliminary stage. It is often referred to as the Grounded Theory Approach or interpretive research, as it is used to answer questions of what, why and how. The exploratory studies are also conducted to develop, refine and/or test measurement tools and procedures.

This type of research is applied when there are a number of factors studied within time constraints and it is possible to define each problem, then this type of research is required. In 1994, exploratory research means "to get a clear knowledge of seeking new approaches, new ideas and assess in innovative manner".

The objective of the exploratory research is to define the problems accurately, clarify concepts, collect details and discard informal and unnecessary ideas after the framing of the hypothesis of the study. Literature, survey, focus group and case studies are usually used to carry out exploratory research. Exploratory research may develop hypothesis, but it does not seek to test them (Darabi, 2007).

Explanatory

This research method has been used by many researchers in explaining theoretical explanations. The researcher is interested in this approach in giving real explanations, predicting the results, controlling the phenomena and searching the causes for the happenings. This approach depicts the relationship between cause and effect variables. This approach focuses on the changes in one variable affects the change in other variables.

This research is conducted in order to help us find the problem that was not studied before in depth. It is actually a type of research design which focuses on explaining the aspect of your study in a detailed manner. Explanatory research is conducted in order to help us find the problem that was not studied before in depth. The explanatory research is not used to give us some conclusive evidence but helps us in understanding the problem more efficiently. Research allows the researcher to tackle such problems where no or less research has been done.

The purpose of the explanatory research method is to increase the understanding of a researcher on a certain subject. It gives flexibility of sources, means published literature or data are commonly used in explanatory type of research. The explanatory research design includes popular methods, such as literature searches, in depth survey of every single problem, focus group research and case analysis research.

Explanatory research is such a type of research which is a pillar of the other type of research.

Descriptive

Descriptive research method is a research method used to describe a situation, subject, behaviour or phenomena. This research is used extensively in social science,

psychology and educational research. It is used to answer questions of who, what, when, where and how associated with a particular research question or problem. Descriptive studies are often described as studies that are concerned with finding out 'what is'. This research is sometimes referred to as non-experimental or correlational research. It studies the relationship among non-manipulated variables only.

In descriptive research, the investigator selects the relevant variables from the events/conditions that have already occurred or exist at present and analyzes their relationship without introducing any manipulation to the variables.

Its purpose in education is to study the present problem of the students, teachers, administration, curriculum, teaching, learning process and the like and to suggest some solutions to the problems. For example, Frederic Jones (1979) conducted a descriptive research on classroom discipline and used the collected information to formulate a system of discipline which now has been used by many teachers in their classroom to maintain discipline among students.

Descriptive research is important as the research studies describe the current and present educational phenomena, problems and/or opinions possessed by the teachers, students, etc, about their educational environment/scenario. This method of research is easy and direct, so it is very popular and widely used. Descriptive research not only describes the current problems but also many times suggests valuable solutions to the educational problems. This type of research is also very useful and helpful in developing the data collection tools, such as questionnaires, schedules, checklists, etc.

Aims of Research as a Scientific Activity

Research is often described as a problem-solving activity and as a result, descriptions of problems and solutions are an essential part of the scientific discourse, used to describe research activity. The problem solving activity helps a learner in constructing new scientific knowledge. The problem-solving activity helps students in developing decision-making skills, critical thinking, autonomy, communication, negotiations, team building and personal responsibility for learning.

Problem-solving can be used for improving research skills, increasing the knowledge base, developing divergent, creative, inventive thinking, developing convergent critical

thinking, fostering innovative solutions and presentation skills. The theory building as a discipline can be considered rich on the basis of scientific theories it has.

We must understand that the theories upon which scientific knowledge is based are only explanations of a particular phenomena as suggested by scientists. As such, there may be good or poor explanations, depending on the extent to which those explanations fit well with reality and consequently, there may be good or poor theories. The progress of science is marked by our progression, over time, from poorer theories to better theories through better observations using more accurate instruments and more informed logical reasoning.

We arrive at scientific laws or theories through a process of logic and evidence. Logic (theory) and evidence (observations) are the two and only two pillars upon which scientific knowledge is based. Theories provide meaning and significance to what we observe and observations help to validate or refine existing theory or construct a new theory. A theory describes the relationship among key variables for purposes of explaining a current state or predicting future occurrences.

The researchers make predictions about phenomena. In developing descriptions, researchers make predictions. Predictions are sometimes made in the form of hypothesis, which are tentative, testable predictions concerning the relationship between or among variables. Hypothesis are frequently derived from theories or interrelated sets of concepts that explain a body of data and make predictions.

Types of Research

Research is classified into three types on the basis of objectives or purposes the researchers intend to accomplish. These are:

Basic or Fundamental Research

Basic research is primarily concerned with the formulation of a theory or contribution to the existing body of knowledge. The major aim is to obtain and use the empirical data and evidence to formulate, expand or evaluate theory.

The purpose of basic research is generation of new knowledge for knowledge's sake.

Some have termed this research **pure** or **fundamental**, and are often used synonymously. Basic research draws its pattern and spirit from the physical sciences. It represents a rigorous and structured type of analysis. It employs careful sampling procedures, in order to extend the findings beyond the group or situation and thus develops theories by discovering proven generalisations or principles.

It ultimately leads to a clearer and sharper definition of laws, which govern nature and also the understanding of natural phenomena. Basic research is not directed towards the solution of immediate practical problems.

According to **Menon** (1982), Basic research by definition is at the frontier of our knowledge and the quality of work and achievements have to be judged by the entire international scientific community. It is characterised by high quality research designs and sophisticated techniques, involving originality, imagination and inventiveness.

Basic research or pure research does not usually generate findings that have immediate applications on a practical level. Fundamental research is driven by curiosity and the desire to expand knowledge in specific research areas. This type of research makes a specific contribution to the academic body of knowledge in the research area. Basic or fundamental research draws its pattern and spirit from the physical sciences.

It represents a rigorous and structured type of analysis. It employs careful sampling procedures, in order to extend findings beyond the group or situation and thus develops theories by discovering proven generalisations or principles. It ultimately leads to a clearer and sharper definition of laws, which govern nature and also the understanding of natural phenomena.

Fundamental research tends to contribute to the pool of fundamental knowledge in the research area. Basic research rarely helps the practitioners, directly with their everyday concerns, nevertheless it stimulates new ways of thinking that have the potential to revolutionise and dramatically improve how practitioners deal with a problem in the future. Basic research is essentially positive. It explains the phenomena as they are and as not they should be. It may verify or establish a new one. Its aim is to obtain empirical data and evidence to formulate expansion.

In the field of education, it involves concepts, such as motivation, reinforcement formation in learning and results into fundamental types of research. The best example in pure or basic research is in psychology, sociology and philosophy. Thus, the fundamental research focuses on one discipline. It involves a descriptive study of the research problem. In this type of research, reporting is done in technical language. It is concerned with generalisations and formulating theories. It aims to solve general problems.

Applied Research

It is directed towards the solution of immediate, specific and practical problems. It is performed in relation to actual problems and under the conditions in which they are found in practice. The goal of applied research in terms of adding scientific knowledge, acquires only a secondary position.

The applied research also uses the Scientific Method of Inquiry. It has most of the characteristics of basic research. Its methodology, however, is not as rigorous as the basic research. Moreover, its findings are to be evaluated in terms of local applicability and not in terms of universal validity. It has very definite practical objectives.

It is not the degree of creative process, involving originality, imagination and inventiveness that distinguishes basic from applied research, but at the clear practical direction of applied research. Most educational research is applied research, to develop generalisations about teaching-learning processes, instructional materials, the behaviour of children and ways to modify it and so on.

Steps in Applied Research

- A growing concern is studied and points of weaknesses in the system are isolated.
- Some of these weaknesses are selected for investigation.
- Investigation is followed by a solution, either in the laboratory or in the field.
- Solution is modified and installed, so that it works in practice. may
- Solution must be maintained by planning it in the organisation, so that it may become a permanent part of the system.

Action Research

The field of education has shown great interest in action research since the 1930s. In 1926, Buckingham used the concept of action research in education for the first time in his book Research for Teachers, but the credit goes to **Stephen M. Corey** for using the concept (action research) for the first time in the field of studying and solving educational problems.

Action Research is a method of systematic enquiry that teachers undertake as researchers of their own practice.

In the field of educational research, it is an applied research that the teachers, instructors and school administrators conduct to tackle and deal with classroom problems and improve their classroom practices.

According to Corey, "Action research is the process by which practitioners attempt to study their problems, scientifically in order to guide, correct and evaluate their decision and action. He further states that "action research is a process for studying problems by practitioners, scientifically to make decisions for improving their current practices".

According to Wallace, "action research is done by systematically collecting data on your everyday practice and analysing it in order to come to some decisions about what your future practice should be".

Best and Kahn write the purpose of action research is to improve school practices and at the same time to improve those who try to improve the practices to combine the research process, habits of thinking, ability to work harmoniously with others and professional spirit.

In India, action research was palpable in the 60s and 70s. However, the boost to research action came with the establishment of the District Institute of Education and Training (DIET). It is worth noting that action research is a research conducted through direct action and is primarily

focused on immediate application, not on the development of general broad theories or generalisations or applications. It studies the problems from the point of view of here

and now in one's local setting and its findings are evaluated in terms of local applicability, not in terms of universal applicability and validity.

Characteristics of Action Research

- In action research, teachers and the classroom practitioners feel and solve the problem. A practitioner undertakes both the function of diagnosis and therapeutic treatment.
- It is a scientific process for studying and solving the current practical problems of education.
- It tries to heighten self-awareness, self-criticality and analytical abilities of teachers and teacher educators.
- It tries to inject innovative approaches to teaching,
- It focuses on immediate application, not on the development of theory or on general application. Its findings are to be evaluated in terms of local applicability and not universal validity.
- It focuses on improving and modifying current practices.
- It is small scale and narrowly focused research, undertaken by teachers in a given context.
- It has also been referred to as "Research into practice by practitioners, for practitioners".

Objectives of Action Research

- To identify problem areas and improve the working conditions of a school.
- To develop scientific attitude among teachers, students, for principals and administrators, studying, understanding and solving their current academic problems.
- To bring potential of excellence in school functionaries.
- To raise the performance and aspiration level of the students, by generating a healthy environment for learning.

Areas of Action Research

The areas of action research can fall under the following categories

Related to Learner It can be on motivation, learning style, attention plan, concentration, etc.

Related to Teacher It can be on level of competencies, commitment, teaching style, attitude towards weak students, attitude towards notoriously inquisitive students, motivation, etc.

Related to Methodology It can be on activity based teaching, child-centered learning, play way approach, project approach, mediated learning, etc.

Related to Evaluation It can be on criterion referenced testing, diagnostic testing, formative testing, achievement testing, objective type testing, etc. Related to Curriculum It can be on mechanism of curriculum design, mechanism of curriculum construction, teacher's role in curriculum design and development, intended, transacted and hidden curriculum.

Steps in Action Research

Action research applies scientific thinking and methods to solve real life problems of immediate concern using following systematic steps

Identification of a Problem For action research, the problem emerges out of perceived dissatisfaction with the existing situation and also with the need for bringing out improvement in the situation.

Defining, Analysing and Explaining the Problem Once the problem is identified, it needs to be defined, analysed and explained in operational terms. It requires the understanding of various issues that surround the perceived problem.

Listing and Stating the Probable Causes This step involves the identification and stating of probable causes in unambiguous terms. Here, the practitioner also needs to spell out the possible strategies with which the problems can be solved in the best possible manner.

Development of Propositions/Formulation Hypothesis After stating the probable causes, it is necessary to develop a conceptual and functional relationship which tentatively aims to explain a given situation in the form of a hypothesis. This facilitates the process of conducting action research.

Planning, Development, Implementation and Evaluation of Action Research Plan This step involves planning and development of a suitable intervention programme, its implementation and examining its effectiveness. The duration of the intervention and modality of its implementation with respect to remediation measures, etc, need to be carefully planned.

Drawing Conclusions and Taking Decisions The impact of intervention programmes is judged on the basis of the conclusions, which are helpful in taking decisions.

Sharing of Results After the completion of the study, it is beneficial to share the results and findings with the colleagues, administrators and other functionaries. The sharing can be done through presentation in seminars, conferences and also publication in journals, newspapers etc.

Approaches to Educational Research

Educational research can take a wide variety of forms and serve many different purposes. Sometimes, it is located within social science disciplines, especially psychology and sociology and sometimes quite closely linked to educational practice, these include laboratory and classroom experiments, large scale surveys of the behaviour, attitudes, aptitudes, etc. of teachers, children's heads and others. Analysis of published and unpublished texts, both qualitative and quantitative and small scale investigations of particular institutions.

The **quantitative and qualitative research** approaches in education have arisen from different research needs. The quantitative research approach endlessly pursues facts, whereas the qualitative research approach recognises that the researcher's viewpoint is central. The **quantitative research approach** is used when the researcher desires to obtain entire trends or statistical truth in the research, while the qualitative research approach is used if the researcher wants to observe in detail by his/her own research view point.

Qualitative Research Approaches

The qualitative paradigm of research is based on the methods and techniques developed in the humanities and social sciences, whereas the quantitative paradigm is developed on the methods used in the natural sciences. Qualitative approaches seek to obtain qualitative information and thick descriptions of complex and dynamic processes, using holistic, naturalistic and non-manipulative methods.

The term 'qualitative approach' covers a variety of research methods, which have some common characteristics.

The four features of qualitative research identified by Bogdam and Biklen (1982) are

(i) "Qualitative research has the natural setting as the direct source of data and the researcher is the key instrument". As the setting influences human behaviour in which it occurs, researchers spend considerable time in the setting and study it in its entirety.

(ii) "Qualitative research is descriptive". It collects soft data consisting of rich descriptions, which cannot always be reduced to numbers and analysed statistically..

(iii) "Qualitative researchers are concerned with process, rather than simply with outcomes or products".

(iv) "Qualitative researchers tend to analyse their data inductively". They do not begin with specific questions to answer or hypothesis to test and then collect data, rather on the basis of the data collected and analysed, explanatory concepts or abstractions are built.

Quantitative Research Approaches

Quantitative research consists of those studies in which the data concerned can be analysed in terms of numbers. An example of quantitative research might be a study comparing two methods of teaching-reading to first-grade children, because the data used to determine which method is more successful will be a test score. The average score of the children receiving one method will be compared to the average score of children receiving the other method.

Research can also be qualitative i.e. it can describe events, persons and so forth scientifically, without the use of numerical data. A study consisting of interviews of mothers of handicapped infants, to determine how a child is an example of qualitative research. Such a study would carefully and logically analyse the responses of the mothers and report those responses that are consistent as well as areas of disagreement.

The quantitative research is based on a logical positive paradigm which utilises experimental methods and quantitative measures to test specific hypothetical generalisations with narrow angle lens. The quantitative research uses scientific methods with 'hard science trappings'. In this the researcher treats their subject of study as having an existence independent of themselves and without any intrinsic meaning.

Quantitative research is deductive in that it tests theories which have already been proposed. It aims at analysing representative and validated quantitative data, through the use of sophisticated statistical methods and software packages. In quantitative research the findings are based on identified statistical relationships and generalisable fundings. Using the principles of probability, quantitative research makes predictions representative of a large population.

Quantitative research uses a deductive approach. Here, the researcher formulates and uses hypothesis and theory with data. Thus, the quantitative research involves successive phases of hypothesis formulation, data collection, analysis and interpretation. Using a deductive approach, it seeks to establish facts, make predictions and test hypothesis that have already been stated.

In quantitative research, the experimenter has carefully planned the study including the tests or other data collection instruments, to be used. Each subject is studied in an identical manner and there is little room for human bias to create problems with the data.

Quantitative research is based more directly on its original plans and its results are more readily analysed and interpreted.

Designs in Educational Research

Research design is needed because it facilitates the smooth sailing of various research operations, thereby making research as efficient as possible, yielding maximal information with minimal expenditure of effort, time and money.

Research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. Research design is the conceptual structure, within which research is conducted, it constitutes the blueprint for the collection, measurement and analysis of data. As such, the design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data. Research design has a great bearing on the reliability of the results, arrived at and as such constitutes the firm foundation of the edifice of the research work.

Here, a research design related to historical descriptive and experimental are discussed as follows-

Historical Research

Historical research design analyses the past events and develops concepts and conclusions. It analyses the previous information or events minutely and tests their validity. The purpose of historical research design is to collect, verify and synthesise evidence from the past to establish facts that defend or refute a hypothesis. It describe what occurred in the past. The historical research design depends upon data observed by others rather than investigators.

It uses secondary sources and a variety of primary documentary evidence, such as diaries, official records, archives and non-textual information (maps, pictures, audio and visual recordings). The limitation is that the sources must be both authentic and valid. The historical research design is unobtrusive, the act of research does not affect the results of the study. The historical approach is well suited for trend analysis. Historical records can add important contextual background, required to more fully understand and interpret a research problem. There is often no possibility of researcher-subject interaction that could affect the findings. Historical sources can be used over and over to study different research problems or to replicate a previous study.

It shares a great deal with qualitative research in education even though it may make use of quantitative material like other forms of quantitative research, the concern is with natural behaviour in a real situation and the focus is on interpretation of what it means in the context. Unlike other forms of educational research, the historical research does not create data. Rather, the historian attempts to discover data that exists already in some form.

Historical research attempts to establish facts, so as to arrive at conclusions concerning past events. This is usually accompanied by an interpretation of these events and of their relevance to present circumstances and what might happen in the future. The main purpose of historical research, therefore, is to arrive at an accurate account of the past, so as to gain a clearer perspective of the present. This knowledge enables us at least partially to predict and control our future existence.

Historical research includes the delimitation of a problem, formulating research questions or tentative generalisations, gathering and analysing data and arriving at conclusions or generalisations based upon deductive-inductive reasoning. However, the historian faces greater difficulty than researchers in any other field. Historical data is a closed class of data, located along a fixed temporal locus and the historian has no choice of sampling his data and he is supposed to include every type of data that comes his way. Historical research is not based upon experimentation, but upon reports of observation, which cannot be repeated. The historian handles unique types of data which cannot be repeated. They are mainly traces of past events. The historian must depend upon the reported observations of others, often witnesses of doubtful competence and sometimes of doubtful objectivity.

Types of Historical Research

Various types of historical researches are

- **Types of Historical Research**
    1. Bibliographic Research
    2. Legal Research
    3. Studying the History of Ideas

4. Studying the History of Institutions

Bibliographic Research It aims at determining and presenting truthfully, the important facts about the life, character and achievement of important educators.

Legal Research It is of immense value and interest to educational administrators. It aims to study the legal basis of educational institutions, run by different religions and castes and relations between central and state governments, with regard to education, legal status of teachers, etc.

Studying the History of Ideas It involves the tracing of major philosophical or scientific thoughts from their origins through their different stages of development. It also aims at tracing changes in popular thoughts and attitudes over a given period of time.

Studying the History of Institutions Studying the history of some prominent schools, universities and other educational institutions also provide numerous opportunities for significant historical research. When studying such history, the same general method applied as for the study of an educator's life.

Steps of Historical Research

The steps involved in undertaking a historical research are not different from other forms of research, but the nature of the subject matter presents a researcher some peculiar problems and requires him to apply some special standards and techniques.

In general, historical research involves the following steps.

Selection of the Problem A researcher may select a problem, pertaining to the history of individuals, institutions, organisations, laws, curriculum, administration, textbooks, teacher education, equipment, important concepts and thoughts that have influenced education during a specific period of time in a given culture or sub-culture, determined by religion, caste, sex, age or work.

Formulation of Hypothesis The hypothesis that the researcher constructs for historical research is useful in explaining events, conditions or phenomenons of the historical period in question. Best and Kahn have also remarked that, although hypothesis are not always explicitly stated in historical investigations, they are usually

implied. The historian gathers evidence and carefully evaluates its trustworthiness. If the evidence is compatible with the consequences of the hypothesis, it is confined.

Collection of Data After formulation of hypothesis, the researcher collects the data through primary and secondary sources. It involves comprehensive gathering of data.

Interpretation of Data After the data have been collected and criticised, the researcher turns himself to the task of interpretation of these data in the light of this problem. As historical data has unique nature, the task of interpretation becomes complicated and acquires special significance. It requires great ingenuity and imagination on the part of the researcher.

The researcher in the historical type of investigation must be very cautious while dealing with cause and effect relationships. Here, his position is entirely different from a researcher of physical sciences, who deals with very simple isolated laboratory phenomena. The researcher in the historical types of investigation should not only establish facts, but also determine trends which the data may suggest and to draw inferences from the data. His goal should be one of synthesis and interpretation rather than mere summation.

Value of Historical Research

Knight (1934), Scates (1941) *and Good has given the following analysis of the value of historical research:-*

- A knowledge of the history of schools and other educational agencies is an important part of the professional training of the teacher or the school administrator.
- Much of the work of the school is traditional. The nature of the work of the teacher and the school administrator is restrictive and tends to foster prejudices in favour of familiar methods. The history of education is the sovereign solvent of educational prejudices.
- The history of education enables the educational worker to detect fads and frills in whatever form, they may appear and it serves as a necessary preliminary to educational reform.

- Only in the light of their origin and growth, can the numerous educational problems of the present be viewed sympathetically and without bias by the teacher, the school administrator or the public.
- The history of education shows how the functions of social institutions shift and support and control of education have changed from very simple and local arrangements to those that are now somewhat centralised and complex.
- It inspires respect for sound scholarship and reverence for great teachers.
- The history of education is an ally in the scientific study of education rather than a competition. It serves to present the educational ideals and standards of other times and it enables social workers to avoid mistakes of the past.

Experimental Research

In descriptive research, a researcher may analyse the data he has collected and discover that different variables are related. The relationships between the variables can be interpreted in several ways. Experimental research on the other hand, provides for such control and therefore, establishes a systematic and logical association between manipulated factors and observed effects.

The researcher defines a problem and proposes a tentative answer or hypothesis. He tests the hypothesis and accepts or rejects it.

John Stuart Mill (**1846**) defined the law of the single variable in his work methods of experimental inquiry.

He stated the following five canons or rules of experimental research-

- The Method of Agreement
- The Method of Difference
- The Joint Method
- The Method of Residues
- The Method of Concomitant Variations

These rules served as guides in the design of early experiments and are now used chiefly as guides in planning of experiments.

Types of Experimental Research Designs

There are various types of experimental research designs. They vary in complexity and adequacy. The selection of a particular design depends upon such factors, as the nature and purpose of the experiment, the type of the variables to be manipulated, the nature of the data, the facilities or the conditions for carrying out the experiment and the competence of the experimenter. Although, the designs can be combined into various ways.

They are broadly classified as under

- Pre-experimental designs
- True experimental designs
- Quasi experimental designs

These designs resemble one another from the point of view of purposes and their adherence to the principles of experimentation. They differ in the degree of accuracy with which they attack the problem or meet the essential criteria of control, manipulation, observations and replication.

Pre-Experimental Research Design It is the simplest form of experimental research design. In this design, a group or various groups are kept under observation, after factors are considered for cause and effect. It is generally conducted to understand whether further investigation needs to be carried out on the target group(s) due to which it is considered to be cost effective.

The pre-experimental design is further divided into three types such as

- One shot case study design.
- One group, pre-test and post test research design.
- Static group comparison.

True Experimental Research Designs This design is the most accurate form of experimental research design as it relies on statistical analysis to prove or disprove a hypothesis. It is the only type of experimental design that can establish a cause effect relationship, within groups. In a true experiment, there are three factors which needs to be satisfied.

They are-

Control group (group of participants for research that are familiar to the experimental group, but experimental rules do not apply to them) and experiment group (research participants on whom the experimental research rules do apply).

Variables which can be manipulated by the researcher.

Random distribution. These designs are mostly used for experimental research in education because they seek to control the main effects of history, maturation, testing, measuring instruments, statistical regression, differential selection and mortality.

Quasi Experimental Research Design The word 'quasi' indicates 'resemblance'. A quasi experimental research design is similar to experimental research, but is not exactly that. The difference between the two is the assignment of a control group. In quasi experimental research design, an independent variable is manipulated but the participants of a group are not randomly assigned as per conditions. The independent variable is manipulated before calculating the dependent variable and so directionally the problem is eliminated. Quasi research is used in field settings, where random assignment is either irrelevant or not required.

Characteristics of Experimental Research

- The experimental researcher randomly assigns participants to groups or other units.
- They provide control over extraneous variables, to isolate the effects of the independent variable on the outcomes.
- They physically manipulate the treatment conditions for one or more groups.
- They then measure the outcomes for the groups to determine if the experimental treatment had a different effect than the non-experimental treatment.
- The researcher designed an experiment to reduce the threats to internal and external validity.

Thus, the experimental research designs are concerned with examination of the effect of independent variables on the dependent variable, where the independent variable is manipulated through treatment or intervention(s) and the effect of those interventions is observed on the dependent variable.

Value of Experimental Research

It is used to determine and evaluate the adequacy and effectiveness of the educational and instructional objectives, through the measurement of their outcomes. After evaluating the efficacy of objectives, the suggestions are made for the formulation, execution and modification of educational programmes and classroom practices. The experimental research is not considered a precise method of research in the field of education because of the complex nature of the human beings and problems of controlling the extraneous variables. However, in spite of all such difficulties, experimentation has been put to various uses in solving educational problems.

Descriptive Research Design

Descriptive research studies are those studies, which are concerned with describing the characteristics of a particular individual or of a group and studies concerned with specific prediction, with narration of facts and characteristics concerning individual or group of situations are all examples of descriptive research studies. Most of the social research comes under this category.

From the point of view of the research design in descriptive studies, the researcher must be able to define clearly what he wants to measure and must find adequate methods for measuring it along with a clear cut definition of 'population' he wants to study. Since, the aim is to obtain complete and accurate information in the said studies, the procedure to be used must be carefully planned. The research design must make enough provision for protection against bias and maximum reliability, with due concern for the economical completion of the research study. The design in such studies must be rigid and not flexible.

Descriptive research design aims to observe, describe and document aspects of a situation as it naturally occurs without any manipulation or control. Descriptive studies are designed to gain more information about characteristics with a select or a particular field of study. These studies provide a picture of a situation as it occurs in a natural setting.

The descriptive design does not involve manipulation of variables. Variables are studied as they exist in the natural world. Descriptive research designs are used to

develop theories, identify problems with current practices, make judgements and determine alternative solutions for the existing practices.

In case of descriptive studies, bias is prevented through operational definitions of variables, by choosing a large sample size, by using random sampling techniques. By means of using valid and reliable tools of measurement and formal data collection procedures. Thus, through descriptive designs, description of variables leads to an interpretation of the theoretical meaning of the findings and development of hypothesis. The descriptive research design is a Scientific Method, which involves observing and describing the behavior of a subject without influencing it in any way.

Descriptive research design is a valid method for researching specific subjects and as a precursor to more quantitative studies. It is the most widely used research design. The means of obtaining information, include the use of the questionnaires and personal interviews with the aid of study guide or interview schedule and observation either participatory or not.

Descriptive study determines and reports the way things are. It has no control over what is and it can only measure what already exists.

Descriptive research has undoubtedly been the most popular and widely used research method in education. It helps to explain educational phenomena in terms of the conditions or relationships that exist held by students, teachers, parents and experts processes that are going on effects that are evident or trends that are developing. Because of the apparent ease and directness of this method, a researcher can gather information in terms of an individual's opinion about some issue by a simple questionnaire.

Descriptive studies are closely associated with observational studies, but they are not limited with Observation Data Collection Method. Case studies and surveys can also be specified as popular data collection methods, used with descriptive studies. Descriptive research is of great importance in solving problems about children, school organisation, supervision and administration, curriculum, teaching methods and evaluation.

Thus, it can be said that the descriptive research design is a Scientific Method which involves observing and describing the behavior of a subject, without influencing it in any way.

Educational research

Research

Research is an art of scientific investigation. It is regarded as a systematic effort to gain new knowledge, so educational research is the way in which one acquires dependable and useful information about the educational process. Research is the voyage of discovery. It is the quest for answers to unsolved problems. Research may be defined as the application of the scientific method in the study of problems. The terms 'Research' and 'Scientific Method' are sometimes used interchangeably. Research is considered to be a more structured and systematic process of carrying on a Scientific Method of Analysis that is directed towards discovery and development of an organised body of knowledge. The only difference which lies between research and Scientific Method is that it is possible to employ Scientific method without research, but it is not possible to conduct any research without employing Scientific method..

Educational research is an application of Scientific method to the study of educational problems

Concept and Definitions of Research

The term ‘research' is a combination of two words ‘re' and 'search'. ‘Re means again and again' and 'search' means 'to explore something new'. Research is a process of observing the phenomenon (i.e. event, anything and process, etc) again and again. Collecting the data and drawing scientific conclusions on the basis of those data. Research is a search for knowledge. It is a systematic effort to gain new knowledge in any kind of discipline.

According to **Advanced Learner's Dictionary of Current English** (**1952**), "Research is a careful investigation or inquiry specially through search for new facts in any branch of knowledge".

According to **Redman and Morey,** "Research is a systematised effort to gain knowledge".

Research is an objective, impartial, empirical, logical analysis and recording of controlled observations that may lead to the development of generalisations, principles or theories, resulting to some extent in prediction and control of events that may be consequences or causes of specific phenomena.

Research is required in any field to come up with new theories or modify, accept or nullify the existing theory, but when it seeks a solution of any educational problems it leads to educational research.

Educational Research

Educational research refers to a systematic attempt to gain a better understanding of the educational process, generally with a view in improving its efficiency. It is an application of Scientific Method to the study of educational problems. The main concerns of educational research are to understand, explain, predict and control human behaviour in individual and social situations, so that events or situations can be improved further.

Educational research primarily aims at conceptualisation and theorisation of the processes and practices so as to understand the educational events and phenomena. In education, growth in knowledge by experience is very slow and accidental. We need solutions based on research, so that the coming generation is not left with ignorance and prejudice.

"Educational research represents an activity directed towards the development of an organised body of scientific knowledge about the events with which the educators are concerned of central importance are the behaviour 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 provide in order to produce desired aspects of learned behaviour among young people who attend school (Travers, 1985)".

Definitions of Educational Research

According to Mouly, "Educational research is the systematic application of Scientific Method for solving educational problems".

According to Whitney, "Educational research aims at finding out solutions to educational problems by using the Scientific Philosophical Method".

Monroe states that "The final purpose of educational research is to ascertain principles and develop procedures in the field of education".

Since, education is a behavioural science, the main aim of educational research is to solve educational problems in systematic and scientific manner, to understand, explain, predict and control human behaviour in educational settings. It is a process of development of an organised and useful body of scientific knowledge with which the academicians are concerned. It tries to gather facts about a child's personality, learning process, emotional development, social adjustment and skills. It also tries to study a child's stage of growth and development and the factors influencing these with the aim of improving the teaching-learning process in the classroom.

Characteristics of Educational Research

- It is highly purposeful.
- It attempts to solve educational problems.
- It is based upon observable experience or empirical evidence.
- It involves gathering new data from primary to first hand source or using existing data for new purposes.
- It attempts to organise data quantitatively and qualitatively to arrive at statistical inferences.
- It deals with educational problems regarding students and teachers as well.
- It emphasizes the development of generalisation, principles or theories which will help in understanding, prediction and control.

- It demands subjective interpretation and deductive reasoning in some cases.
- It generally employs carefully designed procedures and rigorous analysis.
- It discovers new facts in a new perspective i.e. it generates new knowledge.

Need and Importance of Educational Research

The importance and need for research in education was acknowledged for the first time in the Government Resolution of the Indian Educational Policy in 1913, but it was only after independence in 1947 that a planned and systematic effort was made to promote educational and/or classroom research by establishing national and state organisations for the development of elementary and secondary education, research in the development of curriculum and textbooks and evaluation procedures. Research in education is essential for providing useful and dependable knowledge through which the process of education can be made more effective.

Education is considered as much a science as an art. As a science, it has a corpus of knowledge which concerns the nature of human mind, its growth and development, theories of administration and supervision, educational programmes, curricula and practices. Since education depends on a corpus of knowledge, there is a need to add new knowledge which has to be scientific, to enrich and improve education with different dimensions.

Research helps in clarification and re-interpretation of existing knowledge which is also necessary in education. Education has strong roots in the field like philosophy, history, economics, psychology and sociology. It is through an intensive process of scientific inquiry about the philosophical, historical, economical, psychological and sociological impact on various aspects of education that sound educational theories can be established. There is a need for educational research because of the changing conception of education.

The International Commission on the Development of Education in its report 'Learning Be'.

UNESCO (1972) emphasises education from now can no longer be defined in related to a fixed content, which has to be assimilated but must be conceived of as a process in the human being. They can learn to express themselves to communicate and to question the world, through his/her various experiences and increasingly all the time try to fulfill themselves through constant learning. So, the limits of educational research have to be extended from the formal and conventional modes of education to the non-formal and innovative systems based on ecological and cybernetics models.

Purpose of Educational Research

The purpose of educational research is to develop new knowledge about the teaching-learning situation, to improve the educational practice.

Research in education are conducted for fulfilling different purposes, which are

- To solve the immediate local problems in education.
- To ascertain principles and develop procedures for use in the field of education, to determine to what extent we should go in educating children and adults.
- To answer the questions related to education through reflective thinking.
- To discover new applications of principles and laws in the field of education.

***Creswell** (2002) stated the following reasons, describing the various purposes of educational research*

- **Improve Practice** Research can suggest ways of improving practice that have been verified with many applications and by many different types of people which is difficult for practitioners.
- **Expand Knowledge** Research can allow us to extend what we know in ways we were never convinced.
- **Address Gaps in Knowledge** Research can address areas in which we know little, such as the effect of online versus traditional classroom teaching.
- **Replicate Knowledge Research** can act as a test to verify previous findings.
- **Add Voices of Individuals to Knowledge** Research can add important perspectives for different learning types. Much of educational research prior to the 80s was based on middle to upper class males. This is certainly not reflective

of our increasingly heterogeneous students and research helps revise theory and practice to reflect different students' needs.

Scope of Educational Research

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

Educational Psychology

Research in this field, helps the teacher to understand the child in the classroom in order to improve the teaching-learning process.

This research provides the following information

- Relative effectiveness of socio-cultural forces on the development of children.
- Usefulness of learning theories in various educational settings.
- Identification of factors conclusive to learning.
- Role of physical/intellectual efficiencies and defects in learning.
- Role of teachers and textbooks in removing delinquency in adults and so on.
- Conditions conducive to effective learning, factors helpful in promoting memory and concept formation.
- Cognitive and non-cognitive factors, like intelligence, aptitudes, attitudes, creativity, interest, motivation, personality traits, needs and adjustment of pupils provide a promising field of research in educational psychology.

Philosophy of Education

- Role of logic in various areas of education from concept formation to theory development.
- Role of knowledge, beliefs and values in developing educational theories.
- Role of ideologies and religion for improving educational practices.
- Development of a practical philosophy in the Indian context.
- Finding new implications of ancient Indian philosophies in the present scenario.
- Re-organisation of social structure and educational system in India.
- Determining the contribution of different philosophers and their implications.

Sociology of Education

- Effects of changes in the demographic structure on education.
- Effects of New Education Policy (1986), on expansion of education and employment.
- Role of educational institutions in bringing about social change and vice-versa.
- Role of social and cultural factors in bringing about social change and vice-versa.
- Role of teachers as agents of social change, modernisation and social equity.
- Minorities and their problems.
- Reservation policy.

Comparative Education

- Administrative and educational policies of different countries and their impact on the society as a whole. Impact of various systems of education in the world on one another.
- Comparison of educational progress in various countries of the world.
- Impact of economic progress on education.
- Allocation of budget on education in different countries and its impact on educational progress and so on.

Guidance and Counselling

- Role of family and neighbourhood in making the children adjusted in the society.
- Construction of tools for diagnosing adjustment problems of students.
- Methodology of vocational guidance for children belonging to different strata of society.
- Adaptation of foreign tests and inventories to Indian situations.

Educational Technology

- Development of new teaching strategies by action research.
- Role of technology in teaching-learning process.
- Application of psychology to solve teaching problems.
- Development of new audio-visual aids and so on.

- Applications of technological equipment and laws in education.

Educational Management and Administration

- Problems of educational administration in India and its impact on performance.
- Impact of educational planning and legislation on performance.
- Techniques to improve the efficiency of school organisation and inspection systems.
- Role of teachers and principals in enhancing performance of students.
- Supervision and performance.
- Contribution of NGOs to education.

Inclusive Education

The inclusive classroom relies on the simultaneous use of differentiated instruction and assessment techniques for maximizing a student's learning potential by tailoring and teaching to every student. Although many educational innovations take shape and undergo testing in the classroom, research is necessary to substantiate these new techniques beyond anecdotal evidence. This helps broaden their exposure, boost their inclusion in professional development programmes for teachers and encourages widespread implementation.

Curriculum Development

- Structure of the curriculum in India from the primary to higher level.
- Analysis and organisation of curriculum in various subjects.
- Analysis of textbooks at different stages of learning.
- Modernisation of curriculum in relation to changing needs.
- Inculcation of national values through curriculum development.

Scientific Methods

Karl Pearson held that "The Scientific method is one and same in the branches (of science) and that method is the method of all logically trained minds the unity of all

sciences consists alone in its methods, not its material the man who classifies facts of any kind, who sees their mutual relation and describes their sequences, is applying the scientific method and is a man of science." This method is the pursuit of truth as determined by logical considerations. The ideal of science is to achieve a systematic interrelation of facts. Scientific method attempts to achieve the ideal by experimentation, observation, logical arguments from accepted postulates and combination of these three in varying proportions. This method encourages a rigorous method wherein the researcher is guided by the rules of logical reasoning, a method wherein an investigation proceeds in an orderly manner and a method that implies internal consistency.

Educational research is the application of Scientific method to the study of educational problems. The Scientific method has acquired highly specific meaning in modern science.

Scientific method stands for systematic and acceptable set of procedures, used for generating new knowledge, the validity of which is self-evident because of the logical constructs implied in their ordering. To be termed scientific, a method of inquiry is commonly based on empirical or accessible evidence subject to specific principles of reasoning.

Scientific methods operate primarily at the empirical level of research i.e. how to make observations, analyse and interpret observations. Very little of this method is directly pertinent to the theoretical level, which is really the more challenging part of scientific research.

According to **GA Lundburg**, "Scientific method consists of systematic observation, classification and interpretation of data".

According to **Barry F Anderson**, "Scientific method is a set of rules, comprising operational definition, generally controlled observation, repeated observation, confirmation and consistency".

Characteristics of Scientific Method

Replicability It means research must be replicable or repeated. The research is replicable when an independent group of researchers can copy the same process and arrive at the same results as the original study. When a study cannot be replicated it suggests that our understanding of the study or our methods of testing are currently insufficient.

Precision: It refers to theoretical concepts, which are often hard to measure, these must be defined with such precision that others can use those definitions to measure those concepts and test that theory.

Falsifiability It means a theory must be stated in a way that it can be disproven. Theories that cannot be tested or falsified are not scientific theories, any such knowledge is not scientific knowledge. A theory that is specified in imprecise terms or whose concepts are not accurately measurable cannot be tested and is therefore not scientific.

Parsimony When there are numerous explanations of a phenomena, scientists must always accept the simplest or logically most economic explanation. This concept is called parsimony. Parsimony prevents from pursuing overly complex theories with an endless number of concepts and relationships that may explain a little bit of everything but nothing in particular.

Steps of Scientific Method

Identification and Definition of the Problem A scientific inquirer starts with the identification of a problem that is in need of solution. The problem identified must be defined in such a manner that observation or experimentation in the natural world can provide a solution.

Formulation of a Hypothesis Once the problem is defined, the next step is to formulate the hypothesis, which provides an intelligent guess for the solution of the problem. It requires a critical review of the knowledge or information related to the problem.

Implication of Hypothesis through Deductive Reasoning The next step after the formulation of a hypothesis is to deduce the implications of the suggested hypothesis t.e. what would be observed if the hypothesis is true.

Collection and Analysis of Evidence The deduced implications of the hypothesis are tested by collecting relevant evidence related to them through observation, testing and experimentation.

Verification, Rejection or Modification of Hypothesis Once the evidence has been collected and analysed, the results are analysed in order to verify whether the evidence supports the hypothesis. It may be noted that the characteristic of Scientific method is not to prove the hypothesis in terms of absolute truth but to conclude that the evidence does or does not support the hypothesis.

Types of Scientific Method

Exploratory

Exploratory research method is defined as a research, used to investigate a problem which is not clearly defined. It is conducted to have a better understanding of the existing problem, but will not provide conclusive results. In this, a researcher starts with a general idea and uses this research as a medium to identify issues that can be the focus for future research. Such research is usually carried out when the problem is at a preliminary stage. It is often referred to as the Grounded Theory Approach or interpretive research, as it is used to answer questions of what, why and how. The exploratory studies are also conducted to develop, refine and/or test measurement tools and procedures.

This type of research is applied when there are a number of factors studied within time constraints and it is possible to define each problem, then this type of research is required. In 1994, exploratory research means "to get a clear knowledge of seeking new approaches, new ideas and assess in innovative manner".

The objective of the exploratory research is to define the problems accurately, clarify concepts, collect details and discard informal and unnecessary ideas after the framing of the hypothesis of the study. Literature, survey, focus group and case studies are

usually used to carry out exploratory research. Exploratory research may develop hypothesis, but it does not seek to test them (Darabi, 2007).

Explanatory

This research method has been used by many researchers in explaining theoretical explanations. The researcher is interested in this approach in giving real explanations, predicting the results, controlling the phenomena and searching the causes for the happenings. This approach depicts the relationship between cause and effect variables. This approach focuses on the changes in one variable affects the change in other variables.

This research is conducted in order to help us find the problem that was not studied before in depth. It is actually a type of research design which focuses on explaining the aspect of your study in a detailed manner. Explanatory research is conducted in order to help us find the problem that was not studied before in depth. The explanatory research is not used to give us some conclusive evidence but helps us in understanding the problem more efficiently. Research allows the researcher to tackle such problems where no or less research has been done.

The purpose of the explanatory research method is to increase the understanding of a researcher on a certain subject. It gives flexibility of sources, means published literature or data are commonly used in explanatory type of research. The explanatory research design includes popular methods, such as literature searches, in depth survey of every single problem, focus group research and case analysis research.

Explanatory research is such a type of research which is a pillar of the other type of research.

Descriptive

Descriptive research method is a research method used to describe a situation, subject, behaviour or phenomena. This research is used extensively in social science, psychology and educational research. It is used to answer questions of who, what, when, where and how associated with a particular research question or problem. Descriptive studies are often described as studies that are concerned with finding out

'what is'. This research is sometimes referred to as non-experimental or correlational research. It studies the relationship among non-manipulated variables only.

In descriptive research, the investigator selects the relevant variables from the events/conditions that have already occurred or exist at present and analyzes their relationship without introducing any manipulation to the variables.

Its purpose in education is to study the present problem of the students, teachers, administration, curriculum, teaching, learning process and the like and to suggest some solutions to the problems. For example, Frederic Jones (1979) conducted a descriptive research on classroom discipline and used the collected information to formulate a system of discipline which now has been used by many teachers in their classroom to maintain discipline among students.

Descriptive research is important as the research studies describe the current and present educational phenomena, problems and/or opinions possessed by the teachers, students, etc, about their educational environment/scenario. This method of research is easy and direct, so it is very popular and widely used. Descriptive research not only describes the current problems but also many times suggests valuable solutions to the educational problems. This type of research is also very useful and helpful in developing the data collection tools, such as questionnaires, schedules, checklists, etc.

Aims of Research as a Scientific Activity

Research is often described as a problem-solving activity and as a result, descriptions of problems and solutions are an essential part of the scientific discourse, used to describe research activity. The problem solving activity helps a learner in constructing new scientific knowledge. The problem-solving activity helps students in developing decision-making skills, critical thinking, autonomy, communication, negotiations, team building and personal responsibility for learning.

Problem-solving can be used for improving research skills, increasing the knowledge base, developing divergent, creative, inventive thinking, developing convergent critical thinking, fostering innovative solutions and presentation skills. The theory building as a discipline can be considered rich on the basis of scientific theories it has.

We must understand that the theories upon which scientific knowledge is based are only explanations of a particular phenomena as suggested by scientists. As such, there may be good or poor explanations, depending on the extent to which those explanations fit well with reality and consequently, there may be good or poor theories. The progress of science is marked by our progression, over time, from poorer theories to better theories through better observations using more accurate instruments and more informed logical reasoning.

We arrive at scientific laws or theories through a process of logic and evidence. Logic (theory) and evidence (observations) are the two and only two pillars upon which scientific knowledge is based. Theories provide meaning and significance to what we observe and observations help to validate or refine existing theory or construct a new theory. A theory describes the relationship among key variables for purposes of explaining a current state or predicting future occurrences.

The researchers make predictions about phenomena. In developing descriptions, researchers make predictions. Predictions are sometimes made in the form of hypothesis, which are tentative, testable predictions concerning the relationship between or among variables. Hypothesis are frequently derived from theories or interrelated sets of concepts that explain a body of data and make predictions.

Types of Research

Research is classified into three types on the basis of objectives or purposes the researchers intend to accomplish. These are:

Basic or Fundamental Research

Basic research is primarily concerned with the formulation of a theory or contribution to the existing body of knowledge. The major aim is to obtain and use the empirical data and evidence to formulate, expand or evaluate theory.

The purpose of basic research is generation of new knowledge for knowledge's sake.

Some have termed this research **pure** or **fundamental**, and are often used synonymously. Basic research draws its pattern and spirit from the physical sciences. It represents a rigorous and structured type of analysis. It employs careful sampling

procedures, in order to extend the findings beyond the group or situation and thus develops theories by discovering proven generalisations or principles.

It ultimately leads to a clearer and sharper definition of laws, which govern nature and also the understanding of natural phenomena. Basic research is not directed towards the solution of immediate practical problems.

According to **Menon** (1982), Basic research by definition is at the frontier of our knowledge and the quality of work and achievements have to be judged by the entire international scientific community. It is characterised by high quality research designs and sophisticated techniques, involving originality, imagination and inventiveness.

Basic research or pure research does not usually generate findings that have immediate applications on a practical level. Fundamental research is driven by curiosity and the desire to expand knowledge in specific research areas. This type of research makes a specific contribution to the academic body of knowledge in the research area. Basic or fundamental research draws its pattern and spirit from the physical sciences.

It represents a rigorous and structured type of analysis. It employs careful sampling procedures, in order to extend findings beyond the group or situation and thus develops theories by discovering proven generalisations or principles. It ultimately leads to a clearer and sharper definition of laws, which govern nature and also the understanding of natural phenomena.

Fundamental research tends to contribute to the pool of fundamental knowledge in the research area. Basic research rarely helps the practitioners, directly with their everyday concerns, nevertheless it stimulates new ways of thinking that have the potential to revolutionise and dramatically improve how practitioners deal with a problem in the future. Basic research is essentially positive. It explains the phenomena as they are and as not they should be. It may verify or establish a new one. Its aim is to obtain empirical data and evidence to formulate expansion.

In the field of education, it involves concepts, such as motivation, reinforcement formation in learning and results into fundamental types of research. The best example in pure or basic research is in psychology, sociology and philosophy. Thus, the fundamental research focuses on one discipline. It involves a descriptive study of the

research problem. In this type of research, reporting is done in technical language. It is concerned with generalisations and formulating theories. It aims to solve general problems.

Applied Research

It is directed towards the solution of immediate, specific and practical problems. It is performed in relation to actual problems and under the conditions in which they are found in practice. The goal of applied research in terms of adding scientific knowledge, acquires only a secondary position.

The applied research also uses the Scientific Method of Inquiry. It has most of the characteristics of basic research. Its methodology, however, is not as rigorous as the basic research. Moreover, its findings are to be evaluated in terms of local applicability and not in terms of universal validity. It has very definite practical objectives.

It is not the degree of creative process, involving originality, imagination and inventiveness that distinguishes basic from applied research, but at the clear practical direction of applied research. Most educational research is applied research, to develop generalisations about teaching-learning processes, instructional materials, the behaviour of children and ways to modify it and so on.

Steps in Applied Research

- A growing concern is studied and points of weaknesses in the system are isolated.
- Some of these weaknesses are selected for investigation.
- Investigation is followed by a solution, either in the laboratory or in the field.
- Solution is modified and installed, so that it works in practice. may
- Solution must be maintained by planning it in the organisation, so that it may become a permanent part of the system.

Action Research

The field of education has shown great interest in action research since the 1930s. In 1926, Buckingham used the concept of action research in education for the first time in his book Research for Teachers, but the credit goes to **Stephen M. Corey** for using the

concept (action research) for the first time in the field of studying and solving educational problems.

Action Research is a method of systematic enquiry that teachers undertake as researchers of their own practice.

In the field of educational research, it is an applied research that the teachers, instructors and school administrators conduct to tackle and deal with classroom problems and improve their classroom practices.

According to Corey, "Action research is the process by which practitioners attempt to study their problems, scientifically in order to guide, correct and evaluate their decision and action. He further states that "action research is a process for studying problems by practitioners, scientifically to make decisions for improving their current practices".

According to Wallace, "action research is done by systematically collecting data on your everyday practice and analysing it in order to come to some decisions about what your future practice should be".

Best and Kahn write the purpose of action research is to improve school practices and at the same time to improve those who try to improve the practices to combine the research process, habits of thinking, ability to work harmoniously with others and professional spirit.

In India, action research was palpable in the 60s and 70s. However, the boost to research action came with the establishment of the District Institute of Education and Training (DIET). It is worth noting that action research is a research conducted through direct action and is primarily

focused on immediate application, not on the development of general broad theories or generalisations or applications. It studies the problems from the point of view of here and now in one's local setting and its findings are evaluated in terms of local applicability, not in terms of universal applicability and validity.

Characteristics of Action Research

- In action research, teachers and the classroom practitioners feel and solve the problem. A practitioner undertakes both the function of diagnosis and therapeutic treatment.
- It is a scientific process for studying and solving the current practical problems of education.
- It tries to heighten self-awareness, self-criticality and analytical abilities of teachers and teacher educators.
- It tries to inject innovative approaches to teaching,
- It focuses on immediate application, not on the development of theory or on general application. Its findings are to be evaluated in terms of local applicability and not universal validity.
- It focuses on improving and modifying current practices.
- It is small scale and narrowly focused research, undertaken by teachers in a given context.
- It has also been referred to as "Research into practice by practitioners, for practitioners".

Objectives of Action Research

- To identify problem areas and improve the working conditions of a school.
- To develop scientific attitude among teachers, students, for principals and administrators, studying, understanding and solving their current academic problems.
- To bring potential of excellence in school functionaries.
- To raise the performance and aspiration level of the students, by generating a healthy environment for learning.

Areas of Action Research

The areas of action research can fall under the following categories

Related to Learner It can be on motivation, learning style, attention plan, concentration, etc.

Related to Teacher It can be on level of competencies, commitment, teaching style, attitude towards weak students, attitude towards notoriously inquisitive students, motivation, etc.

Related to Methodology It can be on activity based teaching, child-centered learning, play way approach, project approach, mediated learning, etc.

Related to Evaluation It can be on criterion referenced testing, diagnostic testing, formative testing, achievement testing, objective type testing, etc. Related to Curriculum It can be on mechanism of curriculum design, mechanism of curriculum construction, teacher's role in curriculum design and development, intended, transacted and hidden curriculum.

Steps in Action Research

Action research applies scientific thinking and methods to solve real life problems of immediate concern using following systematic steps

Identification of a Problem For action research, the problem emerges out of perceived dissatisfaction with the existing situation and also with the need for bringing out improvement in the situation.

Defining, Analysing and Explaining the Problem Once the problem is identified, it needs to be defined, analysed and explained in operational terms. It requires the understanding of various issues that surround the perceived problem.

Listing and Stating the Probable Causes This step involves the identification and stating of probable causes in unambiguous terms. Here, the practitioner also needs to spell out the possible strategies with which the problems can be solved in the best possible manner.

Development of Propositions/Formulation Hypothesis After stating the probable causes, it is necessary to develop a conceptual and functional relationship which tentatively aims to explain a given situation in the form of a hypothesis. This facilitates the process of conducting action research.

Planning, Development, Implementation and Evaluation of Action Research Plan This step involves planning and development of a suitable intervention programme, its

implementation and examining its effectiveness. The duration of the intervention and modality of its implementation with respect to remediation measures, etc, need to be carefully planned.

Drawing Conclusions and Taking Decisions The impact of intervention programmes is judged on the basis of the conclusions, which are helpful in taking decisions.

Sharing of Results After the completion of the study, it is beneficial to share the results and findings with the colleagues, administrators and other functionaries. The sharing can be done through presentation in seminars, conferences and also publication in journals, newspapers etc.

Approaches to Educational Research

Educational research can take a wide variety of forms and serve many different purposes. Sometimes, it is located within social science disciplines, especially psychology and sociology and sometimes quite closely linked to educational practice, these include laboratory and classroom experiments, large scale surveys of the behaviour, attitudes, aptitudes, etc. of teachers, children's heads and others. Analysis of published and unpublished texts, both qualitative and quantitative and small scale investigations of particular institutions.

The **quantitative and qualitative research** approaches in education have arisen from different research needs. The quantitative research approach endlessly pursues facts, whereas the qualitative research approach recognises that the researcher's viewpoint is central. The **quantitative research approach** is used when the researcher desires to obtain entire trends or statistical truth in the research, while the qualitative research approach is used if the researcher wants to observe in detail by his/her own research view point.

Qualitative Research Approaches

The qualitative paradigm of research is based on the methods and techniques developed in the humanities and social sciences, whereas the quantitative paradigm is developed on the methods used in the natural sciences. Qualitative approaches seek to

obtain qualitative information and thick descriptions of complex and dynamic processes, using holistic, naturalistic and non-manipulative methods.

The term 'qualitative approach' covers a variety of research methods, which have some common characteristics.

The four features of qualitative research identified by Bogdam and Biklen (1982) are

(i) "Qualitative research has the natural setting as the direct source of data and the researcher is the key instrument". As the setting influences human behaviour in which it occurs, researchers spend considerable time in the setting and study it in its entirety.

(ii) "Qualitative research is descriptive". It collects soft data consisting of rich descriptions, which cannot always be reduced to numbers and analysed statistically..

(iii) "Qualitative researchers are concerned with process, rather than simply with outcomes or products".

(iv) "Qualitative researchers tend to analyse their data inductively". They do not begin with specific questions to answer or hypothesis to test and then collect data, rather on the basis of the data collected and analysed, explanatory concepts or abstractions are built.

Quantitative Research Approaches

Quantitative research consists of those studies in which the data concerned can be analysed in terms of numbers. An example of quantitative research might be a study comparing two methods of teaching-reading to first-grade children, because the data used to determine which method is more successful will be a test score. The average score of the children receiving one method will be compared to the average score of children receiving the other method.

Research can also be qualitative i.e. it can describe events, persons and so forth scientifically, without the use of numerical data. A study consisting of interviews of mothers of handicapped infants, to determine how a child is an example of qualitative research. Such a study would carefully and logically analyse the responses of the mothers and report those responses that are consistent as well as areas of disagreement.

The quantitative research is based on a logical positive paradigm which utilises experimental methods and quantitative measures to test specific hypothetical generalisations with narrow angle lens. The quantitative research uses scientific methods with 'hard science trappings'. In this the researcher treats their subject of study as having an existence independent of themselves and without any intrinsic meaning.

Quantitative research is deductive in that it tests theories which have already been proposed. It aims at analysing representative and validated quantitative data, through the use of sophisticated statistical methods and software packages. In quantitative research the findings are based on identified statistical relationships and generalisable fundings. Using the principles of probability, quantitative research makes predictions representative of a large population.

Quantitative research uses a deductive approach. Here, the researcher formulates and uses hypothesis and theory with data. Thus, the quantitative research involves successive phases of hypothesis formulation, data collection, analysis and interpretation. Using a deductive approach, it seeks to establish facts, make predictions and test hypothesis that have already been stated.

In quantitative research, the experimenter has carefully planned the study including the tests or other data collection instruments, to be used. Each subject is studied in an identical manner and there is little room for human bias to create problems with the data.

Quantitative research is based more directly on its original plans and its results are more readily analysed and interpreted.

Designs in Educational Research

Research design is needed because it facilitates the smooth sailing of various research operations, thereby making research as efficient as possible, yielding maximal information with minimal expenditure of effort, time and money.

Research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in

procedure. Research design is the conceptual structure, within which research is conducted, it constitutes the blueprint for the collection, measurement and analysis of data. As such, the design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data. Research design has a great bearing on the reliability of the results, arrived at and as such constitutes the firm foundation of the edifice of the research work.

Here, a research design related to historical descriptive and experimental are discussed as follows-

Historical Research

Historical research design analyses the past events and develops concepts and conclusions. It analyses the previous information or events minutely and tests their validity. The purpose of historical research design is to collect, verify and synthesise evidence from the past to establish facts that defend or refute a hypothesis. It describe what occurred in the past. The historical research design depends upon data observed by others rather than investigators.

It uses secondary sources and a variety of primary documentary evidence, such as diaries, official records, archives and non-textual information (maps, pictures, audio and visual recordings). The limitation is that the sources must be both authentic and valid. The historical research design is unobtrusive, the act of research does not affect the results of the study. The historical approach is well suited for trend analysis. Historical records can add important contextual background, required to more fully understand and interpret a research problem. There is often no possibility of researcher-subject interaction that could affect the findings. Historical sources can be used over and over to study different research problems or to replicate a previous study.

It shares a great deal with qualitative research in education even though it may make use of quantitative material like other forms of quantitative research, the concern is with natural behaviour in a real situation and the focus is on interpretation of what it means in the context. Unlike other forms of educational research, the historical research does not create data. Rather, the historian attempts to discover data that exists already in some form.

Historical research attempts to establish facts, so as to arrive at conclusions concerning past events. This is usually accompanied by an interpretation of these events and of their relevance to present circumstances and what might happen in the future. The main purpose of historical research, therefore, is to arrive at an accurate account of the past, so as to gain a clearer perspective of the present. This knowledge enables us at least partially to predict and control our future existence.

Historical research includes the delimitation of a problem, formulating research questions or tentative generalisations, gathering and analysing data and arriving at conclusions or generalisations based upon deductive-inductive reasoning. However, the historian faces greater difficulty than researchers in any other field. Historical data is a closed class of data, located along a fixed temporal locus and the historian has no choice of sampling his data and he is supposed to include every type of data that comes his way. Historical research is not based upon experimentation, but upon reports of observation, which cannot be repeated. The historian handles unique types of data which cannot be repeated. They are mainly traces of past events. The historian must depend upon the reported observations of others, often witnesses of doubtful competence and sometimes of doubtful objectivity.

Types of Historical Research

Various types of historical researches are

- **Types of Historical Research**
    1. Bibliographic Research
    2. Legal Research
    3. Studying the History of Ideas
    4. Studying the History of Institutions

Bibliographic Research It aims at determining and presenting truthfully, the important facts about the life, character and achievement of important educators.

Legal Research It is of immense value and interest to educational administrators. It aims to study the legal basis of educational institutions, run by different religions and

castes and relations between central and state governments, with regard to education, legal status of teachers, etc.

Studying the History of Ideas It involves the tracing of major philosophical or scientific thoughts from their origins through their different stages of development. It also aims at tracing changes in popular thoughts and attitudes over a given period of time.

Studying the History of Institutions Studying the history of some prominent schools, universities and other educational institutions also provide numerous opportunities for significant historical research. When studying such history, the same general method applied as for the study of an educator's life.

Steps of Historical Research

The steps involved in undertaking a historical research are not different from other forms of research, but the nature of the subject matter presents a researcher some peculiar problems and requires him to apply some special standards and techniques.

In general, historical research involves the following steps.

Selection of the Problem A researcher may select a problem, pertaining to the history of individuals, institutions, organisations, laws, curriculum, administration, textbooks, teacher education, equipment, important concepts and thoughts that have influenced education during a specific period of time in a given culture or sub-culture, determined by religion, caste, sex, age or work.

Formulation of Hypothesis The hypothesis that the researcher constructs for historical research is useful in explaining events, conditions or phenomenons of the historical period in question. Best and Kahn have also remarked that, although hypothesis are not always explicitly stated in historical investigations, they are usually implied. The historian gathers evidence and carefully evaluates its trustworthiness. If the evidence is compatible with the consequences of the hypothesis, it is confined.

Collection of Data After formulation of hypothesis, the researcher collects the data through primary and secondary sources. It involves comprehensive gathering of data.

Interpretation of Data After the data have been collected and criticised, the researcher turns himself to the task of interpretation of these data in the light of this problem. As historical data has unique nature, the task of interpretation becomes complicated and acquires special significance. It requires great ingenuity and imagination on the part of the researcher.

The researcher in the historical type of investigation must be very cautious while dealing with cause and effect relationships. Here, his position is entirely different from a researcher of physical sciences, who deals with very simple isolated laboratory phenomena. The researcher in the historical types of investigation should not only establish facts, but also determine trends which the data may suggest and to draw inferences from the data. His goal should be one of synthesis and interpretation rather than mere summation.

Value of Historical Research

Knight (1934), Scates (1941) *and Good has given the following analysis of the value of historical research:-*

- A knowledge of the history of schools and other educational agencies is an important part of the professional training of the teacher or the school administrator.
- Much of the work of the school is traditional. The nature of the work of the teacher and the school administrator is restrictive and tends to foster prejudices in favour of familiar methods. The history of education is the sovereign solvent of educational prejudices.
- The history of education enables the educational worker to detect fads and frills in whatever form, they may appear and it serves as a necessary preliminary to educational reform.
- Only in the light of their origin and growth, can the numerous educational problems of the present be viewed sympathetically and without bias by the teacher, the school administrator or the public.
- The history of education shows how the functions of social institutions shift and support and control of education have changed from very simple and local arrangements to those that are now somewhat centralised and complex.

- It inspires respect for sound scholarship and reverence for great teachers.
- The history of education is an ally in the scientific study of education rather than a competition. It serves to present the educational ideals and standards of other times and it enables social workers to avoid mistakes of the past.

Experimental Research

In descriptive research, a researcher may analyse the data he has collected and discover that different variables are related. The relationships between the variables can be interpreted in several ways. Experimental research on the other hand, provides for such control and therefore, establishes a systematic and logical association between manipulated factors and observed effects.

The researcher defines a problem and proposes a tentative answer or hypothesis. He tests the hypothesis and accepts or rejects it.

John Stuart Mill (**1846**) defined the law of the single variable in his work methods of experimental inquiry.

He stated the following five canons or rules of experimental research-

- The Method of Agreement
- The Method of Difference
- The Joint Method
- The Method of Residues
- The Method of Concomitant Variations

These rules served as guides in the design of early experiments and are now used chiefly as guides in planning of experiments.

Types of Experimental Research Designs

There are various types of experimental research designs. They vary in complexity and adequacy. The selection of a particular design depends upon such factors, as the nature and purpose of the experiment, the type of the variables to be manipulated, the nature of the data, the facilities or the conditions for carrying out the experiment and the

competence of the experimenter. Although, the designs can be combined into various ways.

They are broadly classified as under

- Pre-experimental designs
- True experimental designs
- Quasi experimental designs

These designs resemble one another from the point of view of purposes and their adherence to the principles of experimentation. They differ in the degree of accuracy with which they attack the problem or meet the essential criteria of control, manipulation, observations and replication.

Pre-Experimental Research Design It is the simplest form of experimental research design. In this design, a group or various groups are kept under observation, after factors are considered for cause and effect. It is generally conducted to understand whether further investigation needs to be carried out on the target group(s) due to which it is considered to be cost effective.

The pre-experimental design is further divided into three types such as

- One shot case study design.
- One group, pre-test and post test research design.
- Static group comparison.

True Experimental Research Designs This design is the most accurate form of experimental research design as it relies on statistical analysis to prove or disprove a hypothesis. It is the only type of experimental design that can establish a cause effect relationship, within groups. In a true experiment, there are three factors which needs to be satisfied.

They are-

Control group (group of participants for research that are familiar to the experimental group, but experimental rules do not apply to them) and experiment group (research participants on whom the experimental research rules do apply).

Variables which can be manipulated by the researcher.

Random distribution. These designs are mostly used for experimental research in education because they seek to control the main effects of history, maturation, testing, measuring instruments, statistical regression, differential selection and mortality.

Quasi Experimental Research Design The word 'quasi' indicates 'resemblance'. A quasi experimental research design is similar to experimental research, but is not exactly that. The difference between the two is the assignment of a control group. In quasi experimental research design, an independent variable is manipulated but the participants of a group are not randomly assigned as per conditions. The independent variable is manipulated before calculating the dependent variable and so directionally the problem is eliminated. Quasi research is used in field settings, where random assignment is either irrelevant or not required.

Characteristics of Experimental Research

- The experimental researcher randomly assigns participants to groups or other units.
- They provide control over extraneous variables, to isolate the effects of the independent variable on the outcomes.
- They physically manipulate the treatment conditions for one or more groups.
- They then measure the outcomes for the groups to determine if the experimental treatment had a different effect than the non-experimental treatment.
- The researcher designed an experiment to reduce the threats to internal and external validity.

Thus, the experimental research designs are concerned with examination of the effect of independent variables on the dependent variable, where the independent variable is manipulated through treatment or intervention(s) and the effect of those interventions is observed on the dependent variable.

Value of Experimental Research

It is used to determine and evaluate the adequacy and effectiveness of the educational and instructional objectives, through the measurement of their outcomes. After

evaluating the efficacy of objectives, the suggestions are made for the formulation, execution and modification of educational programmes and classroom practices. The experimental research is not considered a precise method of research in the field of education because of the complex nature of the human beings and problems of controlling the extraneous variables. However, in spite of all such difficulties, experimentation has been put to various uses in solving educational problems.

Descriptive Research Design

Descriptive research studies are those studies, which are concerned with describing the characteristics of a particular individual or of a group and studies concerned with specific prediction, with narration of facts and characteristics concerning individual or group of situations are all examples of descriptive research studies. Most of the social research comes under this category.

From the point of view of the research design in descriptive studies, the researcher must be able to define clearly what he wants to measure and must find adequate methods for measuring it along with a clear cut definition of 'population' he wants to study. Since, the aim is to obtain complete and accurate information in the said studies, the procedure to be used must be carefully planned. The research design must make enough provision for protection against bias and maximum reliability, with due concern for the economical completion of the research study. The design in such studies must be rigid and not flexible.

Descriptive research design aims to observe, describe and document aspects of a situation as it naturally occurs without any manipulation or control. Descriptive studies are designed to gain more information about characteristics with a select or a particular field of study. These studies provide a picture of a situation as it occurs in a natural setting.

The descriptive design does not involve manipulation of variables. Variables are studied as they exist in the natural world. Descriptive research designs are used to develop theories, identify problems with current practices, make judgements and determine alternative solutions for the existing practices.

In case of descriptive studies, bias is prevented through operational definitions of variables, by choosing a large sample size, by using random sampling techniques. By means of using valid and reliable tools of measurement and formal data collection procedures. Thus, through descriptive designs, description of variables leads to an interpretation of the theoretical meaning of the findings and development of hypothesis. The descriptive research design is a Scientific Method, which involves observing and describing the behaviour of a subject without influencing it in any way.

Descriptive research design is a valid method for researching specific subjects and as a precursor to more quantitative studies. It is the most widely used research design. The means of obtaining information, include the use of the questionnaires and personal interviews with the aid of study guide or interview schedule and observation either participatory or not.

Descriptive study determines and reports the way things are. It has no control over what is and it can only measure what already exists.

Descriptive research has undoubtedly been the most popular and widely used research method in education. It helps to explain educational phenomena in terms of the conditions or relationships that exist held by students, teachers, parents and experts processes that are going on effects that are evident or trends that are developing. Because of the apparent ease and directness of this method, a researcher can gather information in terms of an individual's opinion about some issue by a simple questionnaire.

Descriptive studies are closely associated with observational studies, but they are not limited with Observation Data Collection Method. Case studies and surveys can also be specified as popular data collection methods, used with descriptive studies. Descriptive research is of great importance in solving problems about children, school organisation, supervision and administration, curriculum, teaching methods and evaluation.

Thus, it can be said that the descriptive research design is a Scientific Method which involves observing and describing the behaviour of a subject, without influencing it in any way.

Part B - Research: Tool, Sampling and Writing Proposal

Tools of Data Collection

The collection of data is of paramount importance in the conduct of research. The sampling is the act, process or technique of selecting a suitable sample or representative part of a population for the purpose of determining parameters or characteristics of the whole population.

The instruments that are employed to collect new facts or to explore new fields are called tools. It is of vital importance to select suitable instruments and tools. As for any research study, the researcher has to collect data and on the basis of that data, he draws conclusions and arrives at generalisations. These conclusions and generalisations will be correct and valid, if the data is methodically collected. For collecting reliable and valid data, one needs reliable and valid tools and techniques of data collection. The researcher has to select tools and techniques of data collection, carefully and judiciously. He/she might make use of standardised readymade tools or may develop his/her own tools, ensuring that the tools developed are reliable and valid, so that the data obtained through these tools are also reliable and valid.

Data collection tools are very helpful because they provide a picture of your class/work environment. The goal for using tools is to help the researcher to clarify information, process knowledge and identify opportunities for continuous improvement. These are the instruments used to collect information, for use in performance assessment, self-evaluation and external evaluation.

Tools of data collection are instruments, like rating scale, checklist, questionnaire attitude scale, etc. Whereas, the techniques of data collection are the processes,

through which data are obtained such as interviews, observations, etc. Each research tool is appropriate in a given situation, to accomplish a specific purpose. These tools should be used together or in combination, as they supplement the work of each other. **J W Best,** an author of Research in Education commented that like the tools in the carpenter box, each is appropriate in a given situation, to accomplish a particular purpose. Each data collecting device has both merits and demerits. However, for effective results, each tool has its own significance. It must be used according to the situation.

Criteria of a Good Tool

Following are the criteria of a good tool-

Validity

Each tool of evaluation has specific purposes. Therefore, the foremost consideration one must look for, while choosing a tool is the purpose for which it is being used, that is the tool being used, should be valid. Thus, a tool is valid, if it serves the purpose for which it is designed.

According to **Stanley and Hopkings**, "The validity of a measures how well it fulfils the function, for which it is being used and the degree to which it is capable of achieving certain aims".

Therefore, the concept of validity of a test is chiefly a concern for the basic honesty of the test honesty, in the sense of doing, what are promises to do.

Validity can be divided into five categories and they are :

(**i**) **Content Validity** A systematic evaluation of the test content, to determine whether it covers a representative sample of the behaviour domain or not to be measured.

(**ii**) **Criterion Related Validity** This approach entails detecting the presence of one or more criteria, considered to represent traits or construct of interest.

(**iii**) **Construct Validity** It refers to the limit to which operationalization of a construct, do actually measure what the theory says to do.

(**iv**) **Face Validity** It refers to an estimate of the operationalisation and to see whether or not on its face, it seems like a good translation of the construct.

(**v**) **Factorial Validity** It refers to the validity of the instrument's factor structure, most frequently assessed by factor analysis.

Reliability

It is concerned with the question of 'accuracy' with which the 'what' is measured. It refers to the results obtained with an evaluation instrument and not to the instrument itself. An evaluation tool may have a large number of different reliabilities, depending on the groups of subjects and situations of use. Reliability is a necessary, but not a sufficient condition for validity.

Objectivity

It is an important criteria of a good evaluation tool. A tool is objective if it makes for the elimination of the scorer's personal opinion i.e. bias or judgement. It is an honest opinion based on facts, evidence, without influence of extraneous considerations, the evaluator's personal judgement may also be accepted.

A tool is objective, if it gives the same score even when different scorers score the item. Thus, objectivity in scoring may be considered as consistency, in scoring by different scorers.

Types of Tools

According to **JC Agrawal,** who has authored many books on education and research, the tools of research has been classified into following types:

Different types of tools are-

(i) Inquiry forms

- Rating scale

- Attitude scale
- Questionnaire

(ii) Psychological tests and inventories

- Achievement test
- Inventory
- Aptitude test

Inquiry Forms

It is one of the most important tools of data collection that seeks to extract information and a price of knowledge from the targeted audience. Various types of inquiry forms are administered for assessing people's opinion, attitude, belief and other dimensions of question.

It includes-

Rating Scale

It refers to a scale, with a set of points that describe varying degrees of the dimension of attribute, being observed.

Classification of Rating Scale

★ Numerical scale
★ Graphic scale
★ Standard scale
★ Rating by cumulative points
★ Forced choice ratings

It is a set of categories, designed to elicit information about a quantitative or a qualitative attribute. In social science, common examples are Likert scale and 1-10 rating scale, in which a person selects the number, which is considered to reflect the perceived quality of a product.

Thus, rating scale is a method that requires assigning a value, sometimes numeric to the rated object as a measure of some rated attribute.

It is broadly classified into five categories and they are

(**i**) **Numerical Scale** In a numerical scale, a sequence of definite numbers is supplied to the rater or to the observer. The observer assigns to each stimulus to be rated, an appropriate number in line with those definitions or descriptions.

The following scales may be used in obtaining ratings of the affective values of colours on a point scale, which may consist of different points.

Point Scale	Rating
❖ Most pleasant	9
❖ Extremely pleasant	8
❖ Moderately pleasant	7
❖ Mildly pleasant	6
❖ Indifferent	5
❖ Mildly unpleasant	4
❖ Moderately unpleasant	3
❖ Extremely unpleasant	2
❖ Most unpleasant	1

Instead of 9 point scale, we can draw 3 point, 5 point or 7 point scales too. It is always useful to have an odd number of points in a scale line like 3, 5 and 7, so that there could be a middle point i.e. a favourable one and an unfavourable one. This scale is easiest to construct and to apply. They are also the simplest in terms of handling the results.

(**ii**) **Graphic Scale** It is the most popular and widely used type of rating scale. In this scale, a straight line is shown vertically or horizontally with various clues to help the

rater. The line is either segmented into units or is continuous. If the line is segmented, the number of segments can vary from case to case.

It is also known as 'continuous rating scale'. The ends of the continuous are sometimes labelled with opposite values. Respondents are required to make a mark, at any point on the scale that they find appropriate.
Sometimes, there are numbers along the markings of the line too. At other times, there are no markings at all on the line.
(**iii**) **Standard Scale** In standard scale, a set of standards is presented to the rater. Usually, the standards are objects of the same kind, to be rated with pre-established scale values. This type of scale is like that of the scale for judging the quality of hand writing. The scale of hand writing provides several standard specimens that have previously been spread over on a common scale, by some standardised procedure, like equal appearing intervals. The 'man-to-man' scale and the 'portrait matching' scale are the other two forms that conform more or less to the principles of standard scales.
(**iv**) **Rating by Cumulative Points** The unique and distinctive feature of rating by cumulative points is its immense and easy utility of scoring. The rating score for an attribute, object or individual is the sum or average of the weighted or unweighted points. The 'checklist method' and the 'guess' technique belong to this category of rating.
(**v**) **Forced Choice Ratings** They are those ratings, which are biased or influenced by some external factors.

Advantages of Rating Scale

- Rating scales are less time consuming to develop.
- It can be used with a large number of stimuli.
- They also allow for quantitative comparison. ·
- Rating scale is quite interesting to the raters, especially if graphic methods are used.
- Best rating can be obtained by presenting one stimulus to a rater at a time.
- Rating can be used with rates who have little very training for the purpose.

- Rating scales have a much wider range of application and can be used for teacher ratings, personality ratings, school appraisal, sociological survey, etc.

Disadvantages of Rating Scale

Limited Reliability Rating scale method has limited reliability.

Ease of Use Rating scale can be used by unqualified users.

Sophisticated Treatment Planning Rating scale is not suitable for sophisticated treatment planning.

Error of Central Tendency Most of the raters hesitate to rate the individuals on the extremes of the scale, instead they tend to rate the individual on the middle of the scale. Hence, the results get distorted.

Substantial Variations Rating scale may be substantial variations among informants.

Halo Effect It is an error, which obscures the clusters of traits within an individual. The raters form a general opinion about the person's merit and his ratings on specific traits are greatly influenced by this general impression.

Contrast Error It is due to a tendency of a rater to rate others in the opposite direction (contrasting) from himself in a trait.

Questionnaire

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents. Although they are often designed for statistical analysis of the responses, this is not always the case. The questionnaire was invented by **Sir Francis Galton.**

It is a self-report data collection instrument that each research's participant fills out as part of a research study. Researchers use questionnaire to obtain information about the thoughts, feelings, attitudes, beliefs, values, perceptions, personality and behavioural intentions of research participants. According to **John W. Best,** "a questionnaire is

used when factual information is desired, when opinion rather than facts are desired and an opinionnaire or attitude scale is used".

They have advantages over some other types of surveys in that they are cheap, do not require as much effort from the questioner as verbal or telephone surveys and often have standardized answers that make it simple to compile data.

Basic rules for preparation of questionnaire are:

- Use statements which are interpreted in the same way by members of different sub-populations of the population of interest.
- Use statements where persons that have different opinions or traits will give different answers.
- Think of having an open answer category, after a list of possible answers.
- Use only one aspect of the construct you are interested in per item.
- Use positive statements and avoid negatives or double negatives.
- Do not make assumptions about the respondent.
- Use clear and comprehensible wording, easily understandable for all educational levels.
- Use correct spelling, grammar and punctuation.
- Avoid items that contain more than one question per item (e.g. Do you like apples and tomatoes?).

Types of Questionnaire

Questionnaire means a set of questions prepared for drawing the responses from the subjects for research work. Every researcher uses this technique in their survey research. Researchers have classified questionnaire into the following groups:

According to ***P V Young****, questionnaire is of two types and they are:-*

1. **Structured questionnaire**
2. **Non-structured questionnaire**

1. Structured Questionnaire In structured questionnaires, definite concrete and pre-ordained questions are used for two purposes.

They are:

Accurate Communication It is justified when the respondents understand the survey objectives.

Accurate Response It is obtained when the replies contain the information sought and at the same time fulfil the demands of tabulation plans and analytical programmes.

2. Non-Structured Questionnaire It is known as interview guide. It contains definite subject matter areas. The interviewer is free to arrange the form and timing of enquiry.

Advantages of Questionnaire

Giving Way to Put Forward The questionnaire as a tool of educational research has a great importance in its form. It helps the researcher to put forward his project. **Summarising** A questionnaire summarises the ideas of the respondent.

Written Form Questionnaire in written form will enable the researcher to get more responses. Because the respondent feels more free while expressing his views regarding a question in written form.

Helps in Collecting Information Sometimes, the researchers are unable to move the geographical areas on which they have taken their study. Thus, this helps them to collect information.

Less Pressure on the Subject to Respond A questionnaire places less pressure on the subjects to respond immediately. It gives a lot of time to fill it up. Before filling up the questions, he thinks more about the suitable answer of the question.

To the Point Answers Questionnaire does not require the unnecessary materials. What actually, the question wants the respondent to answer to the point only.

Helps in Minimising the Expenses Questionnaires help in minimising the expenses, both in terms of money and effort. Whenever the researcher is enable to go to collect information about a school, he collects information through his mates and also teachers concerned of the particular school.

Validity of the Project Information collected in a lot will give a greater validity of the project.

Disadvantages of Questionnaire

Rigid and Complicated Questionnaire A rigid and complicated questionnaire does not draw accurate responses from the subject.

Without Holding True Answers Sometimes, respondents do not give a true answer to their questions. Some respondents play mischievous with the researcher.

Confusion About Actual Meaning Some subjects are confused to understand the actual meaning of the questions.

Lost Mail A questionnaire sent by mail is sometimes not found.

Incomplete Answers Sometimes, the respondents give incomplete answers. This makes the researcher confused in drawing the accurate answers.

Not a Matter of Interest Many times, the questionnaire sent to the subjects are neglected and overlooked due to lack of interest. Even after a few nudges, the subject may not reveal true answers.

Attitude Scale

It is a form of appraisal procedure, which is designed to measure the attitude of a subject or group of subjects towards issues, institutions and groups of people.

Attitude is a special type of questionnaire, designed to produce scores, indicating the intensity and direction of a person's feeling or opinion about an object or event. This scale provides a quantitative measurement of attitudes, opinions or values by summarising numerical scores given by researchers to people's responses to a set of statements exploring dimensions of an underlying theme.

The term attitude is defined in many ways. But, all definitions conclude it as an established way of thinking or feeling reflected in a person's behaviour towards others. Sometimes, opinion and attitude are used in a synonymous manner, but there is a thin

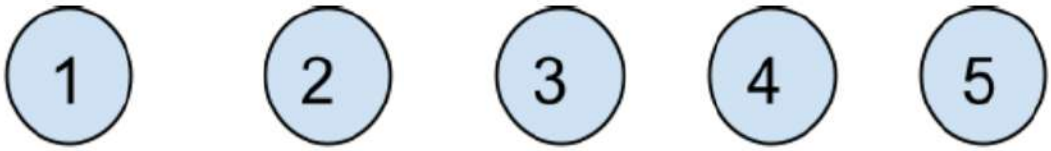
line of difference between the two. An opinion may not lead to a kind of activity in a particular direction. But, attitude compels one to act favourably or unfavourably, depending upon the perception.

The most common types of attitude scales are discussed below:

(**i**) **Likert Scale** It is a psychometric response scale, primarily used in questionnaires to obtain participant's preferences in terms of degree of agreement to a statement or set of statements.

Variations are most commonly seen as a 5 point scale ranging from 'strongly disagree' on one end to 'strongly agree' on the other with 'neither agree nor disagree' in the middle. However, practitioners advocate the use of 7 and 9 point scales, which add additional granularity. Sometimes, a 4 point scale (or other even-numbered) is used to produce an ipsative (forced choice) measure, where no indifferent option is available. Each level on the scale is assigned a numeric value or coding, usually starting at I and incremented by one for each level.

For example:



Strongly Agree Agree Neither Disagree Strongly disagree

Sample Scale Used in Likert Scale Questions

(**ii**) **Guttman Scale** It is based on the idea that items can be arranged along a continuum in such a way that a person, who agrees with an item or finds an item acceptable will also agree with or finds acceptable all other items, expressing a less extreme position. This scale presents a number of items to which the person is supposed to either agree or disagree, which is typically done in a 'Yes/No' dichotomous format.

(**iii**) **Thurstone Scale** It is also known as equal appearing interval scale. It is used to measure the attitude towards a given concept or construct. For this, a large number of

statements are collected that relate to the construct in consideration. The judges rate these statements, along on an 11 category scale, in which each of the categories have a fixed level of propensenties towards the concept.

(**iv**) **Semantic Differential Scale** This method requires respondents to choose in the questionnaire between two opposite positions, using qualifications to bridge the gap between them. One must decide the two extremely opposite terms, related to a particular dimension and create a rating sheet.

It measures an individual's reaction to stimulus words and concepts in terms of ratings on bi-polar adjectives at each end.

For example, enjoyable and unenjoyable, funny and not funny, relatable and non-relatable, etc.

A typical question with semantic differential scale would be as follows:

	Very much	Some what	Neither	Some what	Very much	
Enjoyable		×				Unenjoyable
Funny			×			Not funny
Relatable					×	Unrelatable

Advantages of Attitude Scale

- An attitude is a learned tendency, so it can be learnt.
- It is a point or object of reference.
- It includes certain aspects of personality such as interests, appreciations and social conduct.

Disadvantages of Attitude Scale

- Attitude is a complex affair which can't be wholly described by any single numerical complex.
- Attitude is subject to change. So what is measured today about a student's attitude may not indicate his future attitude towards the subject or occupation.

- Students sometimes give vague responses to items on an attitude scale. It is not always and in all cases possible to get real attitude of a student.
- Generally, pupils or students are trained to give tick marks on the middle of the scale. So their responses don't reveal the true dimension of their attitudes.
- Discrepancy is noticed in student's expressed attitude and tested attitude. Hence tested attitude isn't always dependable.

Psychological Tests and Inventories

Achievement Test

These tests attempt to measure the present level of performance of a group or an individual. It is commonly used in schools and colleges. They are helpful in determining individual or group status in academic learning. Also, they are used in diagnosing strengths and weaknesses and as a basis of awarding degrees, prizes or scholarships.

Advantages of Achievement Tests

- Achievement tests allow for data to be collected about student achievement and learning that helps to inform educators, curriculum planners and the state officials who can help to determine the budget for a school.
- It also helps to point out instructional leaders who are falling short of their duties and whose standards are performing below standards.
- These tests are non-discriminatory because the content evaluated on the tests has been presented to all students. It helps to create educational equity in the schools.

Disadvantages of Achievement Test

- Tests do not help student achievement in any meaningful way and the increase in positive scores that are seen on the test is merely a reflection of curriculum that is designed to help students score high but perhaps less quantifiable learning that should be taking place in the classroom.
- Students lack critical thinking skills and due to these tests they are being focussed predominantly on rote memorisation.

- These tests are not indicative of strong instructional leadership in the classroom nor an academically rigorous classroom. Critics also held that these tests posed challenges for children with learning disabilities whom the stress of test or structure of questions may affect negatively.

Aptitude Tests

These tests attempt to predict the capacities or the degree of achievement that may be expected from a group or an individual in a particular activity. Like achievement tests, they also measure past learning. They attempt to predict group or individual's capacity to acquire improved performance with additional training. It helps to check one's knowledge and filters the good candidates. The ability of creativity and intelligence is proved by the aptitude test.

Advantages of Aptitude Test

- Aptitude tests attempt to predict the capacities or the degree of achievement that may be expected from individuals in a particular activity.
- Aptitude is a means by which one can find the relative knowledge of a person in terms of his intelligence and also his knowledge in general.
- They are excellent predictors of future scholastic achievement. They provide ways for comparison of a child's performance with others in the same situation. They provide a profile of strength and weaknesses. They assess differences among individuals.
- Aptitude tests are valuable in making programme and curricula decisions.

Disadvantages of Aptitude Test

- The physical, social and emotional environment of the pupil is often different from the actual environment in the job or in college. This reduces the predictive value of the aptitude test.
- An aptitude test gives us a prediction of the probability only. There is never any certainty that predictions will always come true. It is noticed that brilliant students sometimes fail to top the list while an average student who was initially not doing well may top the list.

Inventory

It is a list, record or catalogue containing a list of traits, preferences, attitudes, interests or abilities, used to evaluate personal characteristics or skills. The purpose of inventory is to list a specific trait, activity or programme and to check to what extent the presence of that ability.

There are two types of inventories and they are

(**i**) **Interest Inventory** They attempt to yield the measure of the types of activities that an individual has a tendency to like or choose. They are self-report instruments, in which the individuals note their own likes and dislikes. They are the standardized interviews, in which the subject gives an introspective report of his/her feelings about certain situations and phenomena, which is then interpreted in terms of interests. The use of interest inventories is most frequent in the areas of educational, vocational guidance, and case studies.

(**ii**) **Personality Inventory** These are the self-report instruments. These instruments yield scores that are assumed or have been shown to measure certain personality traits or tendencies.

Techniques of Research

Observation

The cause-effect relationship and study of events in the original is known as observation. According to the **C A Mourse,** "Observation employs relatively more visual senses than audio or video organs' '. In this method of data collection, it involves

something that we do most of our working hours i.e. observe things. Researchers are also observers of things in the world.

Classification of Observation

1. **On the Basis of Form of Observation**
    - Formal observation
    - Informal observation
2. **On the Basis of Control of Observation**
    - Controlled observation
    - Uncontrolled observation
3. **On the Basis of Planning of Observation**
    - Planned observation
    - Unplanned observation
4. **On the Basis of Direction of Observation**
    - Direct observation
    - Indirect observation
5. **On the Basis of Information of Observation**
    - Qualitative observation
    - Quantitative observation
    - Qualitative and Quantitative observation
6. **On the Basis of Interview's Observation**
    - Individual observation
    - Group observation
7. **On the Basis of Person's Observation**
    - Self-observation
    - Outsiders observation

In research, observation is defined as the watching of behavioural patterns of people in certain situations to obtain information about the phenomenon of interest. It is an important way of collecting information about people because people do not always do what they say they do. It is a maxim in the social and behavioural sciences that attitudes and behaviour are not always congruent.

Modes of Collecting Observational Data

Modes of collecting observational data are-

(**i**)**Laboratory Observation** It is carried out in settings that are setup by the researcher and inside the confines of a research lab. An example would be a researcher observing the behaviour of children through a one way window in the researcher's laboratory.

(**ii**) **Naturalistic Observation** It is carried out in the real world. Observing the behaviour of children in their classrooms is an example of naturalistic observation.

(**iii**) **Quantitative Observation** Quantitative Or structured observation involves the standardisation of all observational procedures in order to obtain reliable research data.

It often involves the standardisation of each of the following-

Who is observed? (e.g. What kinds of people are to be studied, such as teachers or students).

What is observed? (What variables are to be observed by the researcher, such as time on tasks or out of seat behaviour).

When will the observations take place? (during morning hours or during break time).

Where the observations are to be carried out? (In the laboratory, in the classroom, in the lunchroom, in the library or on the playground).

How are the observations to be done? Usually, quantitative observation results in quantitative data, such as counts or frequencies and percentages. It might also involve observational sampling techniques. One technique is called time interval sampling, which involves checking for events during the time interval, specified in advance of the actual data collection.

Another technique is called **event sampling**, which involves making observations only after a specific event has occurred.

(**iv**) **Qualitative Observation** It involves observing all relevant phenomenas and taking extensive field notes without specifying in advance, exactly what is to be observed.

Usually, it is done for exploratory purposes. It is usually done in a natural setting. It is usually carried out by qualitative researchers.

The four main roles that a researcher can take during qualitative observation are as follows-

(**i**) **Complete Participant Observer** Essentially, the observer takes on the role of an insider, becoming a member of the group being studied and spending a great deal of time with the group and does not tell members they are being studied.

(**ii**) **Participant as Observer** Researcher spends extended time with the group as an insider and tells members they are being studied.

(**iii**) **Observer as Participan**t Researcher spends a limited amount of time observing group members and tells members they are being studied.

(**iv**) **Complete Observer** Researcher observes as an outsider and does not tell the people they are being observed.

Features of Observation

- In an accurate sense, observation involves the use of eyes rather than the use of the ears and the voice. An experienced worker never believes what he hears say. He only trusts if he has observed that with his own eyes.
- Observations which act on scientific grounds are brought in use by the scientists or the researchers with some or the other aim to achieve something. Such scientists make their observations in a very minute and detailed manner, which helps them in achieving specific goals.
- The value of an observation in an operation is only if it is done properly in a planned manner, but if it is done in a careless sense then the chance of making such an observation again may come or not. Hence, observation should be carried out in a very phased and a planned manner in order to get in depth understanding of an activity.

- Observation should be based on standardised tools of research, which makes an observation exact in its nature of working.
- Observation is a very vital scientific method that helps a lot in the collection of the primary information that is reliable in nature, in which direct study of the situation is involved.
- Observation is a scientific method, in which we make hypothesis of explain observation.
- The various operations that we perform and the results that we obtain should be remembered, but a known fact is that memory is very deceptive in nature. With the passage of time, things tend to get out of mind, so it is very important to keep a record of such activities.
- Sense organs have a very critical role to play in the observation process. During the observation, researcher or investigator has to use his sense organs for seeing and hearing things and then has to keep in mind the whole set of observations for an in depth analysis of the matter later on.

Advantages of Observation

- Personality is better assessed by observation of behaviour, than by reporting which may hide facts.
- The tool does not need any communication medium. Thus, it can be used for collecting data regarding infants and illiterates or people who don't understand the observer's language.
- The main strength of observation is that it provides direct access to the social phenomena, under consideration.
- Observation can take diverse forms, from informal and unstructured approaches through to tightly structured and standardised procedures and can yield associated diverse types of data, both qualitative and quantitative observation, therefore, it is applicable in a wide range of contexts.

- All observations entail some form of recording means is that it provides a permanent record of such events or behaviour, thus, allowing further analysis or subsequent comparisons across time or location to be carried out.
- The behaviour can be observed in a natural setting and hence, the inferences can have applicability to ordinary life situations as well. This is called 'external validity' i.e. applicability beyond the observed situation.
- Using more than one technique of data collection through a process of triangulation is seen as highly desirable as an overarching research strategy. Therefore, another strength of observation is that it can effectively complement other approaches and thus, enhance the quality of evidence available to the researcher.

Disadvantages of Observation

- One of the main disadvantages of observation is that it can be very time consuming and resource intensive. It may be a very desirable strategy to explore certain research questions, but it may simply not be feasible for the researcher with limited time and resources to carry out the observation and therefore, alternative strategies would have to be pursued.
- Covert behaviour and traits cannot be observed.
- The behaviour of grown up adult people turns artificial, when they become conscious of the observer.
- Even though the inferences have applicability to ordinary life situations, still the internal validity of the inferences may be low in uncontrolled situations and natural settings without any experimental controls as the data collected may not be really reliable and valid. The observation may get prejudiced and coloured by the subjectivity or feelings of the observer and suffer in reliability.
- Another potential weakness of observation is the so called observer effect, which refers to the way in which the presence of an observer in some way influences the behaviour of those being observed. In order to avoid or minimise this, methods of observation sometimes attempt to be as unobtrusive as possible.

- A fundamental potential weakness of all observation is that it is susceptible to observer bias, subjective bias on the part of the observer, thus undermining the reliability and hence, the validity of the data gathered. This can be because the observer records not what actually happened, but what they either wanted to see, expected to see or merely thought they saw.

Types of Observations

- *Structured to unstructured*
- *Personal*
- *Mechanical*
- *Disguised or undisguised*
- *Natural or contrived*
- *Non-participant to participant*

Sometimes, observation process is treated casually, but is a method that needs to be treated as rigorously as any others.

Observation should includes:

- *planning*
- *recording*
- *authenticating*
- *reflecting*
- *survey design*

Interview

It is one-to-one direct communication between researcher and subject for collection of data. It is a series of questions to be asked in an interview. It is a great process for generating information on a number of questions or issues at once. It balances participation and requires active involvement and critical thinking skills.

The interview design works well with a group of 12 or more people and requires time between 75 to 90 minutes. This is a multi-step process, where each participant first collects information (ideas, opinions or experiences related to the topic) through interviewing at least four other participants.

Interview questions should be generated in advance. Persons with like questions are then grouped for the purpose of analysing the responses in depth. In the final step, each group depicts their response in the form of a graphic display that is shared with the whole group in debriefing the group process.

Types of Interviews

According to Goode and Hatt various types of interviews are as

Clinical Interview In clinical work, social workers and psychiatrists use interviews to secure information about an individual's problem, his past history, job or family adjustment. In such situations, the major purpose of the interview is diagnosis and treatment. This type of interview is called a clinical interview.

Research Interview The investigator attempts to collect relative information for solving his problem of historical, experimental, surveys or clinical type.

Group Interview A group interview is one which consists of some sociable, intellectual and educated persons from whom effective information can be collected.

Direct Interview It is a structured interview. It is a set of closed type questions prepared for the purpose.

Non-Directive Interview It includes the questions of the open end form and the researcher talks freely about the problem under study.

Focused Interview It aims at active responses from the respondents on specific events.

Generally, **Goode** and **Hatt** point out the interview conducted by a researcher may be different in its structure, but its sole aim is to collect information from the respondents for the project taken for study.

Advantages of Interview

An interview is a conversation between two or more people, when questions are asked by the interviewer to elicit facts or statements from the interviewer. Although interviews are a standard part of journalism and media reporting, the focus of this piece is on how interviews can be used as a tool of psychological research.

Interview can be used as a tool in psychological research in following ways:-

- In a questionnaire, only the answer to the question is required. Sometimes, the respondent is unable to answer due to problems in understanding the matter. But, in an interview, if the respondent is not able to answer a particular question, the researcher also asks other questions, relating to the asked question for its answer. Thus, through the interview he gets more responses.
- An interviewer can try his best to establish good rapport with the interviewer.
- An interview can be used to collect facts. e.g. information about people's place of work, age, etc, but such questions are usually not more than opening items, which precede the main substance.
- The bulk of interview questions seeks to elicit information about attitudes and opinions and perspectives and meanings, the very stuff of much of both psychology and sociology.
- Interviews are available in a range of style.
- There is a half-way house, where the researcher designs a set of key questions to be raised before the interview takes place, but builds in considerable flexibility about how and when these issues are raised and allows for a considerable amount of additional topics to be built in response to the dynamics of conversational exchange.

Disadvantages of Interview

- Hesitation to express. ·
- Vague and unclear questions.
- Time restrictions.
- Less time for thinking.
- Subjective in nature.
- Researcher's influence necessary.
- Consciousness required.

- Manipulated/socially accepted responses may preferred.
- Psychological, social and educational hindrances.
- More expense in time and money.
- Requires high level of expertise.

Conducting of an Interview

- Interview schedule should be as per objectives.
- Planning of time duration, place and mode of recording.
- Follow formalities.
- Use of an appropriate language.
- Positive body language.
- Directing the interview.
- Questioning proper stress and tone and use of sub-questions if required.
- Researchers must be sociable and also should be faithful to the respondents. So, the respondents can express their answers more clearly and freely..
- Listen to the opinions of the subject patiently.
- Questions prepared for the hypothesis must be clear in its meaning.
- No irrelevant conversation should be organised at the time of interview.

Usage of Forms of Interview

A great deal of qualitative material comes from talking with people whether it be through formal interviews or casual conversation. If interviews are going to tap into depths of reality of the situation and discover subjects's meanings and understandings, it is essential for the researcher to develop empathy with interviewees and win their confidence to be unobtrusive, in order not to impose one's own influence on the interviewee.

The best technique for this is the unstructured interview. Here, the researcher has some general ideas about the topics of the interview and may have an aid memory of points that might arise in discussion for use as prompts, if necessary. But, the hope is that those points will come up in the natural course of the discussion as the interviewee talks.

As with observation, it may be that the researcher begins with a more focused study and wishes to know certain things. In these cases, a structured interview might be more appropriate. Here, the researcher decides the structure of the interview and sets out with pre-determined questions.

These tests are the useful and most frequently employed tools of educational research. They are used to describe and measure a sample of certain aspects of human behaviour or inner qualities. They provide the data for most experimental and descriptive studies of education. They yield objectives and standardised descriptions of some psychological aspects of an individual's personality and translate them in quantitative terms. There are various kinds of psychological tests.

Projective Techniques

This technique of data collection has been developed by the psychologists to use projections of respondents for inferring about underlying motives, urges or intentions, which are such that the respondent either resists revealing them or is unable to figure out himself. In projective techniques, the respondent in supplying information tends unconsciously to project his/her own attitude or feelings on the subject under study.

Projective techniques play a significant role in motivational researchers or in attitude surveys. The use of these techniques require intensive specialised training. In such techniques, the individual's responses to the stimulus situation are not taken at their face value. The stimuli may arouse different kinds of reactions. The nature of the stimuli and the way they are presented under these techniques do not clearly show the way in which the responses are to be interpreted. The stimulus may be a photograph, a picture, an inkblot and so on. Responses to these stimuli are interpreted as indicating the individual's own view, his personality structure, needs, tensions, etc, in the context of some pre-established psychological conceptualisation of what the individual's response to the stimulus means. Projective techniques may be used in qualitative as well as quantitative techniques and they are useful in both.

The Oxford University Press Dictionary of Psychology (**Colman, 2001**) defines projective techniques as "Any of a variety of personality tests in which the respondents give free responses to a series of stimuli, such as an inkblots, pictures or an incomplete sentence. Such tests are based on the psychoanalytic concept of projection, the assumption being that the respondents project unconscious aspects of their personality into the test items and reveal them in their responses".

The use of projective devices is particularly helpful in counteracting the tendency of subjects to try to appear in their best light, to respond as they believe they should.

The projections may be accomplished through a number of techniques such as-

Association The respondent is asked to indicate what he/she feels or thinks when presented with a picture, carbon, inkblot, word or phrases. The thematic apperception test, the Rorschach's inkblot test and various word association tests.

Completion The respondent is asked to complete an incomplete sentence or task.

A sentence completion instrument may include following items:

- My greatest ambition is
- My greatest fear is
- I mostly enjoy
- I dream a greatful deal about
- I get angry when
- If I could do anything I wanted it would be to

Role Playing Here, the subjects are asked to improvise or act out a situation in which they have been assigned various roles. The researcher may observe such traits as hostility, frustration, dominance, sympathy, insecurity, prejudice or the absence of such traits.

Creative or Constructive Permitting subjects to model clay, figure paint, play with dolls, play with toys or draw or write imaginative stories about assigned situations may be revealing. The choice of colour, form, words, the sense of orderliness, evidence of tensions and other reactions may provide opportunities to infer deep seated feelings.

Universe

The universe consists of all survey elements that qualify for inclusion in the research study. The precise definition of the universe for a particular study is set by the research question. The universe may be individuals, groups of people, organisations or even objects. The population or universe represents the entire group of units. Universe is the set of all experimental units from which a sample is to be drawn. From a statistical point of view, the term 'Universe' refers to the total of the items or units in any field of inquiry. Universe can be finite or infinite. It is said to be finite if it consists of a fixed number of elements so that it is possible to enumerate it in its totality. Whereas in an infinite aspect it is theoretically impossible to observe all the elements. We cannot have any idea about the total number of items.

Sample

The representative proportion of the population is called a s**ample**. To obtain a representative sample, the researcher selects each unit in a specified way under controlled conditions.

Usually, four steps are involved in the process-

- Defining the population
- Listing the population
- Selecting a representative sample
- Obtaining an adequate sample

After defining a population and listing all the units, a researcher selects a sample of units from the sampling frame. The process of such a selection is called sampling. In order to serve a useful purpose, sampling should be unbiased or representative.

A good sample must be as nearly representative to the entire population as possible and ideally, it must provide the whole of the information about the population from which the sample has been drawn.

The logic of the theory of sampling is the theory of induction, that is we proceed from particular, to general and all the results are expressed in terms of probability.

Garrett (**1962**) has pointed out that if the size of the sample is less than 25, there is often little reason for believing such a small group of units to be adequately descriptive of any population. If a greater precision of results in an investigation is needed, the sample should be larger. Greater precision is sometimes needed when one is dealing in areas where differences are likely to be small. The adequacy of the sample depends upon our knowledge of the population as well as upon the method used in drawing the sample.

A true representative sample can exactly be defined by the researcher through given steps-

- Listing the population with comprehensive and accurate list.
- Selecting a representative sample by pairing a list and sample is selected from the frame.
- Obtaining an adequate sample, which depends upon the method used in drawing the sample.

Characteristics of Good Sample

- The sample must be representative of the population. The sample size must be selected, depending upon the research objectives.
- Sample should be flexible, so that it can be modified depending upon the prevailing circumstances.
- Sample should reflect all the members of the population of data.
- Sample should be large enough to give sufficient precision.
- Sample should be unbiased by the sampling procedure or equipment.
- Sample should be chosen in a systematically random way so that chance or the operation of probability is utilised.

Techniques of Sampling

Techniques of sampling are given below-

Probability Sampling

In probability sampling, the units of the population are not selected at the discretion of the researcher, but by the means of certain procedures, which ensure that every unit of a population has one fixed probability of being included in the sample. This method is also called random **sampling.**

Randomisation has two important applications in research, which are as follows-

- Selecting a group of individuals for observation, who are representative of the population about which the researcher wishes to generalise.
- Equating experimental and control groups in a random experiment. Assigning individual assignments (each individual in the sample has an equal and independent chance of being assigned to each of the groups) is the best method of providing for their equivalence.

Characteristics of Probability Sampling

*According to **Good (1966)**, probability sample have the following characteristics*

- Each unit in the sample has some known probability of entering the sample.
- Weights appropriate to the probabilities are used in the analysis of the sample.
- The process of sampling is automatic in one or more steps of selection of units in the sample.

Advantages of Probability Sampling

- It helps the researcher to know the size of the sample needed to achieve any desired level of accuracy.
- The researchers also may be able to specify the chance of each unit being selected.
- This method also helps to estimate the magnitude of error due to sampling.

Disadvantages of Probability Sampling

- It depends upon how good a sampling frame is made, although this remains a limitation in complete enumeration studies.
- In this process, only a portion of the sampling frame is examined and so specific information on every sampling unit (people, account, inventory, etc) are ignored,
- In small areas or rare sub-population, sampling error may be high.
- Representatives of the frame may be questionable and controversial.

Types of Probability Sampling

There are different methods of selecting a probability sample, which have their own advantages and limitations.

Types of probability samplings are as follows-

(i) **Simple or Unrestricted Random Sampling** In simple or unrestricted random sampling, each unit of the population is given an equal chance of being selected. The selection of units from the population is done in such a manner that every unit in the population has an equal chance of being chosen and the selection of anyone. Unit is in no way tied to the selection of any other. The law of chance is allowed to operate freely in the selection of such a sample and carefully controlled conditions are created to ensure that each unit in the population has an equal chance of being included in the sample.

Several devices are used here to draw samples from population:

Lottery Method In this case, researchers will use a set of N tickets, if there are N units in the population, with numbers I to N written on the tickets. The tickets will be thoroughly mixed up and then N tickets will be drawn one by one, if the sample of size N is required. The units which have the serial numbers occurring on these N tickets will be considered as selected.

Use of Random Table In this, consecutive numbers are assigned to the units of the population, the investigator starts at any point on the table of random numbers and consecutive numbers in any direction. Researcher reads the number on the table and picks up every unit one by one and in this way, the required number of units are selected.

(ii) Stratified Random Sampling This method is used to overcome the four problems related to simple random sampling. Here, the researcher first divides his whole population into different strata on the basis of certain characteristics and a random sample is drawn from each stratum.

Such stratification of the population makes different small homogenous groups of the population and simple random sampling techniques can be applied to each group to select the required number of samples.

A population can be stratified on many grounds, such as age, sex, grade, economic condition, place of residing, occupation, caste, etc. The efficiency of stratified random samples depends on the allocation of sample size to strata. Percentage Method is the best method of allocating sample size among strata. Stratified random sampling ensures that specific groups are represented, even proportionally, in the sample(s)(e.g. by gender), by selecting individuals from strata test.

(iii) Systematic Sampling When a frame of a population is available or when a population can be accurately listed and is finite, a method of systematic selection will provide a sample which approximates a random sample. Here, all the units of the population are listed in an alphabetical order first. Then if 100 units, out of 1000 units of a population has to be selected, one may keep interval of 10 units of a population, throughout the population.

(iv) Cluster Sampling This is a variation of simple random sampling.

This method is used when

- population is infinite.
- list of all units of population is not available.
- population is scattered over a wide geographical area
- individuals have to be studied as a group.

In this method, different clusters of the whole population are formed due to the large area of the population. That is why it is also called area sampling. The individuals in 49

these clusters have almost all the same characteristics of their respective groups. The final result is generalised to be the whole state.

(v) **Multi-Stage Sampling** This is used in large scale surveys for making the study more comprehensive. Sampling here is done in two, three or four stages. LE Multi-stage sampling is comparatively convenient, less time consuming and less expensive method of sampling. However, an element of sample bias gets introduced because of the unequal size of some of the selected sub-samples. This method is recommended only when it would be impracticable to draw a random sample.

Non-Probability Sampling

In non-probability sampling, the units are selected at the discretion of the researcher. Such samples use human judgement in selecting units and have no theoretical basis for estimating population characteristics. While selecting the sample, the researcher only thinks where he will get the required data to serve his purpose. That is why it is also called a purposive sample.

The non-probability sampling methods are very convenient in the situations, when the sample to be selected is very small and the researcher wants to get some idea of the population characteristics in a short time.

Such samples are used in the situations, where the researcher does not want a representative sample, but to gain insight into the problem by selecting only an informed person, who can provide him the maximum degree of insight into his problem with comprehensive information.

Types of Non-Probability Samplings

Types of non-probability samples are as follows-

Quota or Chunk Sample In this method, the quota of samples from different units of the population is fixed and thus, a total sample is selected.

Incidental/Volunteer/Convenient Sampling In this method, whosoever is available to cooperate for providing information is selected and thus, the required number of samples is obtained.

Snowball Sampling It is used to find subjects of interest from those, who are most likely to be able to identify them. In this technique, the researcher uses a few subjects to identify the other individuals who might be appropriate for the study. This continues with the new subjects, until the researcher has a sufficient sample size.

Advantages of Non-Probability Sampling

- They are quicker, cost effective and more convenient than probability samples.
- Non-probability samples do not require a sampling frame.
- The sample size and quota requirements are usually achieved.

Disadvantages of Non-Probability Sampling

- Less confidence is placed in the data obtained from samples and thus, results obtained cannot be generalised for the entire population.
- Sampling based on convenience affects the variance within groups as well as between groups.
- Sampling errors of these samples cannot be determined.
- They depend exclusively on uncontrolled factors and researcher's insight and there is no statistical method to determine the margin of sampling errors.
- Sometimes, such samples are based on absolute frame, which does not adequately cover the population.
- There is considerable scope for bias in the selection of units to be included in the sample.

Research Proposal

According to **Koul**, "The research proposal is a systematic plan, which brings to focus the preliminary planning that will be needed to accomplish the purpose of the proposed study".

The preparation of a research proposal is an important step in the process of research. There is no universally accepted format for preparing research proposals. Most of the

institutions and funding agencies require the researcher to submit their research proposal as per the specific format of that agency.

Before submitting a proposal for funding, follow the particular format that is specified by the funding agencies. However, almost all the formats ask for certain specifications of the plan to appear in the research proposal. These specifications provide sufficient information about the researcher's planning and for evaluation of the research proposal. There are certain specifications, which are common to all types of research proposals and are included in all types of format.

Steps for Writing Research Proposal

A research proposal should be framed on the basis of the following steps/guidelines .

Title of the Project

The title of the research proposal is just the name of the topic and suggests the theme of the work to be done. While selecting the title of the project, the researcher should take care that instead of using flowery words, professional language and terms should be used in an easy and understandable manner. Also the title should be brief, concise and specific. Specific in the sense that it should claim for the study what it is going to actually deliver. Thus, a good title is that which provides sufficient information about the nature of the proposed project.

The Statement of the Problem

The statement of the problem may be presented either as a declarative statement or in question form. This attempt to focus on a stated goal, gives direction to the research process. It must be limited enough in scope to make a definite conclusion possible. The major statement may be followed by a minor statement. A problem suggests a specific answer or conclusion. Usually, a controversy or a difference of opinion exists. A cause and effect relationship may be suggested upon the basis of theory or previous research findings.Personal observation and experience may be the basis of a problem.

Some examples of the problem statements are-

- Children who have kindergarten experience might demonstrate greater academic achievement in the first grade than those who have not had this experience.
- Knowledge of participation in an experiment may have a stimulating effect upon the reading achievement of the participants.
- The significance of the problem is important for both the researcher and the evaluator of the research proposal. The researcher must show how his/her research work is going to contribute to the existing knowledge or influence the Educational Theory and/or practice. He/she must focus on the significance and relevance of his/her study. And in order to maintain the quality of educational research, the evaluator must critically examine the significance and relevance of the submitted proposal.

Assumptions, Limitations and Delimitations

The researcher should define all unusual terms that others could misinterpret. These definitions help to establish the frame of reference with which the researcher approaches the problem. The operational definitions of the variables should be given in the research proposal. Such expressions as academic achievement and intelligence are useful concepts, but they cannot be used as criteria, unless they are defined as observable samples of behaviour or score on standardised intelligence tests is an operational definition of intelligence.

Assumptions These are those statements, which are assumed to be the facts but can't be verified without testing. The researcher should give sufficient details and basis of these assumptions in his/her research proposal.

Limitations These are those conditions beyond the control of the researcher that may place restrictions on the conclusion of the study and their application to other situations. The limitations such as inability to select samples randomly or inability to use validated tests for data collection should be properly reported in research proposals. Delimitations These are the boundaries of the study. A study may focus on the achievement motivation in relation to the socio-economic status of the 9th grade students. Here, the conclusions can't be extended beyond this population sample

studied. We should give sufficient space to these various delimitations, also in our research proposal.

Review of Related Literature

The review of literature by any researcher shows how up-to-date he/she is in the area of research. Any new research is built upon or adds to what is known up to that point of time. The review should provide evidence of the investigator's knowledge of the field of investigation and also help him/her evolving new insight and build new approaches to the problem under investigation.

It is usual to review all relevant theories, writings and studies bearing on the theme depending upon the specific needs of the study. Only those studies that are plainly relevant, competently executed and clearly reported should be included.

The reviews must be classified in the most appropriate and meaningful form. The reviews should also point out the inadequacies in existing studies (methodological, conceptual, etc), research areas which have been left out, areas requiring cross cultural confirmation, studies which need updating, etc.

Hypothesis

Hypothesis is a tentative solution to our problem, which is tested on the basis of the analysis of the collected data. In a research proposal, researchers should specify one major hypothesis and several minor hypothesis as the case and the need may be. Hypothesis are not just guess work rather depend upon logic and previous knowledge.

These give direction to data gathering and research process. The hypothesis should always be reasonable and consistent with previously known facts/theories. Also, we must state it in such a way that we can test it and find it to be either probably true or probably false. The formulation of the hypothesis in advance of the data gathering process is necessary for an unbiased investigation. It is not appropriate to formulate additional hypothesis after data are collected, but they should be tested on the basis of new data and not on the old data that suggested them.

Methods

In this part of the research proposal, we usually specify the nature of the subjects, selected through sampling procedures, tools to be used and procedures and data analysis.

Subjects The subject section details the population from which the researcher plans to select the sample. The most frequently studied variables are the subjects, age, gender, race, caste, religion, socio-economic status, educational level, IQ, etc. In this section, we also have to describe the size of the sample (the number of the subjects to be studied) and the sampling procedures (how the sample will be selected from the population).

Tools The researcher in the research proposal, should fully describe the tool(s) to be used, the reliability and the validity of the tools(s) and the reason for the selection of that particular tool or tools for data collection. If the researcher is going to develop his/her own tool, then he should outline the procedure he is going to follow in test development and standardisation. So, the use of any reliable and valid tool is inevitable for the collection of evidence or data for the research study.

Procedures This section outlines the research plan. It describes in detail what will be done, how it will be done, what data will be needed and what data gathering devices will be used. There is no single universal procedure which can be followed in all types of research studies, rather it highly depends on our particular research objectives. For example, the procedure of using a mail questionnaire will be totally different from using an interview technique or observation technique.

Data Analysis There are mainly two types of data i.e. qualitative and quantitative. Both the types of data are to be analysed differently. Mostly there are different types of statistical techniques to analyse these two different types of data. What particular is to be used and how the data are to be analysed, depend on our particular study.

If the data are to be processed through a computer this should be explained in a research proposal. We should completely describe our complete data analysis procedure in our proposal, so that the readers may get a clear idea of the research plan.

Summary and Conclusion

This provides the reader a quick review of what has been done to obtain the results. It is the most utilised part of the report. This chapter usually commences with a re-statement of the problem and brief description of the procedures followed by the principal fundings which are presented as suggestions.

References/Bibliography

This provides information regarding the literature materials and the sources used for conducting the study. In our research proposal, we should list all the references that were cited in the text. We should cite in the research proposal, the material that has helped in the preparation of the research proposal.

In this case, we should prepare and present bibliography in which all the relevant references, whether cited or not, are included. This list to be prepared alphabetically and according to the set pattern of writing the references.

Time Schedule

In the research proposal, the researcher should also indicate a realistic time schedule to complete the study/project. It is very helpful for the researcher in terms of both, using time systematically and minimising the natural tendency of procrastination.

Budget Schedule

Conducting research requires a lot of money also. The researcher while preparing a research proposal should estimate the cost of the project, considering the required persons, months and facilities. This budget along with either research proposal should be submitted by the government, private or any other agency for financial assistance. In our research proposal, the researcher should justify the allocation of money for various heads of the budget estimate because the funding agency evaluates very carefully.

Types of Research Proposals

On the basis of the type and purpose of the research study.

Research proposal can broadly be categorised into the following categories

Research Proposal for Degree

This common type of proposal is prepared and presented by those researchers who are required to conduct a research study for the fulfilment of their Master's degree or Doctoral Degree in Education.

Most universities require the beginner researchers to submit the research proposal, which is then evaluated by a committee of experienced experts. These experts determine the significance, utility and feasibility of the proposed study and may suggest some modifications in the research proposal.

Research Proposal for Financial Assistance

Many times conducting a particular research seems to go beyond the budget of the researcher for which he/she requires some financial assistance. He/she then submits the research proposal to a government or private agency, requesting for financial assistance. Such an agency then asks empanelled experts for comments and/or recommendations, after evaluating the proposal and the agency then decides to provide (or not to provide) the financial assistance on the basis of these comments and/or recommendations.

Research Proposal for Grants by Government

Since, various research organisations, such as universities, the UGC, the NCERT and the ICSSR are ear-marking more and more funds at present for a specific purpose of promoting research. More and more colleges and university teachers are becoming motivated to conduct research in their respective areas of concern at school, college or university level. They are also required to submit their research proposal for evaluation and are provided grants if experts recommend so after evaluation of the research proposal.

Part C- Analysis of Data

Statistics is a numerical representation of information. Whenever, we quantify or apply numbers to data, in order to organise, summarise or better understand the information in which statistical methods are used.

Data Analysis

Data analysis is done for inspecting, cleaning, transforming and presenting data with the goal of discovering useful information.

The credibility of findings and conclusions significantly depends on the quality of the research design, data collection, data management and data analysis. Data analysis is the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap and evaluate data. According to **Koul** (**1997**), "the analysis of the qualitative data means studying the organised material, in order to discover inherent facts. These data are to be studied from as many angles as possible, either to explore new facts or to interpret already existing known facts".

There are many different data analysis methods, depending on the type of research. But the data may be classified into two broad categories i.e.

- **quantitative and**
- **qualitative**

In **quantitative data analysis**, one is expected to turn raw numbers into meaningful data, through the application of rational and critical thinking. It may include the calculation of frequencies of variables and differences between variables. A quantitative approach is usually associated with finding evidence to either support or reject hypothesis, which the researchers have formulated at the earlier stages of the research process.

Qualitative data analysis is the range of processes and procedures, whereby we move from the qualitative data that have been collected into some form of explanation, understanding or interpretation of the people and situations we are investigating.

Levels of Measurement

The level of measurement refers to the relationship among the values that are assigned to the attributes for a variable. It is important to understand the level of measurement as it helps you to decide how to interpret the data from the variable concerned. Second, knowing the level of measurement helps you to decide which statistical techniques of

data analysis are appropriate for the numerical values that were assigned to the variables. The scale of measurement refers to ways in which variables numbers are defined and categorised. Each scale of measurement has certain properties which in turn determine the appropriateness for use in certain statistical analysis.

Types of Measurement Scales

Before a researcher begins his/her analysis he/she must identify the level of measurement, associated with the quantitative data. The level of measurement can influence the type of analysis, one can use.

There are four levels of measurement scale and they are-

Nominal Scale

Simply, it is a system of assigning number symbols to an event, in order to label them. For example, the assignment of numbers of basketball players, in order to identify them. Such numbers cannot be considered to be associated with an ordered scale, for their order is of no consequence, the numbers are just convenient labels for the particular class of events and as such, have no quantitative value. Nominal scales provide convenient ways of keeping track of people, objects and events. One cannot do much with the numbers involved. For example, one cannot usefully average the number on the back of a group of football players and come up with a meaningful value.

Neither can one usefully compare the numbers assigned to one group, with the numbers assigned to another. The counting of members in each group is the only possible arithmetic operation, when a nominal scale is employed. Accordingly, we are restricted to use mode as the measure of central tendency. Generally, there is no used measure of dispersion for nominal scales. Chi-square test is the most common test of statistical significance that can be utilised, and for the measures of correlation, the contingency coefficient can be worked out.

It is the least powerful level of measurement. It indicates no order or distance relationship and has no arithmetic origin. It simply describes difference between things, by assigning them to categories. The scale wastes any information that we may have about varying degrees of attitude, skill understandings, etc. Inspite of all this, nominal

scales are still very useful and are wide used in surveys and other ex-post facto research, when data is being classified by major sub-groups of the population. Thus, nominal data is counted data.

Ordinal Scale

The lowest level of the ordered scale that is commonly used is the ordinal scale. It places events in order, but there is no attempt to make the interval of the scale equal, in terms of some rules. Rank orders represent ordinal scales and are frequently used in research relating to qualitative phenomena. A student's rank in graduation class involves the use of an ordinal scale. One has to be very careful in making statements about scores based on an ordinal scale. For instance, if Ram's 40, it position in his class is 10 and Mohan's position cannot be said that Ram's position is four times as go as that of Mohan. The statement would make no sense at all. Ordinal scales only permit ranking of items, from highest to lowest. Ordinal measures have no absolute values and real differences between adjacent ranks may not be equal. All that can be said is that person is higher or lower on the scale than another, but more precise comparisons can be made.

Thus, the use of an ordinal scale implies a statement of greater than or less than (equality statement is also acceptable) without our being able to state how much greater or less. The real difference between ranks I and 2 may be more or less, than the difference between ranks 5 and 6. Since, the numbers of this scale have only a rank meaning the appropriate measure of central tendency is the median. A percentile or quartile measure can be used for measuring dispersion. Correlations are restricted to various rank order methods, whereas measures of statistical significance are restricted to the non-parametric methods.

Interval Scale

In interval scale, the intervals are adjusted in terms of rules that have been established as a basis for making the units equal. The units are only in so far as one accepts the assumptions, on which the rule is based. It can have an arbitrary zero, but it is not possible to determine for them what may be called an absolute zero or the unique origin.

The primary limitation of the interval scale is the lack of true zero; it does not have the capacity to measure the complete absence of a trait or characteristic.

The **Fahrenheit scale** is an example of an interval scale and shows similarities in what one can and cannot do with it. One can say that an increase in temperature from 10° to 40° involves the same increase in temperature as an increase from 60° to 70°, but one cannot say that the temperature of 60° is twice as warm as the temperature of 30° because both numbers are dependent on the fact that the zero on the scale is set arbitrarily, at the temperature of the freezing point of water. The ratio of the two temperatures i.e. 30° and 60°, means nothing because zero is an arbitrary point.

It provides more powerful measurement than ordinal scales, for interval scale also incorporates the concept of equality of interval. As such, more powerful statistical measures can be used with interval scales. Mean is an appropriate measure of central tendency, while standard deviation is the most widely used measure of dispersion. Product moment correlation techniques are appropriate and the generally used tests for statistical significance are the T-test and F-test.

Ratio Scale

zero of Ratio scale have an absolute or true measurement. The term absolute zero is not as precise as it was once believed to be. We can conceive of an absolute zero of length and similarly we can conceive of an **absolute zero** of time. For example, the zero point on a centimeter scale indicates the complete absence of length or height. But an absolute zero of temperature is theoretically unobtainable and it remains a concept, existing only in the scientist's mind.

The number of minor traffic rule violations and the number of incorrect letters in a page of type script, represents scores on ratio scales. Both these scales have absolute zeros and as such, all minor traffic violations and all typing errors can be assumed to be equal in significance. With ratio scales involved one can make a statement like Jyoti's typing performance was twice as good as that of Reetu. The ratio involved does have significance and facilitates a kind of comparison, which is not possible in case of an interval scale.

It represents an actual amount of variables. Examples are measures of physical dimensions, such as weight, height, distance, etc. Generally, all statistical techniques are usable with ratio scales and all manipulations that one can carry out with real numbers, can also be carried out with ratio scale values. Multiplication and division can be used with this scale, but not with other scales mentioned above. Geometric and harmonic means can be used as measures of central tendency and coefficients of variation may also be calculated.

Thus, proceeding from the nominal scale (the least precise type of scale) to ratio scale (the most precise), relevant information is obtained, increasingly. If the nature of the variables permits, the researcher should use the scale that provides the most precise description. Researchers in physical sciences have an advantage to describe variables in ratio scale form, but the behavioural sciences are generally limited to describe variables in interval scale form, a less precise type of measurement.

Part D - Quantitative Data Analysis

Statistics is a numerical representation of information. Whenever, we quantify or apply numbers to data, in order to organise, summarise or better understand the information, in which statistical methods are used. These methods can range from somewhat simple computations, such as determining the mean of a distribution to very complex computations, such as determining factors or interaction, effects within a complex data set, etc.

Descriptive Data Analysis

There are two major branches of statistics, each with specific formulas. The first, descriptive statistics refers to the analysis of data of an entire population.

In other words, descriptive statistics is merely using numbers, to describe a known data set. The term population means we are using the entire set of possible subjects as opposed to just a sample of these subjects. It is a summary of information and the data presented is easily understood.

- It is used to describe basic features of the data, in the study.
- It is used to present quantitative descriptions, in a manageable form.
- It includes the construction of graphs, charts and tables.

The following statistical measures of descriptive analysis are used to computer further statistical testing

Measures of Central Tendency

Mean, **Median** and **Mode** are three most commonly used measures of central tendency.

They can be explained as below

Mean

The mean of a distribution is commonly understood as the **arithmetic average**. Its perhaps the most familiar, most frequently used and well understood average. The mean of a set of observations or scores is obtained by dividing the sum of all the values by the total number of values. It is used to describe the middle of a set of data that does not have an **outlier.**

Arithmetic Mean (**AM**) The arithmetic mean (or simple mean) of a sample x_1, x_2,...,x, is the sum of the sampled values, divided by the number of items in the sample. It can be represented as:

$$\overline{x} = \frac{x_1 + x_2 + ... + x_n}{n}$$

Geometric Mean (**GM**) It is an average that is useful for sets of positive numbers that are interpreted, according to their product and not their sum (as in the case with the arithmetic mean) e.g. rates of growth.

$$\bar{x} = \left(\prod_{i=1}^{n} x_i \right)^{\frac{1}{n}}$$

Harmonic Mean (**HM**) It is an average, which is useful for sets of numbers, which are defined in relation to some unit, e.g. speed (distance per unit of time).

$$\bar{x} = n.\left(\sum_{i=1}^{n} \frac{1}{x_i}\right)^{-1}$$

Advantages

- Most popular measure in fields of business, engineering and computer science.
- It is unique, there is only one answer.
- Useful, when comparing sets of data.

Disadvantages

- It is affected by extreme values (outliers).
- It is not often used for analysing business problems.
- The calculation of HM involves complicated calculations. •

Relationship Between AM, GM and HM

AM, GM and HM satisfy these inequalities:

AM ≥GM≥ HM

Equality holds, only when all the elements of the given samples are equal.

Median

It is a point in an array, above and below, where one half of the scores fall. It is a measure of position, rather than of magnitude.

Use the median to describe the middle of a set of data that does have an outlier.

Median for Grouped Data In case of grouped data, we first prepare a cumulative frequency distribution. It can be represented as:

$$\text{Median} = l + \frac{N/2 - fc}{fm} \times i$$

where, l = Limit of lower median class

N/2= Half of the sum of total frequencies

fc = Preceding middle class of cumulative frequency

fm = Frequency of median class

i= Size of the class interval

Median for Ungrouped Data If the scores are ungrouped and their number is small, then

(a) For number of scores, if they are **even**

$$\textbf{Median} = \frac{Sum\ of\ mid\ two\ scores}{2}$$

(b) For number of scores, if they are **odd**

Median = Mid score

Advantages

- Extreme values (outliers) do not affect the median as strongly as they do the mean.
- Useful when comparing sets of data.
- It is unique, there is only one answer.

Disadvantages

- Not as popular as mean.
- Takes a long time to calculate for a very large set of data.

Mode

It is defined as the most frequently occurring score in a distribution. If there is only one value, which occurs a maximum number of times, then the distribution is said to have one **mode.**

It is used when the data is non-numeric or when asked to choose the most popular item.

It can be represented as:

$$M_0 = L + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

where, L = Lower limit of the modal class

fo = Frequency before the frequency of modal class

f_1 = Frequency of the modal class

f_2 = Frequency after the frequency of modal class

h = Class size of the modal class

Advantages

- It is easy to understand and simple to calculate.
- It can be located, graphically.
- It is not affected by extreme large or small values.
- It can be useful for qualitative data.

Disadvantages

- It is not used more frequently, as compared to mean and median.
- Not necessarily unique, there may be more than one answer.
- When no values repeat in the data set, the mode is every value and is useless.
- When there is more than one mode, it is difficult to interpret and/or compare.

Relationship Between Mean, Median and Mode

In can be represented as:

Mode = 3 Median 2 Mean
or **M =3 Md - 2Mn**

Statistical Parameter

★ *A statistical parameter is a parameter that indexes a family of probability distribution.*

★ *It can be regarded as a numerical characteristic of a population or a model.*

★ *In statistical inference, parameters are something taken to be unobservable.*

Measures of Variability

The measures of variability are also called the **measure of spread or dispersion**.

There are several measures of variability:

- Limit Method
- Average of Deviation

Limit Method

*There are **four** ways of variability measurement:*

Range

The range is the most general and simplest measure of variability. It is defined as the difference between the most extreme scores in a distribution.

It can be represented as:

$$\boxed{R = L - S}$$

where, R= Range, L = Largest value, S = Lowest value

Applications

- When the data are too scant or scattered to justify, the computation of a more precise measure of variability.
- When a knowledge of extreme scores or of total spread is all that is wanted.

Disadvantages

- The value of range is based on only two extreme scores in the total distribution, which means that it does not give any idea of the variation of other scores of distribution.
- It is not a stable statistic, because its values can differ from sample to sample, drawn from the same population.

Quartile Deviation

Quartile deviation is also known as a **measure of dispersion**. The quartile deviation is one half of the middle 50% of the cases. It is one half of the scale, distance between the third and first quartile. First quartile Q, is a point below, which lies 25% of the scores or the scale. The third quartile Q3, the point below which lies 75% of the scores on the score scale.

It can be represented as:

$$Q = \frac{Q_3 - Q_1}{2}$$

$$Q_3 = l_3 + \frac{3N/4 - fc}{fm} \times i$$

$$Q_1 = l_1 + \frac{N/4 - fc}{fm} \times i$$

$$Q_2 = Q_1 + Q_D, Q_3 - Q_D$$

Applications

- When the median is the measure of central tendency.
- When there are scattered or extreme scores, which would influence the SD.
- When the concentration around the median is the middle 50% of the case, which is of primary interest.

Percentile Range

It is used as a measure of dispersion. It is the difference between 90th and 10th percentile.

It can be represented as:

Percentile range = p90-p10

Inter- Quartile Range

In descriptive statistics, the Inter- Quartile Range (IQR), also called the midspread or middle fifty is a measure of statistical dispersion, being equal to the difference between the upper and lower quartiles. It is a trimmed estimator, defined as the 25% trimmed mid range and is the most significant basic robust measure of scale. It is the third quartile of a box plot minus the first quartile.

It can be represented as:

$$IQR = Q_3 - Q_1$$

Average of Deviation

Two types of average of deviation methods are

Average Deviation

The Average Deviation (AD) is the mean of the deviations of all of the separate scores in a series, taken from their mean. In averaging deviations to find the AD, no account is taken of signs and all deviations, whether plus or minus are treated as positive.

Applications

- When it is desired to weight all deviations from the mean, according to their size.

- When extreme deviations would influence standard deviation unduly.

Standard Deviation

The **average of the square deviations** of the measures or scores from their mean is known as the **variance** and square root of variance is known as standard deviation.

mode.. This is a most stable index of variability. In this, we avoid the difficulty of signs by squaring the separate deviations. The squared deviations used in computing the SD, are always taken from the mean, never from the median and mode.

Standard deviation is denoted σ.

Standard Deviation for **ungrouped data**

$$\sigma = \sqrt{\frac{\Sigma x^2}{N}}$$

Standard Deviation for **grouped data**

(a) In case of actual mean $\sigma = \sqrt{(\frac{\Sigma fx^2}{N} - c^2)}$

(b) In case of assumed mean

$$\sigma = i\sqrt{\frac{\Sigma fx^2}{N} - c^2} \Rightarrow c = \text{Correction factor}$$

$$\sigma = i\sqrt{\frac{\Sigma fx^2}{N} - \left(\frac{\Sigma fx}{N}\right)^2}$$

Applications

- When the statistic having the greater stability is sought.
- When extreme deviations should exercise proportionally greater effect upon the variability.
- When coefficients of correlation and other statistics are subsequently to be computed.

Fudiciary Limits

These indicate the interval (or the fiduciary limits) within which the mean of the population will lie at 0.95 or 0.99 levels of confidence. The fiduciary limits or the confidence interval of the population mean is estimated based on the sample mean. The sample mean is known as the **statistic** and the population mean is known as the **parameter**. The computation of population mean requires the use of standard error of the mean. Similarly, fiduciary limits or the confidence interval of the population standard deviation is also computed.

Graphical Presentation of Data

This includes bar diagrams, pie charts and line graphs. The line graph is usually used to represent the distribution of the scores obtained on a variable with the objective of indicating the shape of the distribution. The bar diagrams are used for making comparisons of mean scores on the variable being studied in various sub-groups, such as boys v/s girls, urban v/s rural, private aided v/s private unaided v/s municipal schools, SSC v/s CBSE v/s ICSE v/s IGCSE schools and so on. Pie charts are used to indicate the proportion of different sub-groups in the sample or the variance of a specific variable associated with another variable.

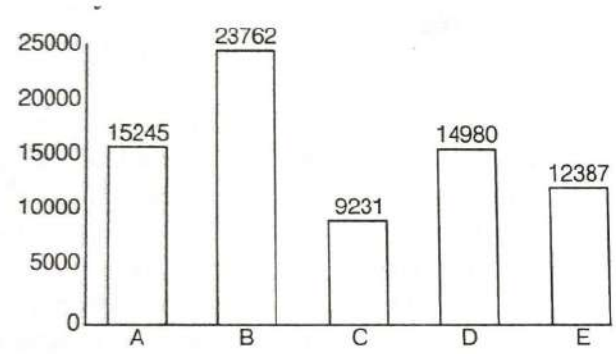
Graphic presentation is another way of the presentation of data and information. The graphic presentation offers a quick and simple way of understanding the features and drawing comparisons. It is an effective analytical tool. Graphical presentation is used in situations, when we observe some functional relationship between the values of two variables.

Graphs help to understand the data easily. All statistical packages, MS Excel, and OpenOffice.org offer a wide range of graphs. In case of qualitative data (or categorised data), most common graphs are bar charts and pie-charts.

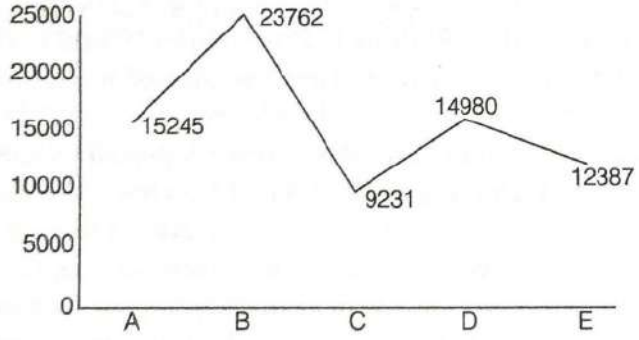
Bar Chart

A bar chart consists of a series of rectangles (or bars). The height of each rectangle is determined by the frequency of that category. Suppose that the sales of a popular soft drink in the year 2018-19, in five geographical regions, denoted as A, B, C, D and E, are 15245, 23762, 9231, 14980, and 12387, respectively, measured in 10,000 USD.

A bar chart of this data is as below:

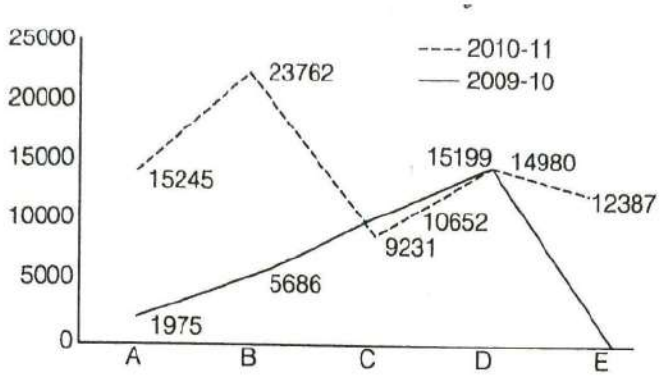


A line chart can also be plotted in this data by connecting the midpoints of each rectangle as below



Line charts are useful when we wish to compare to data sets as we can overlap to line charts. For example, the sales data of the same soft drink in the same geographical regions in the year 2017-18 were 1975, 5686, 10652, 15199 and 726, respectively, measured in 10,000 USD.

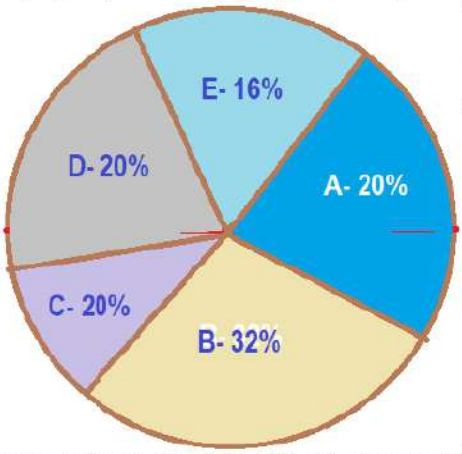
The line chart showing the data for both the years is



Another graphical representation of the same data is using multiple bars as below:

Pie-Chart

A pie-chart is used to emphasise relative proportion or shares of each category. It's a circular chart divided into sectors, illustrating relative frequencies. The relative frequency in each category or sector is proportional to the arc, length of that sector or the area that sector or the central angle of that sector. Given above in the example, the soft drink has its market or [illegible] denoted as A, B, C, D and E. For the year 2018-19, the [illegible] 5, 23762, 9231, 14980, and 12387, respectively, measur[illegible] soft drink is 75605 times 10,000 USD. A pie-chart [illegible] f the shares of different markets.



In case of quantitative data [illegible] which is a generalisation of bar charts. The data is [illegible] s intervals and each bar represents a class interval. [illegible] onal to the width of the corresponding class interval. The area of the bar is proportional to the frequency of the corresponding class interval. After making the class intervals in a quantitative data set, a pie-chart can also be used to read the share of each class interval.

Principles of Hypothesis Testing.

Hypothesis testing is a systematic way to select samples from a group of population with the intent of making a determination about the expected behaviour of the entire group. Hypothesis testing is also known as significance testing. Hypothesis testing is used to infer the result of the hypothesis performed on a sample from a larger population. Hypothesis testing attempts to validate or disprove preconceived ideas.

Hypothesis testing works by collecting data and measuring how likely the particular set of data is assuming the null hypothesis is true. If the data set is very unlikely, defined as being part of a class of sets of data that only rarely will be observed, the experimenter rejects the null hypothesis concluding it (probably) is false. This class of data set is usually specified via a test static, which is designated to measure the extent of apparent departure from the null hypothesis. The procedure works by assessing whether the observed departure measured by the test statistic is larger than a value defined, so that the probability of occurrence of a more extreme value is small under the null hypothesis. If the data does not contradict the null hypothesis, then only a weak conclusion can be made, namely the observed data set provides no strong evidence against the null hypothesis. As the null hypothesis could be true or false, in this case, in some cases this is interpreted as meaning that the data give insufficient evidence to make any conclusion on others. It means that there is no evidence to support changing from a currently useful regime to a different one.

Example

Given the test scores of two random samples of men and women, does one group differ from the other? A possible null hypothesis is that the mean male score is the same as the mean female score.

$$H_0: \mu_1 = \mu_2$$

Where,

H_0 = The null hypothesis

μ_1 = The mean of population 1

μ_2 = The mean of population 2

A stronger null hypothesis is that the two samples are drawn from the same population, such that the variance and shape of the distributions are also equal.

Introduction of Error

The word error entails different meanings. The concrete meaning of the Latin word error is wandering or straying. In statistics, an error is not a mistake but rather a difference between a computed, estimated or measured value and the accepted true, specified or theoretically correct value. A statistical error is the amount by which an observation differs from its expected value. The statistical error is based on the whole population from which the statistical unit was chosen randomly.

The error of an observed value is the deviation of the observed from true function value, while the residual of an observed value is the difference between the observed value and the estimated function.

Types of Error

While testing a hypothesis, there are some wrong decisions can be noticed, which are-

- The researcher decides, based on the statistical findings, to reject the null hypothesis when it is false (Method A ≠ B). Correct decision.
- The researcher decides, based on the statistical findings, to not reject the null hypothesis when it is true (Method A = Method B). Correct decision.
- The researcher decides, based on the statistical findings, to reject the null hypothesis when it is true (Method A ≠ Method B). Wrong decision.

The researcher decides, based on the statistical findings, to not reject the null hypothesis when it is false (Method A B). Wrong decision.

In these cases, two types of errors can be seen i.e.

Hypothesis is true, but our test rejects (Type I error) Hypothesis is false, but our test accepts it. (Type II error) There is always a possibility that the researcher will make a mistake regarding the relationship between the two variables.

There are two possible mistakes or errors i.e.

Type 1 Error

It is committed by rejecting the null hypothesis when it is true. This occurs when the researcher assumes that a relationship exists when in fact the evidence is that it does not. In a Type I error, the researcher should accept the null hypothesis and reject the null hypothesis, but the opposite occurs. The probability of committing a Type I error is called **alpha.**

i.e. β= Prob (Type I error)

Type II Error

Type II error occurs when the researcher assumes that a relationship exists when in fact the evidence is that it does. In a type II error, the researcher should reject the null hypothesis and accept the research hypothesis, but the opposite occurs. The probability of committing a Type II error is called beta.

i.e. β= Prob (Type II error)

While testing hypothesis, a researcher reduces these two types of errors. But due to fixed sample size, it is not possible to control both errors simultaneously. Generally, reducing the possibility of committing a Type I error increases the possibility of committing Type II error and vice-versa reducing the possibility of committing a Type II error increases the possibility of committing a Type I error. Researchers generally try to minimize Type I error because when a researcher assumes a relationship exists when one really does not, things may be worse off than before. In Type II error, the researcher misses an opportunity to confirm that a relationship exists, but is no worse off than before.

Three Kinds of Error

*In **1948, Mosteller** (**1916-2006**) argued that a third kind error was required to describe circumstances. He observed:*

- *Type I error rejecting the null hypothesis when it is true.*
- *Type II error accepting the null hypothesis when it is false.*
- *Type III error correctly rejecting the hypothesis for the wrong reason.*

Mitroff (1974) *argued type III error as either the error of having solved the wrong problem when one should have solved the right problem or the error of choosing the wrong problem representation.*

Level of Significance

The level of significance is defined as the probability of rejecting a null hypothesis by the test when it is really true, which is denoted as a i.e. P (Type I error) = α. Confidence level: The level of significance 0.05 is related to the 95% confidence level.

The rejection or acceptance of a null hypothesis is based on some level of significance as a criterion.

- Rejecting a null hypothesis at the 0.05 level indicates that a difference in means as large as that found between the experimental and control groups would have resulted from sampling error is less than 5 out of 100 replications of the experiment. This suggests a 95% probability that the difference was due to the experimental treatment rather than to sampling error.
- A more rigorous test of significance is the 1% (0.01) level. Rejecting a null hypothesis at the .01 level would suggest that a difference in means as large as that found between the experimental and control groups would have resulted from sampling error is less than I in 100 replications of the experiment.

Example

The reading experiment has found the data and test the null hypothesis that there was no significant difference between the mean, reading achievement of the initial teaching

Experimental ITA Group	Control Traditional Alphabet Group
$N_1 = 32$	$N_2 = 34$
$\bar{X}_1 = 87.43$	$\bar{X}_2 = 82.58$
$S_1^2 = 39.40$	$S_2^2 = 40.80$
$t = \dfrac{\bar{X}_1 - \bar{X}_2}{\sqrt{\dfrac{S_1^2}{N_1} + \dfrac{S_2^2}{N_2}}}$	$= \dfrac{87.43 - 82.58}{\sqrt{\dfrac{39.40}{32} + \dfrac{40.80}{34}}}$
4.85	$= \dfrac{4.85}{\quad} = \dfrac{4.85}{\quad} t = 311$

Because the t value of 3.11 exceeds 2.58, the null hypothesis may be rejected at the .01 level of significance. If this experiment was replicated with random samples from the same population, the probability is that a difference between mean performance as great as that observed would result from sampling error in fewer than 1 out of 100 replications. This test would indicate rather strong evidence that the treatment would probably make a difference in the teaching of reading, when applied to similar populations of pupils.

Procedures Used to Test the Significance

Whenever a significance test is performed, it involves comparing a test value that has been calculated to some critical value for the statistics. It doesn't matter what type of statistic we are calculating, the procedure to test for significance is the same.

- Decide on the critical alpha level (i.e. the error rate which researcher is willing to accept).
- Conduct the research.
- Calculate the statistic.
- Compare the statistic to a critical value obtained from a table.

If statistic is higher than the critical value

- Findings will be significant.
- Null hypothesis will be rejected.
- Probability is smaller than the difference or relationship that happened by chance and P is less than the critical alpha level (P < alpha).

If statistic is lower than the critical value

- Finding will not be significant.
- Null hypothesis will be failed to reject.
- The probability is high that the difference or relationship happened by chance and P is greater than the critical alpha level (P > alpha).

Power of a Statistical Test and Effect Size

The power of a statistical test gives the likelihood of rejecting the null hypothesis when the null hypothesis is false. Just as the significance level (alpha) of a test gives the probability that the null hypothesis will be rejected when it is actually true (a wrong decision), power quantifies the chance that the null hypothesis will be rejected when it is actually false (a correct decision). Thus, power is the ability of a test to correctly reject the null hypothesis.

The effect size tells us something about how relevant the relationship between two variables is in practice. There are two types of effect sizes i.e. effect size based on the proportion of explained variance and the proportion of explained variance is often indicated by one of the following terms i.e. R2 or eta squared, partial eta squared or omega squared.

Techniques Used for Testing Hypothesis

There are two types of statistical techniques which are used for testing of hypothesis. They are parametric and non-parametric techniques.

Parametric Techniques

It can be applied for the purpose of testing the hypothesis if the following conditions are satisfied.

- When the sample is randomly selected.
- When the variance of the various groups are equal or near equal.
- When the data is in the form of interval scale or ratio scale.
- When the observations are independent.
- When the data follows a normal distribution.

Non-Parametric Techniques

The techniques which enable us to compare samples and make inferences or tests of significance without having to assume normality in the population are known as non-parametric techniques. Some of the non-parametric techniques are the Chi square test, the rank difference correlation coefficient, sign test, median test and sum of ranks test. These tests are less able to detect a true difference and it should not be used when other more exact tests are applicable.

Inferential Data Analysis

Inferential statistics has two goals and they are :

- To determine what might be happening in a population, based on a sample of the population.
- To determine what might happen in the future. Thus, inferential statistics are to estimate and/or to predict. To use inferential statistics, only a sample of the population is needed.

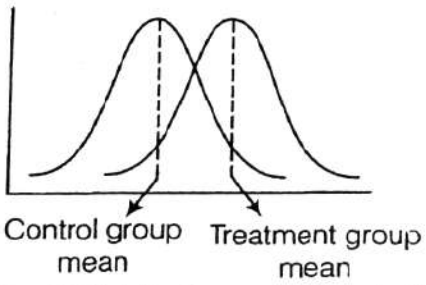
These are much more detailed and are used to draw conclusions about hypothesis and determine probabilities of an outcome.

- It comprise the use of statistics to make inferences, concerning some known aspects of population.
- It draws inferences beyond data, obtained from sample.
- It includes T-test, analysis of variance, Pearson's correlation, linear regression and multiple regression.

Statistical

T-test

The T-test assesses whether the means of two groups are statistically different from each other. This analysis is appropriate, whenever you want to compare the means of two groups and especially appropriate as the analysis for the post test, only two, groups randomised experimental design.

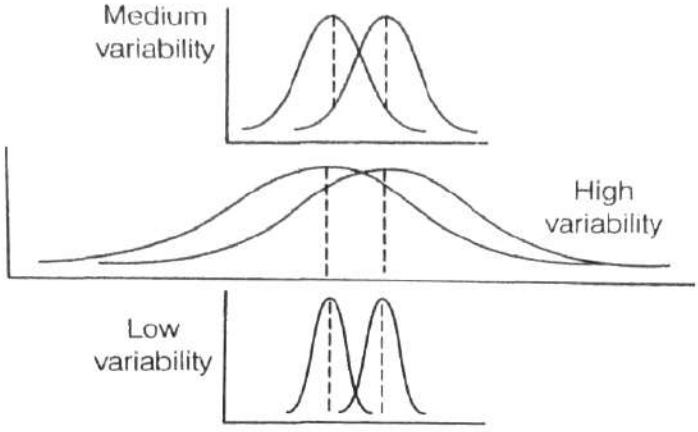


Idealised Distributions for Treated and Comparison Group Post Test Values

The figure shows the distribution for the treated and control groups in a study. In reference to this graph, we can consider the three possible situations. The first thing to notice about the three situations is that the difference between their means is the same in all three.

- First case shows a moderate variability of scores within each group.
- Second situation shows the high variability case.
- Third shows the case with low variability.

Representations of all the three cases are given below:



Three Scenarios for Differences Between Means

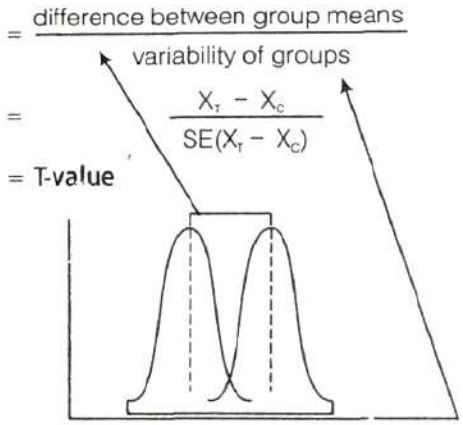
This leads to a very important conclusion. When we are looking at the differences between scores for two groups, we have to judge the difference between their means relative to the spread or variability of their scores. The T-test does just this.

William Sealy Gosset

- ➔ *Gosset devised the T-test in 1908, as a cheap way to monitor the quality of stout.*
- ➔ *Gosset was known as a statistician and the editor.*
- ➔ *He worked for the Guiness Brewery in Dublin, Ireland.*
- ➔ *The T-test work was submitted to and accepted in the journal Biometrika.*

Statistical Analysis of the T-test

The formula for the T-test is a ratio. The top part of the ratio is just the difference between the two means or averages. The bottom part is a measure of the variability or dispersion of the scores.



Formula for the T-Test

Figure shows the formula for the T-test and how the numerator and denominator are related to the distributions. The top part of the formula is easy to compute. The bottom part is called the standard error of the difference. To compute it, we take the variance

for each group and divide it by the number of people in that group. Variance is simply the square of the standard deviation.

$$\mathbf{SE}\left(\overline{X_T} - \overline{X_C}\right) = \sqrt{\frac{var_T}{n_T} + \frac{var_C}{n_C}}$$

Formula for the standard error of the difference between the means.

The final formula for the T-test is, $\mathbf{t} = \frac{\overline{X_T} - \overline{X_C}}{\sqrt{\frac{var_T}{n_T} + \frac{var_C}{n_C}}}$

Properties of T-distribution

- T-distribution ranges from minus infinity to plus infinity.
- Constant C is actually a function of V, the distribution of f(t) is completely specified. Thus, f(t) is a family of functions, one for each value of V.
- Like the standard normal distribution, the T distribution is symmetrical and has a mean zero.

Assumptions of T-test

★ *Each group is considered to be a sample from a distinct population.*
★ *The responses in each group are independent of those in the other group.*
★ *The distributions of the variable of interest are normal.*
★ *At least ordinal measures.*
★ *Representative sample.*
★ *Normal distributions for population.*

Interpretation of T-test Results

If this sign	It means all these things

$p \geq .05$ or .01	Likely to be a result of chance (same as saying A = B) Difference is not significant Null is correct Fail to reject the null There is no relationship between A and B
$p \leq .05$ or .01	Not likely to be a result of chance (same as saying A ≠ B) Difference is significant Null is incorrect Reject the null There is a relationship between A and B

The T value will be positive if the first mean is larger than the second and negative if it is smaller. Once you compute the T value you have to look it up in a table of significance to test whether the ratio is large enough to say that the difference between the groups is not likely to have been a chance finding. To test the significance, researchers need to set a risk level. Researchers also need to determine the degree of freedom in the T-test.

Advantages of T-test

- We test the significance of the difference between two means of the two groups. We can thus, find out whether there is really a difference between means or it is due to chance factors.
- We can easily find out the effectiveness of a treatment, given to two different groups or to a single group.
- We can also find out the mean of the population from which the sample is drawn.
- T-test can be applied to even large samples and we will get very dependable results.

ANOVA

Prof. R A Fisher was the first man to use the term '**variance**' and in fact it was he who developed a very detailed theory concerning ANOVA explaining its usefulness in the practical field. ANOVA is essentially a procedure for testing the difference among different groups of data for homogeneity. The essence of ANOVA is that the total

variation in a set of data is broken down into two types: that amount which can be attributed to chance and that amount which can be attributed to specific causes ANOVA consists in splitting the variance for analytical purposes. It is a method of analysing variance to which response is subject into various components corresponding to various sources of variation. Through ANOVA one can investigate any number of factors which are hypothesised or said to influence the dependent variable.

Types of ANOVA

These are as follows-

One Way ANOVA

It is used to test for differences among two or more independent groups. Typically, however, the one way ANOVA is used to test differences between two or more independent groups. Typically, however, the one way ANOVA is used to test for differences among three or more groups, since the two group case can be covered by a student's T-test.

When there are only two means to compare, the T-test and the F-test are equivalent with F = t2. For example, a researcher wants to compare students' attitude towards the school on the basis of school types (SSC, CBSE and ICSE). In this case, there is one dependent variable, namely attitude towards the school and three groups, namely SSC, CBSE and ICSE schools. Here, the one way ANOVA is used to test for differences in students' attitude towards the school among the three groups.

One way ANOVA for repeated measures is used when the subjects are subjected to repeated measures. This means that the same subjects are used for each treatment. Note that this method can be subject to carry over effects. This technique is often used in experimental research in which we want to compare three or more groups on one dependent variable which is measured twice te as pre-test and post test.

Two Way ANOVA

It is used when the researcher wants to study the effects of two or more independent or treatment variables. It is also known as factorial ANOVA. The most commonly used type of factorial ANOVA is the 2 x 2 (read as two by two, as you would a matrix) design,

where there are two independent variables and each variable has two levels or distinct values.

Two way ANOVA can also be multi-level such as 3 x 3, etc or higher order such as 2 × 2 × 2, etc, but analyses with higher numbers of factors are rarely done by hand because the calculations are lengthy. However, since the introduction of data analytic software, the utilization of higher order designs and analyses has become quite common.

For example, a researcher wants to compare students' attitude towards the school on the basis of school types (SSC,CBSE and ICSE) and gender. In this case, there is one dependent variable, namely attitude towards the school and two independent variables viz school types, including three levels, namely SSC, CBSE and ICSE schools and gender including two levels, namely boys and girls.

Here, the two way ANOVA is used to test for differences in students' attitude towards the school on the basis of school types and gender. This is an example of 3x2 two way ANOVA as there are three levels of school types, namely SSC, CBSE and ICSE schools and two levels of gender, namely boys and girls. It is known as two way ANOVA as it involves comparing one dependent variable (attitude towards the school) on the basis of two independent variables, viz school type and gender.

MANOVA

When one wants to compare two or more independent groups in which the sample is subjected to repeated measures, such as pre-test and post test in an experimental study, one may perform a factorial mixed design ANOVA i.e. Multivariate Analysis of Variance or MANOVA in which one factor is between a subject's variable and the other is within the subject's variable. This is a type of Mixed Effect model. It is used when there is more than one dependent variable.

ANCOVA

While comparing two groups on a dependent variable, if it is found that they differ on some other variable, such as their 10. SES or pre-test, it is necessary to remove these initial differences.

Assumptions of Using ANOVA

- Independence of cases.
- Normality of the distributions in each of the groups.
- Equality or homogeneity of variances, known as homoscedasticity i.e. the variance of data in groups should be the same. Levene's test for homogeneity of variances is typically used to confirm homoscedasticity. The Kolmogorov-Smirnov or the Shpiaro-Wilk test may be used to confirm normality.

According to **Lindman**, F-test is unreliable if there are deviations from normality whereas **Ferguson** and **Takane** claim that the F-test is robust. The **Kruskal-Wallis' test** is a non-parametric alternative which does not rely on an assumption of normality.

Chi-Square (Equal Probability and Normal Probability Hypothesis)

A chi-square test (also chi-squared or χ^2 test) is any statistical test in which the test statistic has a chi-squared distribution when the null hypothesis is true or any distribution in which the probability distribution of the test statistic (assuming the null hypothesis is true) can be made to approximate a chi-square distribution as closely as desired by making the sample size large enough. Chi-square is a statistical test commonly used to compare observed data with data we would expect to obtain, according to a specific hypothesis. For example, if a researcher expects parents' attitude towards sex education to be provided in schools to be normally distributed, then he might want to know about the goodness to fit between the observed and expected results i.e. whether the deviations (differences between observed and expected) the result of chance or whether they are due to other factors. The chi-square test tests the null hypothesis, which states that there is no significant difference between the expected and observed result. If it is assumed that the expected frequencies are equally distributed in all the cells, the chi-square test is known as the equal distribution hypothesis. On the other hand, if it is assumed that the frequencies are expected to be distributed normally, the chi-square test is known as the normal distribution

hypothesis. The chi-square (χ^2) test measures the alignment between two sets of frequency measures.

These must be categorical counts and not percentages or ratios measures.

Thus, $\chi^2 = \Sigma (fo-fe)\ 2/\ fe,$

where fo= observed frequency and fe expected frequency. It may be noted that the expected values may need to be scaled to be comparable to the observed values.

A simple test is that the total frequency/count should be the same for observed and expected values. In a table, the expected frequency, if not known, may be estimated as fe (row total) x (column total)/N, where N is the total number of all the rows (or columns). The obtained chi square is compared with that given in the chi square table to determine whether the comparison shows significance.

In a table, the degrees of freedom are computed as follows

$$\mathbf{df} = (\mathbf{R}-\mathbf{1})\ \mathbf{x}\ (\mathbf{C}-\mathbf{1})$$

Where, R = number of rows

C = number of columns

Chi-square indicates whether there is a significant association between variables, but it does not indicate just how significant and important this is.

Chi-square (χ^2) test is undoubtedly the most important and most used member of the non-parametric family of statistical tests. Chi-square is employed to test the difference between an actual sample and another hypothetical or previously established distribution, such as that which may be expected due to chance or probability. There are many situations, in which it is not possible to make any rigid assumption about the distribution of the population, from which samples are drawn, i.e. the distribution is not definitely said to be normal. Chi-square test is one of them.

The reasons why such tests are used so popularly are given below-

- These tests are distribution free i.e. they can be used with any shape of population distributions.
- They can be easily computed, handled and understood.
- They can be used with those types of measurements that prohibit the use of parametric test.

χ^2 test was first used by **Karl Pearson** in 1890. Chi-square can also be used to test differences between two or more actual samples.

Steps in the Calculation of χ^2

Expected frequencies (E) are calculated first by using the following formula

$$\frac{RT\ X\ CT}{N}$$

RT = The row total for the row containing the cell.

CT=The column total for the column containing the cell.

Get the difference between observed and expected frequencies and then find the value of $(O-E)^2$.

Divide this value by E and then find the sum total. The value of χ^2 ranges from zero to infinity. Zero χ^2 means observed and expected frequencies completely coincide. Greater the discrepancy between O and E, greater will be the value of χ^2.

Basic Computational Equation

(Observed frequency - Expected frequency)2

$$\chi^2 = \sum \frac{(Observed\ frequency - Expected\ frequency)^2}{Expected\ frequency}$$

$$\chi^2 = \sum \frac{(F_o - F_e)^2}{F_e}$$

	A	U	D
Observed responses (Fo)	8	8	14
Expected responses (Fe)	(10)	(10)	(10)
Fo – Fe	– 2	– 2	4
$(F_o - F_e)^2$	4	4	16
$(F_o - F_e)^2$	4	4	1.6

Therefore, accept null hypothesis.

When there is only one degree of freedom, an adjustment known as **Yates**. Correction for continuity must be employed. To use this correction, a value of 0.5 is subtracted from the absolute value (irrespective of algebraic sign) of the numerator contribution of each cell to the above basic computational formula. The basic chi-square computational formula then becomes

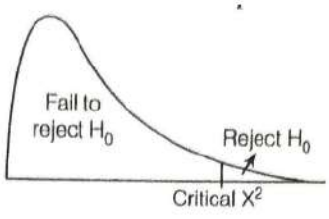
$$\chi^2 = \sum \frac{(Observed\,frequency - Expected\,frequency\,|-0.5|)^2}{Expected\,frequency}$$

- In χ^2, sum of the observed and expected frequencies is always zero i.e.

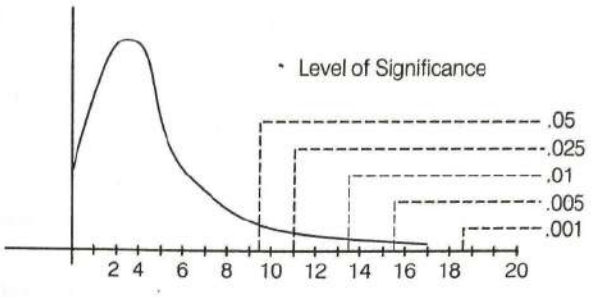
$$\Sigma\,(O-E)=N-N=0$$

- This equation provides a check on the computation of χ^2.
- χ^2 depends upon only the set of observed and expected frequencies and degree of freedom. It is a distribution free test.
- χ^2 distribution is a limiting approximation of the multinomial distribution. Yet, χ^2 test can be applied to discrete random variables whose frequencies can be counted and tabulated.

Level of Significance



df	.05	.025	.010	.005	.001
4	9.49	11.14	13.28	14.86	18.47



The calculated value of χ^2 is compared with the table value of χ^2 for a given degree of freedom at a certain specified level of significance. Generally, a 5% level of significance is selected for this purpose. If the value of χ^2 > table value of χ^2 , the distribution between theory and observation is considered to be significant. The value of χ^2 is a random variable, which takes on different values from sample to sample and its value will always be positive. Besides, χ^2 is derived from observation, so it is a statistic not a parameter.

Above table is representing a graph given for degree of freedom, which is 4 at different levels of significance.

Uses of χ^2 Test

χ^2 Test as the Test of Independence

With the help of χ^2 test, we can find out whether two or more attributes are associated or not. In order to test whether the attributes are related or not we take the null hypothesis that there is no association in the attributes under study.

If the value of χ^2 is less than the table value at a certain level of significance (5% level) we say that the results of the experiment provide no evidence for doubting the hypothesis i.e. attributes are not related. On the other hand, if value of χ^2 > table value, null hypothesis will be rejected i.e. attributes are related.

χ^2 Test as a Test of Goodness of Fit

It enables us to ascertain how appropriately the theoretical distribution fit empirical distribution. When an ideal frequency curve is fitted to the data, χ^2 test to find out how well this curve fits with the observed facts.

χ^2 Test as a Test of Homogeneity

Tests of homogeneity are designated to determine whether two or more independent random samples are drawn from the same population or from different populations.

Example: Suppose that we flip a coin 20 times and record the frequency of occurrence of heads and tails. We know from the laws of probability that we should expect 10 heads and 10 tails. We also know that because of sampling error, we could easily come up with 9 heads and 11 tails or 12 heads and 8 tails.

Let us suppose, our coin flipping experiment yielded 12 heads and 8 tails. We would enter our expected frequencies (10-10) and our observed frequencies (12-8) in a table.

	Observed	Expected	(Fo-Fe-0.5)	$(Fo-Fe-0.5)^2$	$\frac{(Fo-Fe-0.5)^2}{Fe}$
Heads	12	10	1.5	2.25	0.225
Tails	8	10	– 1.5	2.25	0.225
	20	20			0.450

The calculation of x in a one way classification (Yates' correction) is very straight forward. The expected frequency in a category (heads) is subtracted from the observed frequency and since Yates' correction is being used, 0.5 is subtracted from the absolute value of Fo - Fe, the difference is squared and the square is divided by its expected frequency. This is repeated for the remaining categories and as the formula for χ^2 indicates, these results are summed for all categories.

How does a calculated χ^2 of 0.450 tell us if our observed results of 12 heads and 8 tails represent a significant deviation from an expected 10-10 split? The shape of the chi-square sampling distribution depends upon the number of degrees of freedom. The degrees of freedom for a one way classification χ^2 is r- 1, where r is the number of levels.

In our problem above, r = 2, so there would obviously be 1 degree of freedom. From our statistical reference tables, a χ^2 of 3.84 or greater is needed for χ^2 to be significant at the .05 level, so we conclude that our χ^2 of 0.450 in the coin flipping experiment could have happened by sampling error and the deviations between the observed and expected frequencies are not significant.

We would expect any data set yielding a calculated χ^2 value less than 3.84 with 1 degree of freedom at least 5% of the time due to chance alone. Therefore, the observed difference is not statistically significant at the .05 level.

Different Levels of Significance

Degrees of Freedom (df)	χ^2 value[14]										
1.	0.004	0.02	0.06	0.15	0.46	1.07	1.64	2.71	3.84	6.64	10.83
2.	0.10	0.21	0.45	0.71	1.39	2.41	3.22	4.60	5.99	9.21	13.82
3.	0.35	0.58	1.01	1.42	2.37	3.66	4.64	6.25	7.82	11.34	16.27
4.	0.71	1.06	1.65	2.20	3.36	4.88	5.99	7.78	9.49	13.28	18.47
5.	1.14	1.61	2.34	3.00	4.35	6.06	7.29	9.24	11.07	15.09	20.52
6.	1.63	2.20	3.07	3.83	5.35	7.23	8.56	10.64	12.59	16.81	22.46
7.	2.17	2.83	3.82	4.67	6.35	8.38	9.80	12.02	14.07	18.48	24.32
8.	2.73	3.49	4.59	5.53	7.34	9.52	11.03	13.36	15.51	20.09	26.12
9.	3.32	4.17	5.38	6.39	8.34	10.66	12.24	14.68	16.92	21.67	27.88
10.	3.94	4.86	6.18	7.27	9.34	11.78	13.44	15.99	18.31	23.21	29.59
P value (Probability)	0.95	0.90	0.80	0.70	0.50	0.30	0.20	0.10	0.05	0.01	0.001
	Non-significant (df) and their χ^2 Values								**Significant**		

Correlation

Statistically, correlation refers to a quantifiable relationship between two variables. Furthermore, it is a measure of the strength and direction of that relationship. Two measures for every subject in the group are required. If two quantities vary in such a way that movements in the other, these quantities are said to be correlated.

- How much the two variables are correlated is determined by the degree of correlation.
- The degree of relationship is measured through the correlation analysis. This is called correlation coefficient.
- Two independent variables are never correlated because they will have nothing for interpretation.
- The degree of correlation will always vary from −1 to + 1 i.e. from perfectly negative to perfectly positive and zero degree means no correlation at all.

There are four things, which could be determined by correlation.

- Whether a relationship exists between variables i.e. measurement of relation.
- Whether correlation is positive or negative.

- Whether the degree of correlation is significant or not. • Establishment of cause and effect relationships between variables.

Types of Correlation

There are different types of correlation and they are-

Positive and Negative Correlation

- If both the variables are varying in the same direction i.e. if intelligence is high, adjustability is also high and vice-versa, the correlation is said to be positive, which is denoted by (+) sign.
- On the other hand, if values of two variables move in different directions, so that with the increase in the value of one, the other value decreases and vice-versa, the correlation is said to be negative. It is denoted by (-) sign.
- Zero coefficient of correlation, on the other hand shows no relationship between the variables.

Simple, Partial and Multiple Correlation

This distinction in correlation is based on the number of variables studied

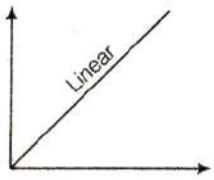
- When only two variables are taken into consideration, it is a simple correlation.
- In partial correlation, more than two variables are considered with only two variables to be influencing each other. Here, the effects of other variables are kept constant.
- In multiple correlation, three or more variables are studied simultaneously.

Linear and Non-Linear Correlation

When the variations in the values of two variables are in a constant ratio, correlation is said to be linear. Here, relationships will be maintained at a constant rate till the end.

Example

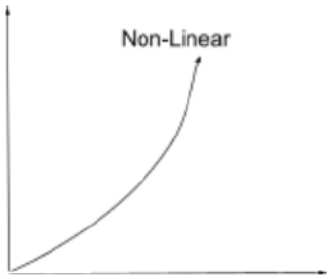
Variable X	2	4	6	8	10
Variable Y	5	10	15	20	25



On the other hand, if percentage change in X and Y are not constant all the time, it is further fluctuating, the relationship is said to be **non-linear or curvi-linear**.

Example

Variable X	2	4	6	8	10
Variable Y	5	8	12	17	24



Methods of Studying Correlation

These are:

- Scatter Diagram
- Correlation Graph
- Product Moment Coefficient of Correlation
- Rank Difference Correlation Method
- Coefficient of Concurrent Deviation
- Method of Least Square.

Uses of Correlation

- To evaluate the degree of reliability and validity of psychological tests and inventories.
- In the technique of factor analysis.
- To make predictions.
- In the technique of path analysis

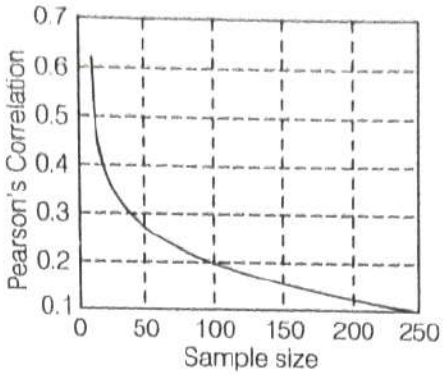
Two Methods of Correlation

Product Moment Method of Coefficient

Pearson's coefficient is denoted as Y.

- It is used where relation between two variable is linear.
- In some situations, the data for two variables X and Y are expressed in interval or ratio level of measurement and the distribution is linear.

Product moment means that the mean of the product of the mean adjusted random variables, hence the modifier product moment in the name. It is a measure of the strength and direction of the linear relationship between two variables that is defined as the (sample) co-variance of the variables, divided by product of their standard deviations.



A graph showing the minimum of Pearson's correlation coefficient that is significantly different from zero at the 0.05 level, for given sample size

There are two methods of Pearson's coefficient of correlation, which are-

- Long Method (Actual Mean Method)
- Short Method (Assumed Mean Method)

For **Actual Mean Method,**

$$\gamma = \frac{\Sigma xy}{\sqrt{\Sigma x^2 . \Sigma y^2}}$$

For **Assume Mean Method,**

$$\gamma = \frac{\frac{\Sigma xy}{N} - C_x C_y}{\sigma_x . \sigma_y}$$

$$C_x = M_x - AM_x$$

$$C_y = M_y - AM_y \text{ and } \sigma_x = \sqrt{\frac{\Sigma x^2}{N} - C_{x^2}}$$

$$\sigma_y = \sqrt{\frac{\Sigma y^2}{N} - C_{y^2}}$$

Points which should be taken care:

- From the above examples, we see that the value of Σ xy is very high in relation to Σ^2. Σy^2, then correlation will be high and vice-versa. Moreover, if the value of Σxy is negative, the negative coefficient of correlation will be there.
- Degree of y only shows the degree of variations on the two series.

Rank Order Coefficient of Correlation

It is used when we do not have data in the form of a score, where the rank of the individual is given. Nominal or cardinal range of scale, it is used if the relationship of two variables are differ and then relation between the variables is found with the help of rho (p). There are problems, in which the relationship among the measurements made is non-linear and cannot be described by product moment coefficient of correlation. In this case, the rank order method is used.

$$\rho = \frac{1 - 6 \Sigma D^2}{N\sqrt{N^2 - 1}}$$

Where, D = Difference in the ranks of two variables

N= Number of pairs

ρ= Coefficient of correlation by Rank Order method

Significance of Correlation Coefficient

- From 1.00 to 1.20 denoted different or negligible relationship.
- From 1.20 to ±.40 denotes how correlation present, but slightly correlated.
- From .40 to ±.70 denotes substantial or marked relationship.
- From ± .70 to 1.00 denotes high to very high relationship.

Z-Test

A Z-test is a type of hypothesis test. Hypothesis testing is just a way for you to figure out if results from a test are valid or repeatable. For example, if someone said they had found a new drug that cures cancer, you would want to be sure it was probably true. A hypothesis test will tell you if it's probably true or probably not true. A Z-test is used when data is approximately **normally distributed.**

You would use a Z-test if:

- Your sample size is greater than 30. Otherwise, use a T-test.
- Data points should be independent from each other. In other words, one data point is not related or does not affect another data point.
- Your data should be normally distributed. However, for large sample sizes (over 30) this does not always matter.
- Your data should be randomly selected from a population, where each item has an equal chance of being selected.
- Sample sizes should be equal if at all possible.

One Sample Z-Test Example

For example, assume an investor wishes to test whether the average daily return of a stock is greater than 1%. A simple random sample of 50 returns is calculated and has an average of 2%. Assume the standard deviation of the returns is 2.50%. Therefore, the null hypothesis is when the average or mean is equal to 3%.

Conversely, the alternative hypothesis is whether the mean return is greater than 3%. Assume an alpha of 0.05% is selected with a two tailed test. Consequently, there is 0.025% of the samples in each tail and the alpha has a critical value of 1.96 or -1.96. If the value of z is greater than 1.96 or less than -1.96, the null hypothesis is rejected.

The value for z is calculated by subtracting the value of the average daily return, selected for the test or 1% in this case, from the observed average of the samples. Next, divide the resulting value by the standard deviation, divided by the square root of the number of observed values.

Therefore, the test statistic is calculated to be 2.83 or (0.02-0.01)/(0.025 / (50) (1/2)). The investor rejects the null hypothesis since Z is greater than 1.96 and concludes that the average daily return is greater than 1%.

Qualitative Data Analysis

Qualitative data are verbal or other symbolic materials. The detailed description of observed behaviours, people, situations and events. The analysis of qualitative data means studying the organised material in order to discover inherent facts. The data are studied from as many angles as possible either to explore new facts or to reinterpret already existing known facts.

The types of qualitative data analysis are:

Data Reduction

Data reduction refers to the process of selecting, focusing, simplifying, abstracting and transforming the data that appear in writing up field notes or transcriptions. First, the mass of data has to be organized and somehow meaningfully reduced or reconfigured. These data are condensed so as to make them more manageable. They are also transformed so that they can be made intelligible in terms of the issues being addressed. Data reduction often forces choices about which aspects of the accumulated data should be emphasised, reduced or set aside completely for the purposes of the topic at hand.

Data in themselves do not reveal anything and hence, it is not necessary to present a large amount of unassimilated and uncategorized data for the reader's consumption in order to show that you are perfectly objective. In qualitative analysis, the researcher uses the Principle of Selectivity to determine which data are to be singled out for description. This usually involves some combination of deductive and inductive analysis. While initial categorizations are shaped by pre-established research questions, the qualitative researcher should remain open to inducing new meanings from the data available. Data reduction should be guided primarily by the need to address the salient question(s) in a research.

In data reduction, the coding of data should be done as per topics of discussion or guide or checklist of observation or semi-structured interviews.

Classification

Classification is a way of knowing the attributes of things to be able to group them (Tesch, 1990). In Fact in the early days, science was considered largely a way of developing classification systems. For some scholarly fields, classification is still a major objective. Botanical classification schemes and the periodic table of elements are well known examples of classification schemes.

The qualitative analyst, using classification as a tool for analysis, then looks for convergence in the data that have been categorised using typologies. Such activity leads to a classification system of data. **Guba** (**1978**) suggested several steps for converting field notes and interview transcripts into systematic categories for the purpose of analysis. The analyst begins by looking for reocurring regularities in the data. These regularities represent patterns that can be sorted into categories. Categories should then be judged by two criteria i.e. internal homogeneity and external heterogeneity. The **first criterion** concerns the extent to which the data that belong to a certain category hold together in a meaningful way. The **second criterion** concerns the extent to which differences among categories are bold and clear.

The existence of a large number of unassignable or overlapping data items is good evidence of some basic fault in the category system. The analyst then works back and forth between the data and classification system to verify the meaningfulness and accuracy of the categories and the placement of data in categories.

Several different classification systems have been developed, some priorities must be established to determine which category systems are more important than others. Prioritising is done, according to the salience, credibility, uniqueness, feasibility and materiality of the classification schemes. Finally, the category system or class of categories are tested for completeness.

The completeness can be tested by examining the categories internally or externally. Internal examination means the individual categories should appear to be consistent. External examination means the class of categories should seem to comprise a whole

picture. The steps and procedures suggested by Guba for categorising and classifying the qualitative data are not mechanical and rigid. It involves both technical and creative dimensions. No infallible procedure exists for performing it.

To sum up, we can say that the basic requirements for classification are to identify, generate and develop categories using either typology or both. Judge the categories for internal homogeneity and external heterogeneity. Arrange or sort out the data as per the developed categories. There might be some data remaining out of the categories. Check, recheck and verify the meaningfulness and accuracy of the categories and the placement of data in categories. Prioritise the categories, according to salience, credibility and uniqueness of the classification schemes. Test the categories for completeness, both internal and external. Label the categories with some identification mark that will represent a class.

Analytical Induction

Analytical induction is a way of building explanations in qualitative analysis by constructing and testing a set of causal links between events, actions, etc, in one case and the iterative extension of this to further cases. It is research logic, used to collect, develop analysis and organise the presentation of research findings. It refers to a systematic and exhaustive examination of a limited number of cases in order to provide generalisations and identify similarities between various social phenomena, in order to develop contacts or ideas. Its formal objective is causal explanation. It has its origin in the theory of symbolic interaction which stipulates that a person's actions are built up and evolve over time through processes of learning, trial and error and adjustment to responses by others.

This helps in searching for broad categories, followed by development of sub-categories. If no relevant similarities can be identified, then either the data needs to be re-evaluated and the definition of similarities changed or the category is too wide and heterogeneous and should be narrowed down.

In analytical induction, definitions of terms are not identified/determined at the beginning of research. They are rather considered hypothesis to be tested, using

inductive reasoning. It allows for modification of concepts and relationships between concepts, aimed at representing the reality of the situation most accurately.

According to **Katz,** "Analytic Induction (AI) is a research logic used to collect data, develop analysis and organize the presentation of research findings". Al calls for the progressive redefinition of the phenomenon to be explained (the explanandum) and of explanatory factors (the explanans), such that a perfect (sometimes called universal) relationship is maintained. Initial cases are inspected to locate common factors and provisional explanations. As new cases are examined and initial hypothesis are contradicted, the explanation is reworked in one or both of two ways.

According to Cressey, the steps of analytical induction process are as follows-

- A phenomenon is defined in a tentative manner. • A hypothesis is developed about it.
- A single instance is considered to determine if the hypothesis is confirmed.
- If the hypothesis fails to be confirmed, either the phenomenon is redefined or the hypothesis is revised so as to include the instance examine.
- Additional cases are examined and if the new hypothesis is repeatedly confirmed, some degree of certainty about the hypothesis is ensured.
- Each negative case requires that the hypothesis be reformulated until there are no exceptions.

Constant Comparison

Constant comparison is used for analysing qualitative data, in order to develop a theory of deep and is considered synonymous with the Grounded Theory approach used by most scientists. The constant comparison allows the researcher to think and compare the analysis of different levels and angles so that the similarities and differences in data acquisition can establish a pattern.

Many writers suggest ways of approaching your data so that you can do the coding of the data with an open mind and recognize noteworthy patterns in the data. This could be done through a constant comparison method. This requires that every time you select a passage of text (or its equivalent in video, etc) and code it, you should compare it with all those passages you have already coded that way, perhaps in other cases.

This ensures that your coding is consistent and allows you to consider the possibility either that some of the passages coded that way do not fit as well and could therefore be better codes as something else or that there are dimensions or phenomenons in the passages that might well be coded another way as well. But, the potential for comparisons does not stop there. You can compare the passage with those codes in similar or related ways or even compare them with cases and examples from outside your data set altogether. Previously coded text also needs to be checked to see if the new codes created are relevant.

Constant comparisons in newly gathered data are continually compared with previously collected data and their coding is done in order to refine the development of theoretical categories. The purpose is to test emerging ideas that might take the research in new and fruitful directions.

*According to **Strauss and Corbin (1990)**, they suggest following components of constant comparison*

Word Repetitions Look for commonly used words and words whose close repetition may indicate emotions.

Indigenous Categories (what the grounded theorists refer to as in vivo codes) It refers to terms used by respondents with a particular meaning and significance in their setting.

Key Words in Context Look for the range of uses of key terms in the phrases and sentences in which they occur.

Compare and Contrast It is essentially the Grounded theory idea of constant comparison. Ask, what is this about? and how does it differ from the preceeding or following statements?

Social Science Queries Introduce social science explanations and theories, for example, to explain the conditions, actions, interactions and consequences of phenomenons.

Searching for Missing Information It is essential to try to get an idea of consequences of phenomena.

Searching for missing information, It is essential to try to get an idea of what is not being done or talked out, but which you would have expected to find.

Metaphors and Analogies People often use metaphor to indicate something about their key and central beliefs about things and these may indicate the way they feel about things too.

Transitions One of the discursive elements in speech which includes turn taking in conversation as well as the more poetic and narrative use of story structures.

Pawing It refers to marking the text and eye balling or scanning the text. Circle words, underline, use coloured high lighters, run coloured lines down the margins to indicate different meanings and coding. Then look for patterns and significance.

Cutting and Sorting It refers to the traditional technique of cutting up transcripts and collecting all those coded the same way into piles, envelopes or folders or pasting them onto cards. Laying out all these scraps and re-reading them, together, is an essential part of the process of analysis.

Triangulation

Triangulation means using more than one method to collect data on the same topic. Triangulation facilitates validation of data through cross verification from more than two sources. It tests the consistency of findings obtained through different instruments and increases the chance to control or at least assess, some of the threats or multiple causes influencing results. Triangulation is not just about validation but about deepening and widening one's understanding. It can be used to produce innovation in conceptual framing. Triangulation is the use of two or more methods of data collection in the study of some aspect of human behaviour.

According to **Berg and Berg,** "Triangulation is a term originally associated with surveying activities, map making, navigation and military practices".

The word 'triangulation' was first used in the social science as metaphor, describing a form of multiple operationalisation or convergent validation. **Camp Bell and Fiske** were the first to apply the navigational term '**triangulation to research**'.

They used the term triangulation to describe multiple data collection strategies for measuring a single concept. This is known as **data triangulation**. According to them, triangulation is a powerful way of demonstrating concurrent validity, particularly in qualitative research.

The purpose of triangulation is not restricted to combining different kinds of data but to relate them so as to enhance the validity of the findings.

Triangulation is an approach to research that uses a combination of more than one research strategy in a single investigation. Triangulation can be a useful tool for qualitative as well as quantitative research.

Types of Triangulation

- Data Triangulation : Time, space and person • Method Triangulation : Design and data collection
- Investigator Triangulation
- Theory Triangulation
- Multiple Triangulation : It uses a combination of two or more triangulation techniques in one study.

Each of these are described in detail in the following paragraphs.

Data Triangulation

*According to **Denzin (1989**), there are three types of data triangulation i.e.*

Time Triangulation Here, the researchers collect data about a phenomenon at different points in time. However, studies based on longitudinal designs are not considered examples of data triangulation for time because they are intended to document changes over time. Triangulations of data analysis in cross sectional and longitudinal research is an example of time triangulation.

Space Triangulation It consists of collecting data at more than one site. At the outset, the researcher must identify how time or space relates to the study and make an argument, supporting the use of different time or space and collection points in the

study. By collecting data at different points in time and in different spaces, the researcher gains a clearer and more complete description of decision-making and is able to differentiate characteristics that span time periods and to spaces from characteristics specific to certain time and space. Person Triangulation According to Denzin, person triangulation has three levels i.e. aggregate, interactive and collective. It is also known as combined levels of triangulation. Here, researchers collect data from more than one level of person i.e. a set of individuals, groups or collectives. Researchers might also discover data that are dissimilar among levels. In such a case, researchers would collect additional data to resolve the incongruence.

*According to **Smith**, there are seven levels of person triangulation as follows-*

- (i) Individual level.
- (ii) Group Analysis The interaction patterns of individuals and groups.
- (iii) Organisational Units of Analysis Units which have qualities not possessed by the individuals making them up.
- (iv) Institutional Analysis Relationships within and across the legal (For example, court and school), political (For example, government), economic (For example, business) and (For example, Marriage) institutions of the society. familial
- (v) Ecological Analysis Concerned with spatial explanation.
- (vi) Cultural Analysis Concerned with the norms, values, practices, traditions and ideologies of a culture.
- (vii) Societal Analysis Concerned with gross factors such as urbanisation, industrialisation, education, wealth, etc.

Methods Triangulation

Method triangulation can occur at the level of design or data collection.

Design Level Triangulation Methods triangulation at the design level has also been called between method triangulation. Design methods triangulation most often uses quantitative methods combined with qualitative methods in the study design. There is simultaneous and sequential implementation of both quantitative and qualitative methods.

Data Collection Triangulation Methods triangulation at the data collection level has been called within method triangulation. Using methods of triangulation at the level of data collection, researchers use two different techniques of data collection, but each technique is within the same research tradition. The purpose of combining the data collection methods is to provide a more holistic and better understanding of the phenomenon under study. It is not an easy task to use method triangulation, it is often more time consuming and expensive to complete a study using method triangulation.

Investigator Triangulation

Investigator triangulation occurs when two or more researchers with divergent backgrounds and expertise work together on the same study. To achieve investigator triangulation, multiple investigators, each must have prominent roles in the study and their areas of expertise must be complementary.

Theory Triangulation

A fourth kind of triangulation involves using different theoretical perspectives to look at the same data. Thus, it can be said that triangulation is a strategy that enhances the quality of the research, thereby ensuring that the findings are reliable, dependable and valid. It helps to unveil the complexities of phenomena under study and understanding. them in depth rather than generalising the findings. In qualitative research, more than one theoretical explanation emerges from the data. Researchers investigate the utility

and power of these emerging theories by cycling between data generation and data analysis, until they reach a conclusion.

Multiple Triangulation

A multiple triangulation approach as described by Denzin is to incorporate multiple methods of data collection, multiple sources of data and multiple investigators with multiple areas of expertise. The multi-site and multi-method design facilitated the identification and validation of relevant issues.

Denzin states that multiple research methods are desirable because each method reveals a different aspect of reality. This idea has since been developed to include triangulation as a metaphor for strength, trustworthiness and comprehensiveness. Guba argues that trustworthiness through triangulation enhances the credibility, dependability and 'confirmability' in qualitative studies.

Part E- Qualitative Research Design

Qualitative Research

Qualitative research is a process of naturalist inquiry that seeks in depth understanding of social phenomena within their natural setting. It focuses on 'why' rather than 'what' of social phenomena and relies on the direct experience of human beings rather than by logical and statistical procedure, qualitative researchers use multiple systems of inquiry for the study of human phenomena including case study, ethnography, grounded theory, etc. In qualitative research, researchers typically gather multiple forms of data such as interviews, observations and documents rather than relying on a single data source. The research process for qualitative research is emergent design.

Qualitative Research Designs

Qualitative research design is a research method used extensively by researchers to study human behaviour, opinions. Here, we will study about the major types of qualitative research design used commonly viz, grounded theory research, narrative research, case study, ethnography, mixed method, triangulation, exploratory and explanatory.

The design of qualitative research is probably the most flexible of the different experimental techniques encompassing a variety of accepted methods and structures. The qualitative research design not only accounts for what is said or done but also the manner in which something is spoken or carried out by a participant. The design is generally based on social constructivism perspectives. Sample size can be as small as

one. Though there is no standardised structure, this type of study still needs to be carefully constructed and designed. The qualitative research methods are not as dependent upon sample size as quantitative methods. Case studies for example can generate results with just a small group.

Grounded Theory Designs

Grounded Theory is a well known methodology employed in many research studies. Its disciplinary origin is sociology. Grounded Theory refers to a set of systematic and inductive methods for conducting qualitative research, aimed towards theory development. The term Grounded Theory denotes dual referents, i.e. a method consisting of flexible methodological strategies and the products of this type of inquiry.

Ground Theory is introduced as an inductive and comparative methodology that provides systematic guidelines for gathering, synthesising, analysing and conceptualising qualitative data for the purpose of theory construction. The founders of Grounded Theory, **Barner, G. Glaser** and **Anselm L. Strauss**, offered the first explicit codified statement of how to analyse qualitative data.

The focus of the Grounded Theory approach is on the development of 'Inductive Bottom-Up Theory' that is 'grounded' directly in empirical data. The fundamental question in Grounded theory is what theory or explanation emerges from an analysis of data collected about the phenomenon. This approach is generally used to generate theories which tell us 'how' and 'why' something operates as it does; theories provide explanation about the phenomenon.

Characteristics of Grounded Theory

The Grounded Theory provides explicit and sequential guidelines for conducting qualitative research.

- It offers specific strategies for handling the analytical phases of inquiry.
- It streamlines and integrates data collection and analysis.

- It advances conceptual analysis of qualitative data. • It legitimises qualitative research as scientific inquiry.
- Grounded Theory is a well known methodology, employed in many research studies.
- Qualitative and quantitative data generation techniques can be used in a Grounded Theory study.
- Creswell (2012) viewed Grounded Theory as a powerful tool when a researcher needs a broad theory or explanation of a natural phenomenon.
- In Grounded Theory, analytical and interpretative procedures are used for analysing and conceptualising data through coding, non-statistical sampling, writing memos, diagraming of conceptual relationships, written and verbal reports.

Types of Grounded Theory

There are several main types of Grounded Theory, namely Classical Grounded Theory, Strauss and Corbin's Grounded Theory, Constructivist Grounded Theory and Feminist Grounded Theory.

They can be explained as given below-

Classical Grounded Theory

This theory is based on the Glaser and Strauss (1967) book, The Discovery of the Grounded Theory in which it is envisaged more as a theory generation methodology, rather than just an Analytical Approach. The idea is that one examines data and discovers it in a new theory and new ways of explaining the world. In this, everything is data and (researcher) should include field work notes and other literature in your process. Here, the common coding types are substantial and theoretical, creating an iterative approach.

Strauss and Corbin's Grounded Theory

This type of Grounded Theory probably links closest to Strauss and Corbin (1990), interpretation of Grounded Theory, which is probably more systematic and concerned with coding and structuring qualitative data. It traditionally proposes a three (or

sometimes two) stage Iterative Coding Approach, first creating open codes (inductive), then grouping them with axial coding and finally a process of selective coding. In this approach, you may consider a literature review to be a restrictive process, binding you to Straussian's prejudices from existing theory. The methodology has proven too difficult for most researchers to follow and most revert back to the less perspective CGT Approach (Partinton, 2000).

Constructivist Grounded Theory

The seminal work on constructivism is from Charmaz (2000) and its about the way researchers create their own interpretations of theory from the data. It aims to challenge the idea that theory can be discovered from the data as if it was just lying there, neutral and waiting to be unearthed. Instead, it tries to recognise that theory will always be biased by the way researchers and participants create their own understanding of society and reality. The engagement between participants and researchers is often cited as a key part of the Constructivist Approach.

Feminist Grounded Theory

This theory was developed initially for nurses in recognition of the androcentric bias and to ensure that women's voices were heard in the research community (Wuest 1955). Wuest overlays Feminist Theory onto the CGT, the Straussian and the Constructivist Grounded Theory, advocating that Grounded Theory is consistent with the post modern feminist epistemology in the recognition of multiple explanations of reality. The Feminist Grounded Theory has been widely accepted as a method of research, ideally suited to the nursing profession and Grounded Theory is enriched by taking a feministic perspective when the research is based on women (Plummer and Young).

The Feminist Grounded theory and other Grounded theory approach can be most appropriate in the efforts to theoretically advance the field of adult and continuing education.

Research Designs in Grounded Theory

Systematic Design

This type of Grounded Theory design is broadly applied in educational research. A systematic Grounded Theory design is composed of three stages of coding, namely open coding, axial coding and selective coding. In the first stage, open coding, the grounded theorist forms initial categories of information about the phenomenon being studied by segmenting information.

The researcher basis categories on all data collected such as interviews, observations and researcher's memos or notes. In open coding the data are divided into segments and then scrutinised for communalities that reflect categories or themes. After data are categorised, they are further examined for properties that characterise each category. In general, open coding is the process of reducing the data to a small set of themes that appear to describe the phenomenon under investigation. In short, open coding is the initial stage of forming Emergent Theory or conceptualisation.

Axial coding comes second after the open coding. In this stage, the grounded theorist selects one open coding category, positions it at the centre of the process being explored and relates other categories to it. These other categories are the causal conditions, strategies, contextual and intervening conditions and consequences. This stage involves drawing a diagram, called a coding paradigm. In this coding stage, hypothetical relationships between the major categories and their corresponding sub-categories are built. Strauss and Corbin refer to this phase as axial coding, reflecting the idea of clustering the open codes around specific axis or points of intersection. So, this step is to group the discrete codes, according to conceptual categories that reflect the communalities among codes.

The selective coding is the third stage of coding. In selective coding, the grounded theorist writes a theory from inter-relationships of the categories in the Axial Coding Model. At a basic level, this theory provides an abstract explanation for the process being studied in the research. It is the process of integrating and refining the theory through such techniques as, writing out a storyline that interconnects the categories and sorting through personal memos about theoretical ideas. At this stage, the researcher treats the various code clusters in a selective fashion, deciding how they relate to each other and what stories they tell. Thus, the analyst constructs a set of relational statements that can be used to explain, in a general sense what is going on.

Use of these three coding procedures means that grounded theorists use set procedures to develop their theory.

Emerging Design

The emerging design was in many ways a reaction to systematic design. Glaser has issues with systematic design, he considered it too rigid and strict with the emphasis on rules and procedures. In response to this, he developed the emerging design. Glaser proposed to allow the theory to emerge from the data rather than forcing the data into pre-conceived categories. Glaser was also focused on the Iterative Approach. This means that data was compared to data, data was compared to category and category compared to category. Glaser viewed Grounded Theory as the process of abstracting to a higher and higher level rather than only describing a process. The Generate Theory should appropriately fit the data, should actually work, be relevant and changeable.

Researcher constructs a theory by discussing the inter-relationships among the emerged categories, without referring to a diagram (Creswell).

The emergent design refers to the ability to adapt to new ideas, concepts or findings that arise while conducting qualitative research. An emergent design welcomes unanticipated information, often adding to the richness of the data. Emergent design is not limited to data collection and analysis.

An Emergent Approach to qualitative research is embedded within every stage from conceptualisation to publication. The researcher takes clues from the data, process or conclusion and the whole study is a reflection of varying levels of emergent characteristics within that research process.

Constructivist Design

It is the youngest of the three Grounded Theory designs. This design was developed by Kathy Charmaz. The design advocator Charmaz viewed that the constructivist design has advantages in addressing 'why' questions and preserving the complexity of social life. Charmaz paid more attention to individual's principles, opinions, beliefs,

sensations, expectations and philosophy, rather than truth and explaining acts (cited in Creswell, 2012). In other words, constructivist design

emphasises the values and beliefs of the researcher. According to Guba, Lincoln and Schwandt (1994), a constructivist design aims to explain participants' meanings towards a process in reality. The Constructivist Ground Theory uses an Inductive Approach to generating a new theory from the data gathered through participant, interview and focus group.

Steps in Conducting a Grounded Theory Research

To conduct the Ground Theory research, the researcher is required to take following steps into consideration

1. First, As a researcher, decide if a Grounded theory design best addresses the research problem. A Grounded theory design is appropriate, when you (researcher) wants to develop or modify a theory, explain a process and develop a general abstraction of the interaction and action of the people.
2. Second, You need to identify an early tentative process to examine Ground theory study because the intent of the Ground theory research is to explain a process. This process should naturally follow from the research problems and questions that have to be answered. It needs to involve people who are acting or interacting with identifiable steps or sequences in their interactions.
3. Third, As a researcher seeks approval and access it means that you need to obtain approval from the institution. You also need access to individuals who can provide insight into the process that you plan to study. This step involves seeking approval to collect data, appraising individuals of the purpose of the study and guaranteeing protection of the site and participants as you conduct inquiry.
4. Fourth, Conduct theoretical sampling, means that in Grounded Theory data collection is to gather information that can assist in developing a theory. A characteristic of Grounded Theory research is that the inquirer collects data more than once and keeps returning to data sources for more information throughout a study, until the categories are saturated and the theory is fully developed.

5. Fifth, In this step, you code the data as the the process of coding data occurs during data collection so that you can determine what data to collect next. It begins with the identification of open coding categories and using Constant Comparison Approach for saturation by comparing data with incident and incident with category.

6. Sixth, Use selective coding and develop the theory. This procedure includes inter-relating the categories in the coding paradigm. It may involve refining the axial coding paradigm and presenting it as a model or theory of the process. It may include writing prepositions that provide testable ideas for further research. This stage may involve narratives that describe writing stories or inter-relationships among categories.
7. Seventh, In Grounded theory research, validation is an active part of the process of research. After developing a theory, the ground theorist validates the process by comparing it with existing processes found in the literature.
8. Eight, In this step, the researcher writes a Grounded Theory research report. The structure of the Grounded Theory report varies from a flexible structure in the emerging and constructivist design to a more quantitatively oriented structure in the systematic design. All Ground Theory projects, however, end with the theory generated by the researcher reporting his/her abstraction of the process examination. under

Advantages of Grounded Theory

- An effective approach to build new theories and understand new phenomenon.
- High quality of the emergent theory.
- Emergent research design reflects the idiosyncratic nature of the study.
- Findings and methods are always refined and negotiated.
- Requires detailed and systematic procedures for data collection, analysis and theorising.
- The resulting theory and hypothesis help generate future investigation into the phenomenon.

- Requires the researcher to be open-minded and able to look at the data through many lenses.
- Data collection occurs over time and at many levels, helping to ensure meaningful results.

Disadvantages of Grounded Theory

- Huge volume of data.
- Time consuming and pain takingly precise process of data collection / analysis.
- Prescribed application required for the data gathering process.
- There are tensions between the evolving and inductive style of a flexible study and the Systematic Approach of Grounded Theory.
- It may be difficult in practice to decide when the categories are saturated or when the theory is sufficiently developed.
- It is not possible to start a research study without some pre-existing theoretical ideas and assumptions.
- Requires a high level of experience, patience and acumen on the part of the researcher.

Narrative Research Design

The term 'narrative' comes from the verb 'to narrate' or 'to tell' (as a story) in detail. It is a literary form of qualitative research with strong ties to literature and it provides a Qualitative Approach in which one can write in a persuasive literary form. In narrative research design, researchers describe the lives of individuals, collect and tell stories about people's lives and write narratives of individual experiences.

As a distinct form of qualitative research, a narrative typically focuses on studying a single person, gathering data through collection of stories, reporting individual experiences and discussing the meaning of those experiences for the individuals. It focuses on micro-analytic pictures and individual stories rather than the broader picture of cultural norms as in ethnography or abstract theories as in Grounded Theory research.

For educators, looking for personal experiences in actual school settings, narrative research offers practical and specific insights. By conductive narrative studies, researchers establish a close bond with the participants. This may help reduce a commonly held perception by practitioners in the field that research is distinct from practice and has little direct application.

Additionally, for participants in a study, sharing their stories may make them feel that their stories are important and they are heard. When they tell a story, it helps them understand topics that they need to process. Telling stories is a natural part of life and all individuals have stories about their experiences to tell others.

In this way, narrative research captures an everyday normal form of data that is familiar to individuals.

Characteristics of Narrative Research Design

- Narrative research places the data in chronological order. This is one main characteristic that makes narrative research different from other forms of research. The sequencing of events helps in creating a picture for the reader to appreciate the experiences of the individual.
- Narrative research allows restorying which helps the researcher to develop a sequence of events while establishing cause and effect. The researcher needs to be sensitive to the interaction of characters in the narrative, continuity of text and the setting of experience.
- Narrative research includes coding. Benefit of coding is that it is one way in which to summarise information and make it understandable to readers.

- In narrative research, collaboration involves including the participants in the interpretation and results of the project. There is an active discussion about the presentation and meaning of the data.

Steps in Conducting Narrative Research

There are many everyday examples that employ narrative design, including autobiographies, biographies, narrative interviews, oral histories and personal accounts. But, there are commonly used steps during a narrative study.

These are as follows-

- Identify an issue of concern, provides the purpose for a study and enables the researcher to understand personal or social experiences of an individual.
- Select an individual who can provide an understanding of the issue. Carefully select this persons based on their experiences.
- Collect the story from that participant. It means that besides the participants verbally sharing their story through conversation or interviews, field texts also provide information about the participant. For example, journal or diary entries, letters sent by the individual, photographs, memory boxes and stories acquired through friends or family members.
- Restory or retell the individual's story. Collaborate with participant story tellers.
- Write a story about a participant's experience. It is the biggest step in narrative research. The participants' life experiences are written into a story by the researcher.
- Validate the accuracy of the report, as an accurate report is essential to preserving the story.

Case Study

Case study research refers to an in depth and detailed study of an individual or a small group of individuals. Such studies are typically qualitative in nature, resulting in a narrative description of behaviour or experience. Case study research is not used to determine cause and effect, nor it is used to discover generalisable truths or make predictions. Rather, the stress in case study research is placed on exploration and description of a phenomenon.

Characteristics of Case Study

- The main characteristics of case study research are that it is narrowly focused, provides a high level of detail and is able to combine both objective and subjective data to achieve an in depth understanding.
- It is highly data based and strives for the same degree of reliability and validity as any good research.
- The case study strives towards a holistic understanding of the cultural system of action. (Cultural system of actions refer to sets of interrelated activities engaged in by the action in a social situation). The case studies must always have boundaries.
- Case study research is not a sampling research. However, selecting cases must be done so as to maximise what can be learned in the period of time available for the study.
- Case study tends to be selective, focusing on one or two issues that are fundamental to understanding the system being examined.
- Case studies are multi-perspective analysis. This means that the researcher considers not just the voice and perspective of the action but also of the relevant groups of actors and the interaction between them.
- The case study is undertaken to examine a social unit as a whole. The unit may be a person, a social group, a family, a social institution or a community. •
- The basic question in a case study is what are the characteristics of this single case or of these comparison cases? The case studies are used to answer the question of how or why.
- They are commonly used to collect in depth data in a natural setting, where the researcher has little or no control over the events and there is a real life context.

Oftentimes, the goal of a case study is to provide information that may research in the formulation of hypothesis for future research.

- Case studies are commonly used in social science research and educational settings. For example, case study may be used to study psychological problems, such as the development of a child raised by a single, deaf parent or the effects on a child who had been isolated, abused and neglected until the age of 12 years. In the educational context, case studies may be used to study typical individuals, such as juvenile delinquents, school dropouts, gifted children, etc.. Institutions such as school showing poor performance.

Components of Case Study Research Design

Components of case study research design are as follows-

Study Questions

It means the form of question in terms of 'who', 'what' 'where' 'how' and 'why' provides an important clue regarding the most relevant research strategy to be used. The case study strategy is most likely to be appropriate for 'how' and 'why' questions, so your initial task is to clarify precisely the nature study questions in this regard. of your

Study Propositions

As for the second component, each proposition directs attention to something that should be examined within the scope of the study. For instance, the research on the topic of inter-organisational partnerships began with the questions how and why do organisations collaborate with one another to provide joint services.

These how and why questions, capturing what you are really interested in answering, led you to the case study as the appropriate strategy in the first place.

Study Unit of Analysis

This component is related to the fundamental problem of defining 'what the case' is a problem that has plagued many investigators at the outset of the case studies. The case studies of clinical patients, of exemplary students or of certain type of leaders. In each situation, an individual person is the case being studied and the individual is the primary unit of analysis.

Information about each relevant individual would be collected and several such individuals or cases might be included in a multiple case study.

The fourth and fifth component is the logical linking of data to prepositions and criteria for interpreting the finding have been the least well-developed in case studies. These components represent the data analysis steps in case study research and a research design should lay the foundations for this analysis.

Types of Case Study Designs

There are several types of case study methods. The methods selected depend upon the nature of the questions being asked and the goals of the researcher.

Following are the different types of case study designs-

Illustrative: This is used to illustrate or describe an event or situation in such a way that people can become more familiar with the topic in question and perhaps become acquainted with the terminology associated with the topic.

Exploratory: This is a condensed case study and the purpose is to gather basic and initial data that could be used to identify a particular question for a larger study. This study is not designed to produce detailed data from which any conclusions could be drawn. It is simply exploratory in nature.

Cumulative: The cumulative design is designed to pull together information for several events/situations and aggregate it in such a way that it allows for greater generalisation. It has the advantage of saving time and money by not creating new and repetitive studies.

Critical Instance: These studies are used to examine situations of unique interest or to challenge a universal or generalised belief. Such studies are not to create new generalisations, rather several situations or events may be examined to raise questions or challenge previously held assertions.

Once the question has been identified and the basic type of case study method has been selected, the researcher will need to begin designing their Case Study Approach. In order to obtain a full and detailed picture of the participant or small group, the researcher can use a variety of approaches and methods to collect data. These methods may include interviews, field studies, protocol or transcript analysis, direct participant observations, a review of documents and archived records and an exploration of artifacts. Researchers may choose to use one of these methods to collect data (Single Method Approach) or they may use several methods (Multi-Model Approach).

After the researcher has determined the data collection methods and what type of data will be used and recorded in the study, he/she will need to decide upon a strategy for analysing the data.

Case study researchers typically interpret their data either holistically or through coding procedures. A Holistic Approach reviews all of the data as a whole and attempts to draw conclusions based on the data in its entirety. This is an appropriate approach when the question being studied is more general in nature and the data provides an overview. Sometimes, it may be more useful to break the data into smaller pieces. This usually involves searching the data to identify and categorise specific actions or characteristics. These categories can be assigned a numeric code that allows the data to be analysed using statistical and quantitative methods.

In the design of a case study, it is important to plan and design how you are going to address the study and make sure that all data collected is relevant. Unlike scientific reports, there is no strict set of rules, so the most important part is making sure that the study is focused and concise. Otherwise, you will end up having to wade through a lot of information.

It is best to make a short list of 4 to 5 bullet points that you are going to try and address during the study. With a case study, even more than a questionnaire or survey. It is

important to be passive in your research, you are much more of an observer than an experimenter. Even in multi-subject cases, each case must be treated individually and then cross case conclusions can be drawn.

The final report of the case study is a rich (vivid and detailed) and holistic (describes the whole and its parts) description of a case/cases. It is a detailed discussion of the themes and issues concerning the case/cases along with their implications.

Steps of Conducting Case Study Research

Following are the steps of conducting case study research:

Step 1: Determine and Define the Research Questions

The first step in case study research is to establish a firm research focus to which the researcher can refer over the course of study of a complex phenomenon or object. The researcher establishes the focus of the study by forming questions about the situation or problem to be studied and determining a purpose for the study. The research object in a case study is often a program, an entity, a person or a group of people. Each object is likely to be intricately connected to political, social, historical and personal issues, providing wide ranging possibilities for questions and adding complexity to the case study. The researcher investigates the object of the case study in depth, using a variety of data gathering methods to produce evidence that leads to understanding of the case and answers the research questions. The study's questions are most likely to be 'how' and 'why' questions and their definition is the first task of the researcher. assist in targeting and formulating the questions, researchers conduct a literature review.

This review establishes what research has been previously conducted and leads to refined and insightful questions about the problem. Careful definition of the questions at the start, pinpoints where to look for evidence and helps determine the methods of analysis to be used in the study.

Step 2: Select the Cases and Determine Data Gathering and Analysis Techniques

During the design phase of case study research, the researcher determines what approaches to use in selecting single or multiple real life cases to examine in depth and which instruments and data gatering approaches to use.

When using multiple cases, each case is treated as a single case. Each case's conclusion can then be used as information contributing to the whole study, but each case remains a single case. Exemplary case studies carefully select cases and carefully examine the choices available from among many research tools, available in order to increase the validity of the study. Careful discrimination at the point of selection also helps erect boundaries around the case.

The researcher must determine whether to study cases, which are unique in some way or cases which are considered typical and may also select cases to represent a variety of geographic regions, a variety of size parameters or other parameters. A useful step in the selection process is to repeatedly refer back to the purpose of the study, in order to focus attention on where to look for cases and evidence that will satisfy the purpose of the study and answer the research questions posed. Selecting multiple or single cases is a key element, but a case study can include more than one unit of embedded analysis.

A key strength of the case study method involves using multiple sources and techniques in the data gathering process. The researcher determines in advance, what evidence to gather and what analysis techniques to use with the data to answer the research questions. Data gathered is normally largely qualitative, but is may also be quantitative. Tools to collect data can include surveys, interviews, documentation review, observation and even the collection of physical artifacts.

Step 3: Prepare to Collect the Data

Because case study research generates a large amount of data from multiple sources, systematic organization of the data is important to prevent the researcher from becoming overwhelmed by the amount of data and to prevent the researcher from losing sight of the original research purpose and questions. Advance preparation assists in handling large amounts of data in a documented and systematic fashion. Researchers prepare databases to assist with categorizing, sorting, storing and retrieving data for analysis.

Step 4: Collect Data in the Field

The researcher must collect and store multiple sources of evidence, comprehensively and systematically that can be referenced and sorted so that converging lines of inquiry and patterns can be uncovered. Researchers carefully observe the object of the case study and identify causal factors associated with the observed phenomenon. Renegotiation of arrangements with the objects of the study or addition of questions to interviews may be necessary as the study progresses. Case study research is flexible, but when changes are made they are documented systematically.

Good case studies use filed notes and databases to categorize and reference data so that it is readily available for subsequent reinterpretation. Field notes, record feelings and intuitive hunches, pose questions and document the work in progress. They record testimonies, stories and illustrations which can be used in later reports.

Step 5: Evaluate and Analyse the Evidence

This aspect of the case study methodology is the least developed. As a result, some researchers have suggested that if the studies were made conducive to statistical analysis, the process would be easier and more acceptable. This quantitative approach would be appealing to some of the critics of the case study methodology. Miles and Huberman suggested analytic techniques, such as rearranging the arrays, placing the evidence in a matrix of categories, creating flow charts or data displays, tabulating the frequency of different events, using means, variance and cross tabulations to examine the relationship between variables and other such techniques to facilitate analysis.

Step 6: Prepare the Report

Case studies do not have the uniform outline as do other research reports. It is essential to plan this report as the case develops, to avoid problems at the end.

Advantages of Case Study

- Case studies are more flexible than any other type of research and allow the researcher to discover and explore as the research develops.

- Case studies emphasise in depth content. The researcher is able to develop deep and use a variety of data sources to get a complete picture.
- Often leads to the creation of new hypothesis that can be tested later and context.
- The data is collected in a natural setting
- Case studies often shed new light on an Established Theory that results in future exploration.
- Researchers are able to study and analyse situations, events and behaviours that could be created in a laboratory setting. *

Disadvantages of Case Study

- The uniqueness of the data usually means that it is not able to be replicated.
- Case studies have some level of subjectivity and researcher bias may be a problem.
- Due to in depth nature of the data, it is not possible to conduct the research on a large scale.
- There are concerns about the reliability, validity and generalisability of the results.

Ethnographic Research

Ethnography is a qualitative research, sometimes known as **cultural anthropology** or more recently as **naturalist inquiry**. Its disciplinary origin is **anthropology**. This research study looks at the social interaction of users in a given environment. It provides an in depth insight into the user's views and actions along with the sights and sounds they encounter during the day. Ethnography deals with the discovery and description of the culture of a group.

Since, the concept of culture is of central importance, it seeks to answer the question of what are the cultural characteristics of this group of people or of this cultural scene?

Culture is the system of shared beliefs, values, practices, languages, customs, norms, rituals and material things that group members use to understand their world.

In its early application, ethnography was used to study the cultural characteristics of African, South Sea Island and American-Indian primitive tribes, who were geographically and culturally isolated, with little specialisation in economics, technology and social function. Here, observation was used as the main technique to gather information in respect of cultural features. Since the researcher used to spend too little time with the primitive tribal groups and didn't know their language they had to depend on the information gathered by the poorly trained informants.

Later, researchers made their studies more reliable and valid by spending more time among the tribes during observation. They also learnt the native language of tribal groups so as to interpret observations in terms of tribes' concepts, feelings, norms and values.

The informants were given training in systematically recording field data in their own language and cultural perspective. The ethnographic methods are of recent origin in the field of education.

The ethnographic methods include direct observation, diary studies, video recordings, photography and artifact analysis, such as devices that a person uses throughout the day. Ethnographic study uses participant's observation as the primary data collection technique, along with the interviews with the members of group or community.

The participant's observation may extend from one month to a year, depending upon the nature of the problem as well as the research questions formulated for probing the cultural characteristics of a group of people or describing the cultural scenes.

This research involves intensive data collection on many variables, over an extended period of time in a naturalistic situation. The variables are studied where they naturally occur and as they occur without any control of the researcher on the environment or experimental conditions. The concern in ethnographic research is the context and therefore, the researcher goes there and participates in it. As during observation, the main objective of the researcher is to observe, listen and converse with the participants in as free and natural a atmosphere as possible.

Characteristics of Ethnographic Research

People's behaviour is studied in everyday contexts.

It is conducted in a natural setting.

Its goal is more likely to be exploratory than evaluative.

It is aimed at discovering the local person's or native's point of view, wherein, the native may be a consumer or an end user.

Data is gathered from a wide range of sources, but observation and/or relatively informal conversations are usually the principle ones.

The approach to data collection is unstructured in that it does not involve following through a predetermined detailed plan setup at the beginning of the study, nor does it determine the categories that will be used for analysing and interpreting the soft data obtained. This does not mean that the research is unsystematic. It simply means that initially the data is collected as raw form and a wide amount as feasible.

The focus is usually a single setting or group of a relatively small size. In life history research, the focus may even be a single individual.

The analysis of the data involves interpretation of the meanings and functions of human actions and mainly takes the form of verbal descriptions and explanations, with quantification and statistical analysis playing a subordinate's role at most.

It is cyclic in nature, concerning data collection and analysis. It is open to change and refinement throughout the process as new learning shapes future observations. As one type of data provides new information, this information may stimulate the researcher to look at another type of data or to elicit confirmation of an interpretation from another person, who is part of the culture being studied.

Assumptions in Ethnographic Research

- Ethnography assumes that the principal research interest is primarily affected by community cultural understandings. The methodology virtually assures that common cultural understandings will be identified for the research interest at

hand. Interpretation is apt to place great emphasis on the causal importance of such cultural understandings. There is a possibility that an ethnographic focus will overestimate the role of cultural perceptions and underestimate the causal roles of objective forces.

- Ethnography assumes an ability to identify the relevant community of interest. In some settings, this can be difficult. Community, formal organisation, informal group and individual level perceptions may all play a causal role in the subject, under study and the importance of these may vary by time, place and issue. There is a possibility that an ethnographic focus may overestimate the role of community and culture and underestimate the causal role of individual psychological or of sub-community (or for that matter, extra community) forces.
- Ethnography assumes that the researcher is capable of understanding the cultural mores of the population under study, has mastered the language or technical jargon of the culture and has based findings on comprehensive knowledge of the culture. There is a danger that the researcher may introduce bias towards perspectives of his/her own culture.
- While not inherent to the method, cross cultural ethnographic research runs the risk of falsely assuming that given measures have the same meaning across cultures.

Steps of Conducting Ethnographic Research

The following steps are involved in conducting ethnographic research

Identify Research Question

Here, you (researcher) determine what problem you are seeking to better understand? Develop a problem statement that raises questions you seek to know more about. The problem or question may be about nearly any topic that addresses people in a designated environment.

Determine Location(s) for Research

Identify the best place to conduct the participatory research. You may choose more than one location, if the research question or problem warrants. 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.

Formulate Presentation Method

Consider the most effective way(s) to obtain objective information. For example, will you be adopting a role of a person in the community or organisation you are observing?, Will you be covert or will others know you are conducting a research? If as a researcher they don't know you then consider the most ethical way to observe and collect data.

Acquire Permission

As ethnographic research can be a bit intrusive, it usually necessary to obtain permission for access into the location you plan to research. Always obtain permission in writing.

Observe and Participate

Ethnography requires more than just observation. To research, effectively determine the types of things you are looking for in regards to your question and problem. Determine the most effective way to collect notes. Be as objective as possible, as a researcher when observing and participating write running descriptions, things you remember, impressions and feelings, ideas that come to your mind, etc.

Interview

To increase your understanding of behaviours and actions, interviews may be necessary. You may do these interviews immediately after witnessing something, at the end of a designated observation period, at the end of the day or even at the end of the entire research period.

Collect Archival Data

It means that many organisations, communities and cultures have other artifacts and information that you can use to assist in your data collection. For example, reviewing

things like papers, physical artifacts, phone conversations and other information rich sources.

Code and Analyse Data

As a researcher, code your data in a way that makes the most sense for your observations. Code and label things you saw and heard, sort for patterns, identify outliers, compare with theories and take notes of reflective remarks.

Writing an Ethnographic Account

In this type of research, the report is not attempted until the field notes have been analysed and the major conclusions have been formulated in the mind.

Following are the steps followed in writing the ethnographic account:

Questionnaire Formation Doing research for ethnography means that when you are physically present in the community or society under investigation, you need to design a questionnaire. Through this questionnaire, you need to ask a series of questions from the specific people of that community, centering on how they perceive their culture and lifestyle. Questionnaires make the ground work for most anthropological studies.

Research for a Questionnaire It should be based on your personal and theoretical observations. This would help in drafting real-time questions leading to viable conclusions.

Introduction Now, when you have collected the data through a questionnaire, you need to construct an introduction.

The introduction must communicate two things to the readers i.e.

1. What are you studying?
2. How are you studying?

Once you succeed in providing justified answers for these two points, include a brief background of the culture you intend to study as well as the areas you want to probe.

Methodology In this explanation to the readers, how you went about gathering information for your study. Support by giving reference to the conversations you had

with community folks and their response. You can also mention the difficulties and limitations you faced in collecting data. It includes:

Data Analysis Present a thorough analysis of the data, collected through observation and questionnaire. Here, you can also give a brief account of your personal opinions and experiences during the cultural study. You can also include learning from the study.

Conclusion Sum up your cultural research in the conclusion focusing on your methodology and learning. Restate the main points of your study. The ethnography must convince the readers that your findings have contributed a lot in the overall study of that community/ culture.

Advantages of Ethnographic Research

- It provides a comprehensive perspective.
- Ethnographic research observes behaviours in their natural environments.
- It accounts for the complexity of group behaviours, reveals interrelationships among multifaceted dimensions of group interactions and provides context for behaviours.

Disadvantages of Ethnographic Research

- This research is dependent on the researcher's observations and interpretations.
- It is difficult to check the validity of the researcher's conclusion.
- Observer bias in almost impossible to eliminate.
- It may lack transferability.
- Ethnographic research is time consuming and requires a well-trained researcher.

Mixed Method Research Designs

The term 'mixed method' refers to an emergent methodology of research that advances the systematic integration or mixing of quantitative and qualitative data within a single investigation or sustained program inquiry. The basic premise of this methodology is that such integration permits a more complete and synergistic utilization of data than

do separate quantitative and qualitative data collection and analysis. It also encourages the collection of more comprehensive evidence for study problems, help answer questions that quantitative or qualitative methods alone cannot answer.

Mixed method research is important today because of the complexity of problems that need to be addressed, the rise of interest in qualitative research and the practical need to gather multiple forms of data for diverse people/audiences. **Johnson Onw Uegbuzie** and **Turner** defined "Mixed Method research is the type of research in which a researcher or a team of researchers combine elements of quantitative and qualitative approaches (e.g. use of qualitative and quantitative viewpoints, data collection analysis and inference techniques) for the purpose of breadth and depth of understanding and collaboration".

The Mixed Method research involves both collecting and analysing quantitative and qualitative data. Quantitative data includes closed-ended information, such as that found on attitude, behaviour or performance instruments. The analysis consists of statistically analysing scores collected on instruments, checklist or public documents to answer research questions or to test hypothesis.

On the other hand, qualitative data consists of open ended information that researchers gathered through interviews with participants. Qualitative data may be collected by observing participants. The analysis of qualitative data (word or text, images) follows the path of aggregating the words or images into categories of information and presenting the diversity of ideas gathered during data collection.

Characteristics of Mixed Method Research Designs

- The analysis of both qualitative and quantitative data.
- The collection of both open and closed-ended data (qualitative and quantitative data) in response to research questions.
- Persuasive and rigorous procedures for the qualitative and quantitative methods are used.
- The use of a specific mixed method design that involves a concurrent or sequential integration.

Types of Mixed Method Research Designs

Triangulation Design

It is the most common and well known approach. According to Creswell, Plano Clark and et.al, (2003), the purpose of this design is to obtain different but complementary data on the same topic. Morse, (1991) says that to best understand the research problem, the intent in using this design is to bring together the differing advantages and non-overlapping disadvantages of quantitative methods (large sample size, trends, generalisations, etc.) with those of qualitative methods (small N, details in depth, etc).

This design is used when a researcher wants to directly compare and contrast quantitative statistical results with qualitative findings or to validate or expand quantitative results with qualitative data. It is an efficient design in which both types of data are collected during one phase of research at roughly the same time. In this design, each type of data can be collected and analysed separately and independently using the technique, traditionally associated with each data type.

Explanatory Design

It is a two phased mixed method design. The overall purpose of this design is that qualitative data helps explain or build upon initial quantitative results. For instance, this design is well suited to a study in which a researcher needs qualitative data to explain significant (or non-significant) results or surprising results. This design can also be used when a researcher wants to form a group based on quantitative results and follow-up with the groups through subsequent qualitative research (Morgan, Tasha Kkori and Teddlie, 1998).

This design starts with the collection and analysis of qualitative data. There are two variants of the explanatory design i.e. the Follow-Up Explanation model and the Participant Selection model. The explanatory design is considered the most straightforward of mixed method designs. Its two phase structure makes it straightforward to implement because the researcher conducts the two methods in separate phases and collects only one type of data at a time. This means that a single researcher can conduct this design; a research team is not required to carry out the design. The final report can be written in two phases, making it straightforward to write and provide clear delineation for readers. This design lends itself to multiphase

investigations as well as single mixed method studies. This design appeals to quantitative researchers because it often begins with a strong quantitative orientation.

Exploratory Design

This design is based on the premise that exploration is needed for one of several reasons. Measures or instruments are not available, the variables are unknown or there is no guiding framework or theory because this design begins qualitatively, it is best suited for exploring a phenomenon. This design is mainly useful when a researcher needs to develop and test an instrument because one is not available or identify important variables to study quantitatively. When the variables are unknown. It is also appropriate when a researcher wants to generalise results to different groups, to test aspects of an Emergent Theory or classification or to explore a phenomenon in depth and then measure its prevalence.

Researcher using this design builds on the results of the qualitative phase by developing an instrument, identifying variables or stating propositions for testing based on an Emergent theory or framework. In this design, the researcher first qualitatively explores the research topic with the few participants. The qualitative findings then guide the development of items and scales for a quantitative survey instrument. In the second data collection phase, the researcher implements and validates this instrument quantitatively. In this design, the qualitative and quantitative methods are connected through the development of the instrument items.

Due to its two phase structure and the fact that only one type of data is collected at a time, the exploratory design shares many of the same advantages as the explanatory designs. This design typically emphasizes the qualitative aspect, the inclusion of a quantitative component can make the qualitative approach more acceptable to a quantitative based audience. This design is applied to multi-phase research studies in addition to single studies.

Steps in Conducting MM Research Designs

- Be proficient in MM research by keeping up to data with latest techniques, software, textbooks and manuals.
- Consider other data analytic approaches that are not used in your field.

- Choose the research design that best represents the hypothesis and know the assumptions and limitations of that design.
- Incorporate figures and tables into your qualitative codebook to deepen the conceptualisations for the codes and provide a few examples of already coded data in order to provide thorough instructions.
- Create and use summary statements for each participant to help with the abstract portion of the analysis. Summary statement should be in a few sentences that describes the participants' statements and provide an overall gist of the available qualitative information.

Advantages of Mixed Method Research Designs

- It can be used to increase the generalisation of the results.
- Researchers can provide strong evidence for a conclusion through convergence and collaboration of findings.
- Researchers can answer a broader and more complete range of research questions because they are not confined to a single method or approach.
- Words, pictures and narratives can be used to add meaning to numbers and numbers can be used to add precision to words and narrative.
- Researchers can add insights and understanding that might be missed; only a single method is used.
- It provides the strength of both qualitative and quantitative research.
- Qualitative and quantitative research are used together to produce more complete knowledge, necessary to inform theory and practice.

Disadvantages of Mixed Method Research Designs

- Researcher has to learn about multiple methods and approaches and understand how to mix them appropriately.
- It can be difficult for a single researcher to carry out both qualitative and quantitative research, especially if two or more approaches are expected to be used concurrently, it may require a research team.
- It may be more time consuming and require additional finding.

- Methodological pursuits contend that one should always work with either a qualitative or a quantitative paradigm.