

BASIC RESEARCH AND STATISTICS



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BASIC RESEARCH AND STATISTICS

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BLOCK- I INTRODUCTION TO RESEARCH

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UNIT-1 RESEARCH -SCIENTIFIC METHOD

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1.1 OBJECTIVES

After Studying this unit, you will be able to:

- define Research
- describe the meaning of Research
- explain the Scientific Method in Research
- understand the concept of educational Research
- understand the scope of educational Research
- comprehend the purpose of Educational Research
- learn characteristics of a good research

1.2 INTRODUCTION

The word research is composed of two syllables, re and search. re is a prefix meaning again, anew or over again search is a verb meaning to examine closely and carefully, to test and try, or to probe. Together they form a noun describing a careful, systematic, patient study and investigation in some field of knowledge, undertaken to establish facts or principles. Research is a structured enquiry that utilizes acceptable scientific methodology to solve problems and create new knowledge that is generally applicable. Scientific methods consist of systematic observation, classification and interpretation of data. Although we engage in such process in our daily life, the difference between our casual day- to-day generalization and the conclusions usually recognized as scientific method lies in the degree of formality, rigorousness, verifiability and general validity of latter. Research makes an attempt to answer certain questions which have not answered till date. It generally explores the answer to those problems.

Research is the systematic process of collecting and analyzing information to increase our understanding of the phenomenon under study. Research is an honest effort which presents solutions to the problem in specific area of education. The Research imparts training in scientific method to neo-researchers, enhances the pyramid of education and develops scientific attitude in the researchers. For which the answer can be given on the basis of available date.

According to the American sociologist Earl Robert Babbie, “Research is a systematic inquiry to describe, explain, predict, and control the observed phenomenon. Research involves inductive and deductive methods”. Inductive research methods are used to analyze an observed event. Deductive methods are used to verify the observed event. Inductive approaches are associated with qualitative research and deductive methods are more commonly associated with quantitative research.

Research is a process through which new knowledge is discovered. A theory, such as a theory of motivation, or development, or learning, for example, helps us to organize this new information into a coherent body, a set of related ideas that explain events that have occurred and predict events that may happen. Conducting research requires following a sequence of steps. The exact sequence and steps vary somewhat with the type of research. The steps vary slightly by whether a study involves a quantitative or a qualitative approach and data

1.3 RESEARCH CONCEPT, DEFINITION AND APPLICATION OF SCIENTIFIC

Research is an in depth inquiry in to a problem which need an amicable solution. Every invention in the world happens as a result of a scientific enquiry. Research is a systematic, scientific, objective activity, which includes the collection relevant information, and careful analysis of data, recording and reporting of valid conclusion, that may lead to creation of new knowledge, development of theory, principles, and generalization. The developed theory, Knowledge, principles or generalization may help the researcher or concerned authority to predict occurrences of certain possible events and thereby make possible to ultimate control of unwanted events.

Research also means that the process of testing the validity of assumptions and formulated hypotheses. When we come to the educational research it is the process of scientific inquiry to solve the problems of educational sector of a country. It includes theoretical elaboration, quality enhancement matters, policy draft and implication, classroom dimension and so forth. It involves a continuous enquiry in search of knowledge, advancement, problem solving methodology and an attempt to realize the truth from an objective point of view based on factual understanding and systematic study. Educational research refers to the systematic collection and analysis of data related to the field of education. Research may involve a variety of methods and various aspects of education including student learning, teaching methods, teacher training, and classroom dynamics.

Education is considered as a vital tool for social as well as national development. It has significant role in evaluating the human development of a country. When we assessing the development of a person, society, community or a Nation, the educational attributes, such as educational qualifications, number of educated person in the society or community, number of educational institution in the state or country (elementary, secondary, higher, professional educational sector) with respects to its population, rate of enrolment, retention, quality of education provided, equity and equality for educational opportunity and so forth are considered as the prime criteria for consideration. Educational research also helps to evaluate the effectiveness as well as the impact of particular programmes and project which has been undertaken by any governmental or non-governmental agencies. It has a scope to conduct research in any area of education which has a chance to contribute knowledge for the development of education of a society, community and Nation as well.

DEFINITION

The word research is composed of two syllables, *re* and *search*. The dictionary defines the former as a prefix meaning again, a new or over again and the latter as a verb, meaning to examine closely and carefully, to test and try, or to probe. Together they form a noun describing a careful, systematic, patient study and investigation in some field of knowledge, undertaken to establish facts or principles (Grinnell 1993). The simplest meaning of research is to search for facts, answers to research question and solution for the problem.

Scientific Research is a systematic and objective attempt to provide answers to certain questions. The purpose of scientific research is to discover and develop an organized body of knowledge. Therefore, scientific research may be defined as the systematic and empirical analysis and recording of controlled observation, which may lead to the development of theories, concepts, generalizations and principles, resulting in prediction and control of those activities that may have some cause-effect relationship. Some of the definitions of research in literature are given below which can help you to understand proper meaning and concept of research.

Encyclopedia of Social Science defines research as, “the manipulation of generalizing to extend, connect or verify knowledge...” Manipulation incorporates experimentation adopted for the purpose of arriving at generalization.

Kerlinger (1973) defines research as a “systematic, controlled, empirical and critical investigation of hypothetical propositions about the presumed relationship about various phenomena.”

Burns (1994) also defines research as ‘a systematic investigation to find answers to a problem’. Thus, the term research refers to the systematic method consisting of enunciating the problem, formulating a hypothesis, collecting the facts or data, analyzing the facts and reaching certain conclusions either in the form of solution (s) towards the concerned problem or in certain generalization for some theoretical formulation.

McGrath says, “ Research is a process (tool) which has utility only to the extent that the class of inquiry employed as the research activity vehicle is capable of adding knowledge of stimulating progress and of helping society and man relate more efficiently and effectively to the problems that society and man relate more efficiently and effectively to the problems that society and man perpetuate and create.

The Purpose of Research

There are three purposes of research

1. **Exploratory:** As the name suggests, exploratory research is conducted to explore a group of questions. The answers and analytics may not offer a final conclusion to the perceived problem. It is conducted to handle new problem areas which haven't been explored before. This exploratory process lays the foundation for more conclusive research and data collection.
2. **Descriptive:** Descriptive research focuses on expanding knowledge on current issues through a process of data collection. Descriptive studies are used to describe the behavior of a sample population. In a descriptive study, only one variable is required to conduct the study. The three main purposes of descriptive research are describing, explaining, and validating the findings. For example, a study conducted to know if top-level management leaders in the 21st century possess the moral right to receive a huge sum of money from the company profit.

3. **Explanatory:** Explanatory research or causal research is conducted to understand the impact of certain changes in existing standard procedures. Conducting experiments is the most popular form of casual research. For example, a study conducted to understand the effect of rebranding on customer loyalty.

To understand the characteristic of research design using research purpose here is a comparative analysis:

	Exploratory Research	Descriptive Research	Explanatory Research
Research approach used	Unstructured	Structured	Highly structured
Research conducted through	Asking research questions	Asking research questions	By using research hypotheses.
When is it conducted?	Early stages of decision making	Later stages of decision making	Later stages of decision making

Characteristics of a Good Research

While analyzing the discussions of eminent educationalists and social scientists, we can draw the following characteristics of a good research.

- Research is directed towards the solution of a problem
- Research is a continuous enquiry in search of knowledge
- Research emphasis the development of generalization, principles, theories
- Research is based upon observable experiences and empirical evidences
- Research rejects revelation and dogmas as methods of establishing knowledge
- Research employs in depth review of related literature
- Research depends on valid and reliable data gathering procedure
- Research demands accurate observations and descriptions
- Research applies systematic and scientific procedure for the study
- Research involves gathering of new data from first hand sources (primary) or existing data (secondary sources) for a new purposes
- Research is based on carefully designed procedure with rigorous analysis
- Research requires expertise
- Research is a objective, logical process and eliminate personal bias
- Research involve the quest for answer to unsolved problems
- Possibility for Replication
- Research is characterized by patient and unhurried activity
- Research is carefully recorded and reported
- Research sometimes required courage
- Quantitative Research involves hypotheses testing using suitable statistical techniques
- Qualitative Research involve objective thick description on thin data

The Types of Research

Following are the types of research methods

Basic Research: A basic research definition is data collected to enhance knowledge. The main motivation is knowledge expansion. It is a non-commercial research that doesn't facilitate in creating or inventing anything. For example: an experiment to determine a simple fact.

Applied Research: Applied research focuses on analyzing and solving real-life problems. This type refers to the study that helps solve practical problems using scientific methods. Studies play an important role in solving issues that impact the overall well-being of humans. For example: finding a specific cure for a disease.

Problem Oriented Research: As the name suggests, problem-oriented research is conducted to understand the exact nature of a problem to find out relevant solutions. The term "problem" refers to multiple choices or issues when analyzing a situation.

For example, revenue of a car company has decreased by 12% in the last year. The following could be the probable causes: there is no optimum production, poor quality of a product, no advertising, or economic conditions.

Problem Solving Research: This type of research is conducted by companies to understand and resolve their own problems. The problem-solving method uses applied research to find solutions to the existing problems.

Qualitative Research: Qualitative research is a process that is about inquiry. It helps create in-depth understanding of problems or issues in their natural settings. This is a non-statistical method.

Qualitative research is heavily dependent on the experience of the researchers and the questions used to probe the sample. The sample size is usually restricted to 6-10 people. Open-ended questions are asked in a manner that encourages answers that lead to another question or group of questions. The purpose of asking open-ended questions is to gather as much information as possible from the sample.

Application of Scientific Method of Research in Education

The scientific method is a very formal procedure scientist, including psychologists; use to evaluate their predictions or hypotheses. The hypothesis is based on observations and other research. Once those important details are defined, the experimenter can test the hypothesis by manipulating a variable. The scientific method is a method of investigation used by researchers to identify a problem, observe associated variables, and collect data to reach conclusions about the problem. Human growth and development research utilizes the scientific method to conduct research.

The value of the scientific method in researching development

The scientific method attempts to minimize the influence of bias or prejudice in the experimenter. Even the best-intentioned scientists can't escape bias. It results from personal beliefs, as well as cultural beliefs, which means any human filters information based on his or her own experience.

Criteria of Good Research

The criteria for good research are as follows:

- Purpose of research should be clearly defined and common concepts that are used should be operationally defined.

- The research procedure should be precisely planned, focused and appropriately described in order to enable other researcher to do research for further advancement.
- Research design should be carefully planned to generate results to maintained objectivity.
- The research report should be as much as possible frank enough to gauge effects of the findings.
- Data analysis in the research report should be adequate to reveal its significance and the method of analysis employed be appropriate and
- Validity and reliability of data should be examined carefully.

Objectives of Good Research

The purpose of research is to discover answers to questions through the application of scientific procedures. The main aim of research is to find out the truth which is hidden and which has not been discovered as yet. Though each research study has its own specific purpose, we may think of research objectives as falling into a number of following broad groupings:

1. To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory research studies);
2. To portray accurately the characteristics of a particular individual, situation or group (studies with this object in view are known as descriptive research studies);
3. To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies)'
4. To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis- testing research studies/experimental studies).

Thus, research is the fountain of knowledge for the sake of knowledge and an important source of providing guidelines for solving different business, personal, profession governmental and social problems. It is a sort of formal training which enables one to understand the new developments in one's field in a better way.

Qualities of a Good Research

Good research possesses certain qualities which are as follows:

- **Good Research is Systematic:** it means that research is structured according to set of rules to follow certain steps in specified sequence. Systematic research also invites creative thinking, and certainly avoids use of guessing and intuition for arriving at the conclusion.
- **Good Research is Empirical:** it implies that any conclusion drawn is based upon hardcore evidence gathered from information collected from real life experiences and observations. This provides a basis for external ability to research results.
- **Good Research is Valid and Verifiable:** Research involves precise observation and accurate description. The researcher selects reliable and valid instruments to be used in the collection of data

and uses some statistical measures for accurate description of the results obtained. Whatever you conclude on the basis of finding is correct and can be verified by yourself and others.

- **Good Research is Logical:** it suggests that research is guided by the rules of reasoning and logical process of induction (general to specific) and deduction (specific to general) that plays an important role in carrying out research. In fact, logical reasoning makes research feasible and more meaningful in the context of decision making.
- **Good Research Develops Theories and Principles:** which are very helpful in accurate prediction regarding the variables under study. On the basis of the sample observed and studied, the researcher makes sound generalization regarding the whole populations. Thus, research goes beyond immediate situations, objects or groups being investigated by formulating a generalisation or theory about these factors.
- **Research is Replicable:** the designs, procedures and results of scientific research should be replicable so that any person other than the researcher himself may assess their validity. Thus, one researcher may use or transit the results obtained by another researcher. Thus, the procedures and results of the research are replicable as well as transmittable.

Basic Approach

Basic or academic research focuses on the search for truth or the development of educational theory. Researchers with this background "design studies that can test, refine, modify, or develop theories". Generally, these researchers are affiliated with an academic institution and are performing this research as part of their graduate or doctoral work.

Applied Approach

The pursuit of information that can be directly applied to practice is aptly known as applied or contractual research. Researchers in this field are trying to find solutions to existing educational problems. The approach is much more utilitarian as it strives to find information that will directly influence practice. Applied researchers are commissioned by a sponsor and are responsible for addressing the needs presented by their employer. The goal of this research is "to determine the applicability of educational theory and principles by testing hypotheses within specific settings"

Comparison of Basic and Applied Research

The following are several defining characteristics written by Gary Anderson to compare basic (academic) and applied (contract) research.

	Basic (Academic) Research	Applied (Contract) Research
1	Is sponsored by an agency committed to the general advancement of knowledge.	Is sponsored by an agency with a vested interest in the results.
2	Results are the property of society and the research community.	Results become the property of the sponsor.
3	Studies rely on the established reputations of the researchers and are totally under their control.	Studies follow explicit terms of reference developed by the sponsor to serve the sponsor's needs.
4	Budget allocations are generally based on global proposals and accounting is left to the researchers.	Budget accountability is directly related to the sponsor and relates to agreed terms of reference, time frames and methodologies.
5	The conduct of research is based on 'good faith' between funder and researcher.	The work is contractual between sponsor and researcher.
6	The research produces findings and conclusions, but rarely recommendations except those related to further research needs.	The research includes applied recommendations for action.
7	Academic research tends to extend an identifiable scholarly discipline.	By its nature, contract research tends to be interdisciplinary.

8	Academic research is typically focused on a single set of testable hypotheses.	Contract research frequently analyzes the consequences of alternative policy options.
9	Decision-rules relate to theoretically-based tests of statistical significance.	Decision-rules relate to predetermined conventions and agreements between the sponsor and the researcher.
10	Research reports are targeted to other specialized researchers in the same field.	Research reports are intended to be read and understood by lay persons.

1.4 SCIENTIFIC METHOD

The basis for educational research is the scientific method. The scientific method uses directed questions and manipulation of variables to systematically find information about the teaching and learning process. The two main types of data that are used under this method are qualitative and quantitative. The scientific method is a standardized way of making observations, gathering data, forming theories, testing predictions, and interpreting results. Researchers make observations in order to describe and measure behaviour. A theory is an explanation that organizes separate pieces of information in a coherent way. Formal syntheses of research findings across studies are often necessary to discover, test, and explain the diversity of findings that characterize many fields. And it takes time to build scientific knowledge, whether in the physical, life, and social sciences or in areas related to education.

Scientific Method

- Observation
- Hypothesis
- Experiments
- Analysis
- Support or Reject the Hypothesis
- New Hypothesis
- Experiment etc.

Steps of Scientific Method

- Selecting the topic and Identifying the research problem
- Defining the objectives of the study
- Reviewing the literature from theory and other related studies
- Defining concepts and variables to be studied

- Stating hypothesis about expected observations or phenomenon to be studied
- Identifying assumptions and Implications

Limitations of Scientific Method

- Moral or ethical problem
- Human complexity
- Measurement problems
- External variable control problems

Educational research that uses the scientific method to collect scientific data can provide a definite answer about best practices in teaching. The purpose of educational research is to develop new knowledge about the teaching-learning situation to improve educational practice.

The Benefits of Educational Research for Teachers

- help you find solutions to particular problems arising in your classroom or school.
- underpin professional learning of knowledge, skills and understanding.
- connect you with sources of information and networks of professional support

Steps of the Research Process

Step 1: Identify the Problem.

Step 2: Review the Literature.

Step 3: Clarify the Problem.

Step 4: Clearly Define Terms and Concepts.

Step 5: Define the Population.

Step 6: Develop the Instrumentation Plan.

Step 7: Collect Data.

Step 8: Analyze the Data.

Scientific method is defined as controlled, systematic investigations that are tooted in objectives really and that aim to develop general knowledge about natural phenomena. The basis for educational research is the scientific method. The scientific method uses directed questions and manipulation of variables to systematically find information about the teaching and learning process. The two main types of data that are used under this method are qualitative and quantitative.

1.5 METHODS OF RESEARCH IN EDUCATION

The basis for educational research is the scientific method. The scientific method uses directed questions and manipulation of variables to systematically find information about the teaching and learning process. In this scenario questions are answered by the analysis of data that is collected specifically for the purpose of answering these questions. Hypotheses are written and subsequently proved or disproved by data which leads to the creation of new hypotheses.

There also exists a new school of thought that these derivatives of the scientific method are far too reductionist in nature. Since educational research includes other disciplines such as psychology, sociology, anthropology, science, and philosophy and refers to work done in a wide variety of contexts it is proposed that researchers should use "multiple research approaches and theoretical constructs." This could mean using a combination of qualitative and quantitative methods as well as common methodology from the fields mentioned above. In social research this phenomenon is referred to as triangulation (social science). This idea is well summarized by the work of Barrow in his text *An introduction to philosophy of education*:

Since educational issues are of many different kinds and logical types, it is to be expected that quite different types of research should be brought into play on different occasions. The question therefore is not whether research into teaching should be conducted by means of quantitative measures (on some such grounds as that they are more 'objective') or qualitative measures (on some such grounds as that they are more 'insightful'), but what kind of research can sensibly be utilized to look into this particular aspect of teaching as opposed to that.

Most frequently used methods include:

- Observation / Participant Observation.
- Surveys.
- Interviews.
- Focus Groups.
- Experiments.
- Secondary Data Analysis / Archival Study.
- Mixed Methods (combination of some of the above)

Observation

Observation as a data collection method can be structured or unstructured. In structured or systematic observation, data collection is conducted using specific variables and according to a pre-defined schedule. Unstructured observation, on the other hand, is conducted in an open and free manner in a sense that there would be no pre-determined variables or objectives.

Advantages of observation data collection method include direct access to research phenomena, high levels of flexibility in terms of application and generating a permanent record of phenomena to be referred to later. At the same time, observation method is disadvantaged with longer time requirements, high levels of observer bias, and impact of observer on primary data, in a way that presence of observer may influence the behavior of sample group elements. Observation data collection method may be associated with certain ethical issues. Fully informed consent of research participant(s) is one of the basic ethical considerations to be adhered to by researchers. At the same time, the behaviour of sample group members may change with negative implications on the level of research validity if they are notified about the presence of the observer.

Surveys

The data collected from surveys is then statistically analyzed to draw meaningful research conclusions.

In the 21st century, every organization's eager to understand what their customers think about their products or services and make better business decisions. Research can be conducted in multiple ways but surveys are proven to be one of the most effective and trustworthy research methods. An online survey is classified as a method for extracting information about a significant business matter from an individual or a group of individuals and consists of structured survey questions that motivate the participants to respond.

A creditable survey research can give these businesses access to a colossal information bank. Organizations in media, other businesses, and even governments rely on survey research to obtain accurate data.

The traditional definition of survey research is a quantitative method for collection of information from a pool of respondents by asking multiple survey questions. This research type includes recruitment of individuals, collection, and analysis of data. It's useful for researchers who aim at communicating new features or trends to their respondents.

Generally, it's the primary step towards obtaining quick information about mainstream topics and conducting more rigorous and detailed quantitative research methods like surveys/polls or qualitative research methods like focus groups/on-call interviews can follow. There are many situations where this research can be conducted using a blend of both, qualitative and quantitative strategies.

Survey Research Methods

Survey research methods can be derived on the basis of two critical factors: Survey research tool and time involved for conducting research.

There are three main survey research methods, divided based on the medium of conducting survey research:

1. **Online/ Email-**Online survey research is one of the most popular survey research methods in this day and age. The cost involved in online survey research is extremely minimal and the responses gathered are highly accurate but the only drawback of this survey research method is that the response rates are lower compared to the other mediums.
2. **Phone-**Survey research conducted over phone can be useful in collecting data from a larger section of the target population but there are chances that the money invested in phone surveys will be higher than other mediums and also that the time required will be higher.
3. **Face-to-face-** In situations where there is a complicated problem to solve, face-to-face survey research can be conducted. The response rate of this method is the highest but it can be extremely expensive.

Survey research can be classified into two methods:

- **Longitudinal Survey Research:** Longitudinal survey research involves conducting survey research over a continuum of time, which may be spread across years and decades. The data collected using this survey research method from one time period to another, is qualitative or quantitative in nature. Respondent behaviour, preferences, attitudes are observed constantly over time to analyze reasons for change in behaviour or preferences. For example, if a researcher intends to learn about eating habits of teenagers, he/she will follow a sample of teenagers over a considerable period of time to ensure that the collected information is reliable.

Longitudinal survey research is often followed by cross-sectional survey research.

- **Cross-sectional Survey Research:** Cross-sectional survey research is conducted to collect insights from a target audience at a particular time interval. This survey research method is implemented in various sectors such as retail, education, healthcare, SME businesses etc. Cross-sectional survey research can either be descriptive or analytical in nature. This survey research method is quick and helps researchers collect information in a brief time span. Researchers rely on cross-sectional survey research method in situations where descriptive analysis of a subject is required.

Process of Implementing Survey Research Methods:

1. **Decide survey questions:** Brainstorm and put together effective survey questions which are grammatically and logically appropriate. This can be done by understanding the objective and expected outcomes of the survey. There are many surveys where details of responses are not as important as gaining insights about what customers prefer from the provided options.

In such situations, a researcher can include multiple choice questions or closed-ended questions. Whereas, if details about certain questions are to be obtained, researchers can include open-ended questions.

Ideally, the surveys should include a clever balance of open-ended and closed-ended questions. Use survey questions like Likert Scale, Semantic Scale, Net Promoter Score question etc. to avoid fence-sitting.

2. **Finalize a Target Audience:** Send out relevant surveys as per the target audience and filter out irrelevant questions as per the requirement. The survey research will be extremely effective in case a sample is decided from the target population. This way, results can be according to the desired market and be generalized to the entire population.
3. **Send out Surveys via Decided Mediums:** Distribute the surveys to the target audience and patiently wait for the feedback and comments- this is the most important step of the survey research. The survey needs to be scheduled keeping in mind the nature of the target audience and the regions they belong to.

Surveys can be conducted via email, embedded in website, shared via social media etc. to gain maximum responses.

4. **Analyze Survey Results:** Analyze the feedback in real-time and identify patterns in the responses which might lead to a much-needed breakthrough for your organization. GAP, TURF, Conjoint analysis, Cross tabulation and many such survey feedback analysis methods can be used to spot and shed light on respondent behavior. The results can be then used to implement corrective measures to improve customer/employee satisfaction.

Interviews

Interviews can be defined as a qualitative research technique which involves “conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program or situation.” There are three different formats of interviews: structured, semi-structured and unstructured.

Structured interviews consist of a series of pre-determined questions that all interviewees answer in the same order. Data analysis usually tends to be more straightforward because researcher can compare and contrast different answers given to the same questions.

Unstructured interviews are usually the least reliable from research viewpoint, because no questions are prepared prior to the interview and data collection is conducted in an informal manner. Unstructured interviews can be associated with a high level of bias and comparison of answers given by different respondents tends to be difficult due to the differences in formulation of questions.

Semi-structured interviews contain the components of both, structured and unstructured interviews. In semi-structured interviews, interviewer prepares a set of same questions to be answered by all interviewees. At the same time, additional questions might be asked during interviews to clarify and/or further expand certain issues.

Advantages of interviews include possibilities of collecting detailed information about research questions. Moreover, in this type of primary data collection researcher has direct control over the flow of process and she has a chance to clarify certain issues during the process if needed. Disadvantages, on the other hand, include longer time requirements and difficulties associated with arranging an appropriate time with perspective sample group members to conduct interviews.

When conducting interviews you should have an open mind and refrain from displaying disagreements in any forms when viewpoints expressed by interviewees contradict your own ideas. Moreover, timing and environment for interviews need to be scheduled effectively. Specifically, interviews need to be conducted in a relaxed environment, free of any forms of pressure for interviewees whatsoever.

Respected scholars warn that “in conducting an interview the interviewer should attempt to create a friendly, non-threatening atmosphere. Much as one does with a cover letter, the interviewer should give a brief, casual introduction to the study; stress the importance of the person’s participation; and assure anonymity, or at least confidentiality, when possible.”

There is a risk of interviewee bias during the primary data collection process and this would seriously compromise the validity of the project findings. Some interviewer bias can be avoided by ensuring that the interviewer does not overreact to responses of the interviewee. Other steps

that can be taken to help avoid or reduce interviewer bias include having the interviewer dress inconspicuously and appropriately for the environment and holding the interview in a private setting.

Focus Groups

Focus groups are group discussions conducted with the participation of 7 to 12 people to capture their experiences and views regarding specific issues closely related to research question(s). Focus groups data collection method is most suitable for types of studies where multiple perspectives needed to be obtained regarding the same problem.

Focus groups are led by a moderator who is responsible to ensure that group discussions remain focused on the research area. Advantages of focus groups include the possibility of obtaining primary data through non-verbal channels, as well as, verbal channels and approaching the research area from various perspectives.

As is it is the case with any other research method, focus groups have some disadvantages as well. Group discussions may be heavily influenced by one or two dominant individuals in the group. Also, some members of focus group may be discouraged from participating in discussions due to lack of confidence or not articulate communication skills. Moreover, the nature of primary data obtained through focus groups are greatly influenced by environmental factors such as design of the room, room temperature, time of the day, etc.

It is important to understand that data collection and data analysis using focus groups is much more difficult compared to questionnaires and interviews. You have to make sure that you fully understand these difficulties before making a final choice of primary data collection method. However, this is not to say that you should not use focus group to collect primary data for your dissertation.

Experiments

Experimental research is a scientific approach to research, where one or more independent variables are manipulated and applied to one or more dependent variables to measure their effect on the latter. The effect of the independent variables on the dependent variables is usually observed and recorded over some time, to aid researchers in drawing a reasonable conclusion regarding the relationship between these 2 variable types.

The experimental research method is widely used in physical and social sciences, psychology, and education. It is based on the comparison between two or more groups with a straightforward logic, which may, however, be difficult to execute.

Mostly related to a laboratory test procedure, experimental research designs involve collecting quantitative data and performing statistical analysis on them during research. Therefore, making it an example of quantitative research method.

They are of 3 types, namely; pre-experimental, quasi-experimental, and true experimental research.

Pre-experimental Research Design

In pre-experimental research design, either a group or various dependent groups are observed for the effect of the application of an independent variable which is presumed to cause change. It is the simplest form of experimental research design and is treated with no control group.

Although very practical, experimental research is lacking in several areas of the true-experimental criteria. The pre-experimental research design is further divided into three types

One-shot Case Study Research Design

In this type of experimental study, only one dependent group or variable is considered. The study is carried out after some treatment which was presumed to cause change, making it a posttest study.

One-group Pretest-posttest Research Design:

This research design combines both posttest and pretest study by carrying out a test on a single group before the treatment is administered and after the treatment is administered. With the former being administered at the beginning of treatment and later at the end.

Static-group Comparison:

In a static-group comparison study, 2 or more groups are placed under observation, where only one of the groups is subjected to some treatment while the other groups are held static. All the groups are post-tested, and the observed differences between the groups are assumed to be a result of the treatment.

Quasi-experimental Research Design

The word "quasi" means partial, half, or pseudo. Therefore, the quasi-experimental research bearing a resemblance to the true experimental research, but not the same. In quasi-experiments, the participants are not randomly assigned, and as such, they are used in settings where randomization is difficult or impossible.

This is very common in educational research, where administrators are unwilling to allow the random selection of students for experimental samples.

Some examples of quasi-experimental research design include; the time series, no equivalent control group design, and the counterbalanced design.

True Experimental Research Design

The true experimental research design relies on statistical analysis to approve or disprove a hypothesis. It is the most accurate type of experimental design and may be carried out with or without a pre-test on at least 2 randomly assigned dependent subjects.

The true experimental research design must contain a control group, a variable that can be manipulated by the researcher, and the distribution must be random. The classification of true experimental design includes:

- **The pos-test-only Control Group Design:** In this design, subjects are randomly selected and assigned to the 2 groups (control and experimental), and only the experimental group is treated. After close observation, both groups are post-tested, and a conclusion is drawn from the difference between these groups.
- **The pre-test-post-test Control Group Design:** For this control group design, subjects are randomly assigned to the 2 groups, both are presented, but only the experimental group is treated. After close observation, both groups are post-tested to measure the degree of change in each group.
- **Solomon four-group Design:** This is the combination of the pre-test-only and the pre-test-post-test control groups. In this case, the randomly selected subjects are placed into 4 groups.

The first two of these groups are tested using the post-test-only method, while the other two are tested using the pre-test-post-test method.

Secondary Data Analysis / Archival Study

Secondary analysis is the practice of using secondary data in research. As a research method, it saves both time and money and avoids unnecessary duplication of research effort. Secondary analysis is usually contrasted with primary analysis, which is the analysis of primary data independently collected by a researcher.

Researchers Obtain Secondary Data

Unlike primary data, which is collected by a researcher herself in order to fulfill a particular research objective, secondary data is data that was collected by other researchers who likely had different research objectives. Sometimes researchers or research organizations share their data with other researchers in order to ensure that its usefulness is maximized. In addition, many government bodies within the U.S. and around the world collect data that they make available for secondary analysis. In many cases, this data is available to the general public, but in some cases, it is only available to approved users.

Secondary data can be both quantitative and qualitative in form. Secondary quantitative data is often available from official government sources and trusted research organizations. In the U.S., the U.S. Census, the General Social Survey, and the American Community Survey are some of the most commonly used secondary data sets within the social sciences. In addition, many researchers make use of data collected and distributed by agencies including the Bureau of Justice Statistics, the Environmental Protection Agency, the Department of Education, and the U.S. Bureau of Labor Statistics, among many others at federal, state, and local levels.

While this information was collected for a wide range of purposes including budget development, policy planning, and city planning, among others, it can also be used as a tool for sociological research. By reviewing and analyzing numerical data, sociologists can often uncover unnoticed patterns of human behavior and large-scale trends within society.

Secondary qualitative data is usually found in the form of social artifacts, like newspapers, blogs, diaries, letters, and emails, among other things. Such data is a rich source of information about individuals in society and can provide a great deal of context and detail to sociological analysis. This form of secondary analysis is also called *content analysis*.

Conduct Secondary Analysis

Secondary data represents a vast resource to sociologists. It is easy to come by and often free to use. It can include information about very large populations that would be expensive and difficult to obtain otherwise. Additionally, secondary data is available from time periods other than the present day. It is literally impossible to conduct primary research about events, attitudes, styles, or norms that are no longer present in today's world.

There are certain disadvantages to secondary data. In some cases, it may be outdated, biased, or improperly obtained. But a trained sociologist should be able to identify and work around or correct for such issues.

Validating Secondary Data before Using It

To conduct meaningful secondary analysis, researchers must spend significant time reading and learning about the origins of the data sets. Through careful reading and vetting, researchers can determine:

- The purpose for which the material was collected or created
- The specific methods used to collect it
- The population studied and the validity of the sample captured
- The credentials and credibility of the collector or creator
- The limits of the data set (what information was not requested, collected, or presented)
- The historic and/or political circumstances surrounding the creation or collection of the material

In addition, before using secondary data, a researcher must consider how the data are coded or categorized and how this might influence the outcomes of secondary data analysis. She should also consider whether the data must be adapted or adjusted in some way prior to her conducting her own analysis.

Qualitative data is usually created under known circumstances by named individuals for a particular purpose. This makes it relatively easy to analyze the data with an understanding of biases, gaps, social context, and other issues.

Quantitative data, however, may require more critical analysis. It is not always clear how data was collected, why certain types of data were collected while others were not, or whether any bias was involved in the creation of tools used to collect the data. Polls, questionnaires, and interviews can all be designed to result in pre-determined outcomes.

Mixed Methods (combination of some of the above)

The term "mixed methods" 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 of inquiry. Collecting and analyzing both quantitative

(closed-ended) and qualitative (open-ended) data. This approach to research is used when this integration provides a better understanding of the research problem than either of each alone.

Quantitative data includes close-ended information such as that found to measure attitudes (e.g., rating scales), behaviors (e.g., observation checklists), and performance instruments. The analysis of this type of data consists of statistically analyzing scores collected on instruments (e.g., questionnaires) or checklists to answer research questions or to test hypotheses.

Qualitative data consists of open-ended information that the researcher usually gathers through interviews, focus groups and observations. The analysis of the qualitative data (words, text or behaviors) typically follows the path of aggregating it into categories of information and presenting the diversity of ideas gathered during data collection.

Approaches in Research

- **Quantitative**
- Experimental
- Quasi-Experimental
- Survey
- Co-relational

- **Qualitative**
- Ethnography
- Case Study
- Historical

Check Your Progress

1. What is research?

.....
.....
.....

2. Discuss qualities of good research

.....
.....
.....

1.6 SUMMARY

Scientific research may be defined as the systematic and empirical analysis and recording of controlled observation, which may lead to the development of theories, concepts, generalization and principles, resulting in prediction and control of those activities that may have some cause-effect relationship. Qualities of good research are empirical, logical, verifiable, based on theories and principles and replicable. This unit has provided an overview of the research process. The steps of research process includes problem identification, formulation of hypothesis, identification manipulation

and controlling of the variable, formulation of research design, constructing devices for observation, sample selection and data collection, data analysis and interpretation, drawing conclusions and preparation of report and publications.

1.7 CHECK YOUR PROGRESS: MODEL ANSWERS

1. **Research** is the process of solving problems and finding facts in an organised way. Sometimes, **Research** is used for challenging or making contribution to generalizable knowledge. Additional knowledge can be discovered by proving existing theories, and by trying to better explain observations

2. **The main characteristics for good quality research is listed below:**

- It is based on the work of others.
- It can be replicated and doable .
- It is generalisable to other settings.
- It is based on some logical rationale and tied to theory. ...
- It generates new questions or is cyclical in nature.
- It is incremental

1.8 MODEL EXAMINATIONS QUESTIONS

I short Questions

1. Explain what is Scientific method?
2. Write about concept of Research.
3. Write own definition of research.

II Essay Questions

4. What are the methods of Research? Explain.
5. Discuss about application of scientific method.

1.9 GLOSSARY

Investigation: Examination, inquiry, research express the idea of an active effort to find out something

Hypothesis A tentative and testable explanation of the relationship between two or more events or variables.

Standardisation: The use of uniform consistent procedures in all phases of data collection.

Variable : Something that can occur with different values and can be measured

Independent Variable : a variable that represents the hypothesized “cause” that is precisely controlled by the experimenter and independent of what the participant does..

Dependent Variable : a variable that represents the hypothesized “effect “whose values

ultimately depend on the values of independent variable.

1.10 FURTHER READINGS

1. Aylward, E.H., Richards, T.L., Berwinger, V.W., Nagy, W.E., Field, K.M., Grimme, A.C., Richard, A.L., Thomson, J.B. & Cramer, S.C. (2003). *Instructional Treatment Associated with Changes in Brain Activities in Children with Dyslexia*. *Neurology*, 61, 212-219.
2. D; Amato, M.R. (1970): *Experimental Psychology*. Tokoya : McGraw – Hill.
3. Grinnell, Richard Jr (ed.) 1988, *Social Work Research and Evaluation* (3rd edition) Itasca, Illinois, F.E. Peacock Publishers.
4. Kerlinger, F. N. (1979) *Foundation of Behavioural Research*, New York, : H 107, Rinehart and Winstem Inc.
5. Kuhn, T.S. (1970). *The Structure of Scientific Revolutions* (2nd edition) Chicago : University of Chicago Press.
6. Kumar. R (2006) *Research Methodology*. New Delhi: Dorling Kingsley
7. McGuigan, F.J. (1990): *Experimental Psychology: A Methodological Approach*. New York : Printice Hall.
8. Shaywitz, S.E. (1996): *Dyslexia*. *Scientific American*, 275 (5) 98-104.
9. Townsend, J.C. (1953): *Introduction to Experimental Method*. Tokyo : McGraw Hill.
10. Hsieh, P-H; Acee, T.; Chung, W-H; Hsieh, Ya-P.; Kim, H.; Thomas, G.D.; You, Ji-in; Levin, J.R.; Robinson, D.H. (November 2005). "[Is Educational Intervention Research on the Decline?](#)" (PDF). *Journal of Educational Psychology*. **97** (4): 523–9. doi:10.1037/0022-0663.97.4.523. ^{[[permanent dead link](#)]}
11. Furlong, J. and Oancea, A. (2008) *Assessing Quality in Applied and Practice Based Research. Continuing the Debate*. London, Routledge. <https://www.routledge.com/Assessing-quality-in-applied-and-practice-based-research-in-education/Furlong-Oancea/p/book/9780415448017>.
12. Barry, W.J. (2012). "[Challenging the Status Quo Meaning of Educational Quality: Introducing Transformational Quality \(TQ\) Theory](#)". *Educational Journal of Living Theories*. **4**: 1–29.

UNIT-2 PURPOSE OF RESEARCH: RESEARCH IN EDUCATION & SPECIAL EDUCATION

Structure

2.1 Objectives

- 2.2 Introduction
- 2.3 Purpose of Research
- 2.4 Research in Education
- 2.5 Special Education
- 2.6 Summary
- 2.7 Check Your Progress: Model Answers
- 2.8 Model Examination Questions
- 2.9 Glossary
- 2.10 Further Readings

2.1 OBJECTIVES

After Studying this unit, you will be able to:

- ❖ to understand Purpose of Research
- ❖ to know about Research in Education
- ❖ to describe Special Education

2.2 INTRODUCTION

Educational research that uses the scientific method to collect scientific data can provide a definite answer about best practices in teaching. The purpose of educational research is to develop new knowledge about the teaching-learning situation to improve educational practice. Educational research that uses the scientific method to collect scientific data can provide a definite answer about best practices in teaching.

2.3 PURPOSE OF RESEARCH

The purpose of educational research is to develop new knowledge about the teaching-learning situation to improve educational practice. Educational research can address the following variables:

- Learning: How do student's best learn various subjects?
- Teaching: What are the best teaching practices to foster student achievement?
- Motivation: What are the best practices for teachers to motivate their students to achieve?
- Development: How do children and adults change over time, including their cognitive, social, and emotional skills?
- Classroom management: What classroom or school practices make the classroom optimal for student learning?

By collecting scientific data about these important topics in education, educational research can establish the best practices that teachers, counselors, administrators, and students should use to improve learning outcomes. Therefore, educational researchers - particularly researchers in Nigeria - should focus on practical research projects that will have significant implications for education.

type of educational research you are pursuing, though, recall that the purpose of educational research is to improve educational practice. Having an understanding of educational research

and conducting high quality educational research can have the following benefits for educational practice:

- Provide instruction that maximizes students' learning.
- Understand and support the developmental needs of pupils.
- Develop an educational environment that supports students' motivation.
- Provide solutions to educational problems.

Therefore, develop a research study that can have a significant impact on improving the teaching-learning situation. Because educational research can have significant implications for the teaching-learning situation, it is essential that educational researchers complete their research projects in good faith. Poorly conducted research can cause further harm to the educational process than no research at all. Consequently, under no circumstances should an educational researcher "cut corners" to get their project completed faster or easier. Educational researchers also have a responsibility to check and double check their work to ensure that their methods are valid, their calculations are correct, and their conclusions accurately reflect the data that has been collected. Careful, thoughtful, and trustworthy research. The Educational research has enormous purposes. Some important purposes are presented as following.

- To identify truth regarding Enrolment, retention, dropout, quality of Education and so forth
- To build new knowledge regarding the methodology, pedagogy or other core subject areas
- Adding of existing stock of knowledge related to educational field
- To solve a problem related to classroom, institution, administrative level, policy level
- Invention of new teaching methods, curriculum transaction strategies, effective grouping technique and so forth
- Realizing the exact problem of educational sector
- Assess the Effect of New methodology of teaching
- Identify and assess the ICT enabled classroom and teaching
- To understand the teachers knowledge on latest evaluation techniques
- To identify the hindrances to achieve universalization of education

2.4 RESEARCH IN EDUCATION

Research is a systematic, scientific, objective activity, which includes the collection relevant information, and careful analysis of data, recording and reporting of valid conclusion, that may lead to creation of new knowledge, development of theory, principles, and generalization. The developed theory, Knowledge, principles or generalization may help the researcher or concerned authority to predict occurrences of certain possible events and thereby make possible to ultimate control of unwanted events. Research also means that the process of testing the validity of assumptions and formulated hypotheses. When we come to the educational research it is the process of scientific inquiry to solve the problems of educational sector of a country. It includes theoretical elaboration, quality enhancement matters, policy draft and implication, classroom dimension and so forth. It involves a continuous enquiry in search of knowledge,

advancement, problem solving methodology and an attempt to realize the truth from an objective point of view based on factual understanding and systematic study.

Educational research refers to the systematic collection and analysis of data related to the field of education. Research may involve a variety of methods and various aspects of education including student learning, teaching methods, teacher training, and classroom dynamics.

General Types of Educational Research

- ❖ Descriptive — survey, historical, content analysis, qualitative (ethnographic, narrative, phenomenological, grounded theory, and case study)
- ❖ Associational — correlational, causal-comparative.
- ❖ Intervention — experimental, quasi-experimental, action research (sort of)

Scope Educational Research

Education is considered as a vital tool for social as well as national development. It has significant role in evaluating the human development of a country. When we assessing the development of a person, society, community or a Nation, the educational attributes, such as educational qualifications, number of educated person in the society or community, number of educational institution in the state or country (elementary, secondary, higher, professional educational sector) with respects to its population, rate of enrolment, retention, quality of education provided, equity and equality for educational opportunity and so forth are considered as the prime criteria for consideration.

Every nation in the world has been giving emphasis to the development educational sector of their country. Many innovative programmes and projects are preparing by the policy makers as well as the academic bodies across the world to improve their educational quantity as well as the quality. Crores of rupees are allocating in their budget for implementing such planned programmes and project. In India the projects like District Primary Education Programme (DPEP) , Sarva Siksha Abhiyan (SSA), Area Intensive Programme (AIP) , Kasturba Gandhi Balika Vidhyalaya (KGBV), Rashtriya Madhyamik Siksha Abhiyan (RMSA), Rashtriya Uchayistic Siksha Abhiyan (RUSA), Scheme for the Promotion of Quality Education in Madrassas (SPQEM) are constituted and implemented to improve the standard of educational sector of the country. Educational Researches are the main input as well as the output to bring such change in the educational sector.

Research findings identify the shortcomings, strength and weakness of the educational sector of the country and it recommends implementing such and such programme for the development of their educational sector. Educational research also helps to evaluate the effectiveness as well as the impact of particular programmes and project which has been undertaken by any governmental or non governmental agencies. Hence the breadth and width of the educational research is unlimited. It has a scope to conduct research in any area of education which has a chance to contribute knowledge for the development of education of a society, community and Nation as well.

Characteristics of Research

1. A systematic approach must be followed for accurate data. Rules and procedures are an integral part of the process that set the objective. Researchers need to practice ethics and a code of conduct while making observations or drawing conclusions.
2. Research is based on logical reasoning and involves both inductive and deductive methods.
3. The data or knowledge that is derived is in real time from actual observations in natural settings.
4. There is an in-depth analysis of all data collected so that there are no anomalies associated with it.
5. Research creates a path for generating new questions. Existing data helps create more opportunities for research.
6. Research is analytical in nature. It makes use of all the available data so that there is no ambiguity in inference.
7. Accuracy is one of the most important aspects of research. The information that is obtained should be accurate and true to its nature. For example, laboratories provide a controlled environment to collect data. Accuracy is measured in the instruments used, the calibrations of instruments or tools, and the final result of the experiment

2.5 SPECIAL EDUCATION

Special education teachers who understand research methodology and supported practices can not only innovate in the classroom but also help other teachers understand and incorporate new and effective teaching strategies, helping all students achieve their highest potential. Education is constantly evolving, with educators and educational theorists involved in an ongoing search for innovative and effective methods and teaching strategies to meet the unique needs of each student. This approach is perhaps most essential in special education and the inclusive classroom.

The inclusive classroom relies on the simultaneous use of differentiated instruction and assessment techniques for maximizing a student's learning potential by tailoring the 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, boosts their inclusion in professional development programs for teachers, and encourages widespread implementation.

Educational research refers to the systematic collection and analysis of data related to the field of education. Research may involve a variety of methods and various aspects of education including student learning, teaching methods, teacher training, and classroom dynamics.

The Benefits of Special Education

“The main benefit of special needs schools and programs is the individualized and personal education. Small class sizes and specialized staff allow for addressing individual needs, strategizing to capitalize on academic and other strengths, and teaching self-advocacy skills.”

The current issues in special education

Five Current Trending Issues in Special Education

- Technology. As technology continues to substantially alter the classroom, students with Individualized Education Programs (IEPs) are especially targeted for extra support. ...
- Trauma-Informed Teaching. ...
- Homelessness. ...
- Twice-Exceptional Students. ...
- Parental Support. ...
- Next Steps for Educators.

Types of Research Methods

There are three main types of descriptive methods: observational methods, case-study methods and survey methods.

Four basic research methods for business start-ups

- Quantitative surveys.
- Focus groups.
- Qualitative research interviews.
- Qualitative case studies..
- But which business research methods work best

The Scope of Special Education.

The goals of special education are the same as those of education for normal children—to teach each child up to the level of the child's abilities. In some cases this means teaching the same material as is taught in regular classrooms.

The Disadvantages of Special Education

Students who have been in special education for a long period of time tends to suffer from issues with self esteem and thus perform below their ability (Heward, 2003). This creates a situation where the student approaches tasks with an attitude of “I can't” rather than I wil

Check Your Progress

1. What is the purpose of Educational Research?

What are the characteristics of a good research?

2.6 SUMMARY

Educational research refers to the systematic collection and analysis of data related to the field of education. Research may involve a variety of methods and various aspects

of education including student learning, teaching methods, teacher training, and classroom dynamics.

2.7 CHECK YOUR PROGRESS: MODEL ANSWERS

1. The purpose of educational research is to develop new knowledge about the teaching-learning situation to improve educational practice. Educational research can address the following variables: Learning
2. The main characteristics for good quality research are
 - It is based on the work of others.
 - It can be replicated and doable.
 - It is generalisable to other settings.
 - It is based on some logical rationale and tied to theory. ...
 - It generates new questions or is cyclical in nature.
 - It is incremental.

2.8 MODEL EXAMINATION QUESTIONS

I short Questions

1. Explain what is Educational research?
2. Write about scope of Research.

II Essay Questions

3. What are the types of educational Research? Explain.
4. Discuss about research in special education..

2.9 GLOSSARY

Research- the systematic investigation

Education- the process of receiving or giving systematic instruction, especially at a school or university

Special Education- Special education is the practice of educating students in a way that addresses their individual differences and special needs.

2.10 FURTHER READINGS

Siegler, R. S. & Ramani, G. B. (2009). Playing linear number board games - but not circular ones - improves low-income preschoolers' numerical understanding. *Journal of Educational Psychology*, 101, 545-560.

Website

wikipedia.org › wiki › Special Education, wikipedia.org › wiki › Educational Research

BLOCK- II TYPES AND PROCESS OF RESEARCH

Unit-3 Types of Research

Unit-4 Tools of Research

UNIT-3 TYPES OF RESEARCH

Structure

3.1 Objectives

3.2 Introduction

3.3 Types of Research

3.3.1 Basic/Fundamental,

3.3.2 Applied and Action

3.3.3 Process of Research

3.3.4 Selection of Problem

3.3.5 Formulation of Hypothesis

3.3.6 Collection of Data

3.3.7 Analysis of Data & Conclusion

3.4 Summary

3.5 Check Your Progress: Model Answers

3.6 Model Examination Questions

3.7 Glossary

3.8 Further Readings

3.1 OBJECTIVES

After Studying this unit, you will be able to:

- to understand types of research
- to know about basic/fundamental
- to discuss about applied and action, process of research, selection of problem
- to analyse formulation of hypothesis, collection of data and analysis of data & conclusion

3.2 INTRODUCTION

Education Research produces information to reduce uncertainty. It helps focus decision making. In a number of situations educational researchers know exactly what their problems are and design studies to test specific hypothesis. Most basic scientific studies in education, for example, the development of organisational behaviour theory ultimately seek to identify cause and affect relationships. When one thinks of science, casual studies often create statistical experimental control to establish contrast groups. A number of experiments are

3.3 TYPES OF RESEARCH

Educational research produces information to reduce uncertainty. It helps focus decision-making. In a number of situations educational researchers know exactly what their problems are and design studies to test specific hypothesis. Most basic scientific studies in education, for example, the development of organisational behaviour theory ultimately seek to identify cause and effect relationship. When one thinks of science, one often associates it with experiments. Thus to predict a relationship between say, absenteeism and achievement in science, causal studies often create statistical experiments controls to establish contrast group. A number of experiments are conducted by both theory developments and pragmatic administrators.

Types of Educational Research

	Exploratory Research(Ambiguous Problem)	Descriptive Research (Aware of Problem)	Causal Research (Clearly Defined Problem)
Possible Situation	Absenteeism in class in increasing and we do not know why.	What kind of student is prone to absenteeism?	Which of the two remedial measures programmed instruction and supervised study in more effective?

3.3.1 Basic/Fundamental

Research is conducted at different levels for different purposes. Broadly speaking educational research is of three types namely Fundamental Research, Applied research and Action Research.

Fundamental Research

The purpose of this type of research is to add to the theory of education. In its conduct sophisticated procedures, tools and techniques are employed and greater controls are exercised and the generalizations arrived at have wide application. It is concerned with the formulations of theory and is not hampered by considerations of immediate utility.

3.3.2 Applied Research

In this type of research the knowledge produced. The concepts discovered the theory constructed and the law established is put to application in specific educational situations. The researcher in such a frame of reference works out the strategy for applying the already discovered facts, principles and truths. In educational research there is considerable scope for pursuing applications of scientific method. This type of research is concrete by its very nature and required understanding of the practical situation encountered by the practitioners.

Action Research

Action research is undertaken to the strategy for applying the problem. The goal of research in terms of adding to scientific knowledge by arriving at sound generalizations, takes a back seat. This research places importance on a specific problem which is present here and now. As its methodology is not as rigorous that of pure research, the person facing the problem, that is the teacher or the administrator, can undertake it himself. Since the purpose of action research is limited to the solution of the immediate problem at hand and no sophisticated technique is need for conducting it, we can see the following features which distinguish this type of research from fundamental and applied research.

It does not need a trained and specialized research. The practitioner in the field becomes the researcher. No sampling is needed, since it has to do with all the people concerned who form the limited and accessible population. Knowledge of descriptive statistics is enough. As no inferences have to be drawn about the population from the study of a sample, the inferential statistics does not come in. No special tools for collection of data are needed: as the remedial measures taken have to be assessed with the same instrumentations that hand recorded the deficiencies.

3.3.3 Process of Research

The **research process** involves identifying, locating, assessing, and analyzing the information you need to support your **research** question, and then developing and expressing your ideas. The research process can be broken down into seven steps, making it more manageable and easier to understand. This module will give you an idea of what's involved at each step in order to give you a better overall picture of where you are in your research, where you will be going, and what to expect at each step.

1. Selection of topic
2. Reviewing the literature

3. Development of theoretical and conceptual frameworks
4. Clarification of research question/hypothesis
5. Research design
6. Data collection
7. Data analysis
8. Drawing conclusions

3.3.4 Selection of Problem

Expected to state that you have selected the research area due to professional and personal interests in the area and this statement must be true. The importance of this first stage in the research process is often underestimated by many students. If you find research area and research problem that is genuinely interesting to you it is for sure that the whole process of writing your dissertation will be much easier. Therefore, it is never too early to start thinking about the research area for your dissertation.

3.3.5 Formulation of Hypothesis

Formulating research aim, objectives and research questions or developing hypotheses. The choice between the formulation of research questions and the development of hypotheses depends on your research approach as it is discussed further below in more details. Appropriate research aims and objectives or hypotheses usually result from several attempts and revisions and these need to be mentioned in Methodology chapter. It is critically important to get your research questions or hypotheses confirmed by your supervisor before moving forward with the work.

Conducting the literature review. Literature review is usually the longest stage in the research process. Actually, the literature review starts even before the formulation of research aims and objective; because you have to check if exactly the same research problem has been addressed before. Nevertheless, the main part of the literature review is conducted after the formulation of research aim and objectives. You have to use a wide range of secondary data sources such as books, newspapers, magazines, journals, online articles etc.

Selecting methods of data collection. Data collection method(s) need to be selected on the basis of critically analyzing advantages and disadvantages associated with several alternative data collection methods. In studies involving primary data collection, in-depth discussions of advantages and disadvantages of selected primary data collection method(s) need to be included in methodology.

3.3.6 Collection of Data

Collecting the primary data. Primary data collection needs to be preceded by a great level of preparation and pilot data collection may be required in case of questionnaires. Primary data

collection is not a compulsory stage for all dissertations and you will skip this stage if you are conducting a desk-based research.

3.3.7 Analysis of Data & Conclusion

Data analysis. Analysis of data plays an important role in the achievement of research aim and objectives. Data analysis methods vary between secondary and primary studies, as well as, between qualitative and quantitative studies.

Reaching conclusions. Conclusions relate to the level of achievement of research aims and objectives. In this final part of your dissertation you will have to justify why you think that research aims and objectives have been achieved. Conclusions also need to cover research limitations and suggestions for future research.

Completing the research. Following all of the stages described above, and organizing separate chapters into one file leads to the completion of the first draft. The first draft of your dissertation needs to be prepared at least one month before the submission deadline. This is because you will need to have sufficient amount of time to address feedback of your supervisor.

3.3.7 Analysis of Data and Conclusion

Data and conclusions are both key elements of a scientific research process. In carrying out a study or experiment, data is the result collected from testing. Conclusions are your interpretation of the data. The process of data analysis uses analytical and logical reasoning to gain information from the data. The main purpose of data analysis is to find meaning in data so that the derived knowledge can be used to make informed decisions.

Data Analysis to Make Research

- ❖ Trim your data prior to analysis, making it easier to focus on analysis
- ❖ Never perform analysis on the master copy of your data
- ❖ Base your hypothesis in theory, not on a hunch (or on the data)
- ❖ Accept that you may not find "significance"
- ❖ Check assumptions BEFORE you analyze your data.
- ❖ Carefully select your analysis.

Check Your Progress

1. Explain types of educational research.

2. Write how many steps of educational research process?

3.4 SUMMARY

The research process involves identifying, locating, assessing, and analyzing the information you need to support your research question, and then developing and expressing your ideas. These are the same skills you need any time you write a report, proposal, or put together a presentation.

3.5 CHECK YOUR PROGRESS: MODEL ANSWERS

1. Research is a logical and systematic search for new and useful information on a particular topic. Research is important both in scientific and non-scientific fields. The research is broadly classified into two main classes: 1. Fundamental or basic research and 2. Applied research.

2. The research process can be broken down into eight steps, making it more manageable and easier to understand. This module will give you an idea of what's involved at each step in order to give you a better overall picture of where you are in your research, where you will be going, and what to expect at each step.

1. Selection of topic
2. Reviewing the literature
3. Development of theoretical and conceptual frameworks
4. Clarification of research question/hypothesis
5. Research design
6. Data collection
7. Data analysis
8. Drawing conclusions

3.6 MODEL EXAMINATION QUESTIONS

I Short questions

1. What is action research?
2. What is basic fundamental research? Explain.

II Essay questions

1. Describe Types of Educational Research.
2. Explain about Process of Research

3.7 GLOSSARY

PROCESS - a series of actions or steps taken in order to achieve a particular end.

ACTION- the fact or process of doing something, typically to achieve an aim.

3.8 FURTHER READINGS

Aylward, E.H., Richards, T.L., Berwinger, V.W., Nagy, W.E., Field, K.M., Grimme, A.C., Richard, A.L., Thomson, J.B. & Cramer, S.C. (2003). *Instructional Treatment Associated with Changes in Brain Activities in Children with Dyslexia*. *Neurology*, 61, 212-219.

D; Amato, M.R. (1970): *Experimental Psychology*. Tokoya : McGraw – Hill.

Grinnell, Richard Jr (ed.) 1988, *Social Work Research and Evaluation* (3rd edition) Itasca, Illinois, F.E. Peacock Publishers.

Kerlinger, F. N. (1979) *Foundation of Behavioural Research*, New York, : H 107, Rinehart and Winstem Inc.

Kuhn, T.S. (1970). *The Structure of Scientific Revolutions* (2nd edition) Chicago : University of Chicago Press.

Kumar. R (2006) *Research Methodology*. New Delhi: Dorling Kingsley

McGuigan, F.J. (1990): *Experimental Psychology: A Methodological Approach*. New York : Printice Hall.

Shaywitz, S.E. (1996): *Dyslexia*. *Scientific American*, 275 (5) 98-104.

Townsend, J.C. (1953): *Introduction to Experimental Method*. Tokyo : McGraw Hill.

UNIT-4 TOOLS OF RESEARCH

- 4.1 Objectives
- 4.2 Introduction
- 4.3 Tools of Research and Tests
- 4.4 Questionnaire
- 4.5 Checklist and Rating Scale
- 4.6 Action Research
- 4.7 Research in Teaching Learning Environment and Professional Competencies for Research
- 4.8 Summary
- 4.9 Check Your Progress: Model Answers
- 4.10 Model Examination Questions
- 4.11 Glossary
- 4.12 Further Readings

4.1 OBJECTIVES

After Studying this unit, you will be able to:

- ❖ to know about the tools of research and Tests
- ❖ to explain the Questionnaire
- ❖ to describe the Checklist, Rating Scale and Action
- ❖ to discuss about the Research in Teaching Learning Environment and Professional
- ❖ Competencies for Research

4.2 INTRODUCTION

Research requires many data gathering tools or techniques. For example tests are the tools of measurement that guides the researcher in data collection and also in evaluation. Tools may vary in complexity, interpretation, design and administration. Each tool is suitable for the collection of certain type of information. One has to select from the available tools those which will provide data s/he seeks for testing hypothesis. It is possible that existing research tools do not suit the purpose in some situation, so researcher should modify and adopt them or construct their own. Different tools used for data collection such as Questionnaire, Checklist and Rating Scale are discussed in this unit. Further, Action Research in teaching learning environment is an impart aspect of research which gives the practitioner to study and arrive at practical solutions immediately which is also discussed in this unit. Finally, Professional competencies for research are essential for quality research to be carried out, which is also presented as a part of this unit.

4.3 TOOLS OF RESEARCH AND TESTS

It is essential, in research work, to collect factual material or data required which is unknown or untapped so far. The same can be obtained from many sources, direct or indirect. It is necessary to adopt a systematic procedure to collect essential data. Relevant data, adequate in quantity and quality should be collected. The data collected should be adequate, reliable and valid. For collecting new, unknown data required for the study of any problem you may use various devices, instruments, and tests. The instruments thus employed as means for collecting data are called tools. The selection of suitable tools is important for successful research. Different tools are suitable for collecting various kinds of information for various purposes.

The researcher may use one or more of the tools in combination for the purpose. Research students should therefore familiarise themselves with variety of tools with their nature, merits and limitations. They should also know how to construct and use them effectively. The major tools of research in education are discussed hereunder:

Tests

Psychological and educational testing and measuring instruments are an important part of research and clinical practice in the social sciences. There are thousands of testing and measuring instruments available today. Finding the right psychological test or achievement test for your research needs can be a challenging task since there is no single source to consult and your source may only include a test description or review, not an actual copy of the test. Another issue is whether you want to find information about a test - psychometric information such as reliability, validity and norm development - or whether you want to find the actual instrument used for a particular research project.

Availability of psychological tests and measures depends on whether they are published or unpublished, as defined below:

- Published tests are commercially available for purchase. These measurement instruments have established validity, reliability and norms and typically come with test manuals and testing protocols. In many cases only qualified or professionally trained individuals can purchase copies.
- Unpublished tests are found in the scholarly literature and have typically been developed by university researchers or other professionals, government agencies, or nonprofit organizations. Copies of these tests may sometimes be found as appendices to journal articles, dissertations, books and other research reports. While access to these tests is not restricted, ethical conduct requires that these tests should be used only with the permission of the instrument's author. In this unit let us discuss about achievement test.

Achievement Test

An achievement test is a test of developed skill or knowledge. The most common type of achievement test is a standardized test developed to measure skills and knowledge learned in a given grade level, usually through planned instruction, such as training or classroom instruction. Achievement tests are often contrasted with tests that measure aptitude, a more general and stable cognitive trait.

Achievement test scores are often used in an educational system to determine the level of instruction for which a student is prepared. High achievement scores usually indicate a mastery of grade-level material, and the readiness for advanced instruction. Low achievement scores can indicate the need for remediation or repeating a course grade.

Achievement tests are also used as assessing proficiency of students. Proficiency is defined as the amount of grade-appropriate knowledge and skills a student has acquired up to the point of testing. Better teaching practices are expected to increase the amount learned in a school, and therefore to increase achievement scores, and yield more "proficient" students than before. When writing achievement test items, writers usually begin with a list of content standards (either written by content specialists or based on state-created content standards for example 'academic standards' of teaching learning of a school subject) which specify exactly what students are expected to learn in a given school year. The goal of item writers is to create test items that measure the most important skills and knowledge attained in a given grade-level. The number and type of test items written is determined by the grade-level content standards. Content validity is determined by the representativeness of the items included on the final test.

4.4 QUESTIONNAIRE

A questionnaire is a form prepared and distributed to secure responses to certain questions. It is a device for securing answers to questions by using a form which the respondent fills by himself. It is a systematic compilation of questions that are submitted to a sampling of population from which information is desired.

Questionnaire rely on written information supplied directly by people in response to questions. The information from questionnaires tends to fall into two broad categories - 'facts' and 'opinions'. It is worth stressing that, in practice, questionnaires are very likely to include questions about both facts and opinions.

The purpose of the questionnaire is to gather information from widely scattered sources. It is mostly used in uses in cases where one can not readily see personally all of the people from whom he desires responses. It is also used where there is no particular reason to see them personality.

Types

Questionnaire can be of various type on the basis of it's preparation. They are like:

- Structured - Non Structured
- Closed – Open and
- Facts – Opinion based.

Characteristics of a Good Questionnaire

- Questionnaire should deal with important or significant topic to create interest among respondents.
- It should seek only that data which cannot be obtained from other sources.
- It should be as short as possible but should be comprehensive.
- Directions should be clear and complete.
- It should be presented in good Psychological order proceeding from general to more specific responses.
- Double negatives in questions should be avoided.
- It should avoid annoying or embarrassing questions.
- It should be designed to collect information which can be used subsequently as data for analysis.
- It should consist of a written list of questions.

Use of Questionnaire

Different methods are better suited to different circumstances and questionnaire are no exception to it. Questionnaires are used at their most productive:

- When used with large numbers of respondents.
- When what is required tends to be fairly straight forward information.
- When there is a need for standardize data from identical information.
- When time is allowing for delays.
- When resources allow for the cost of printing and postage.
- When respondents can be expected to be able to read and understand the questions.
-

Background Information about the Questionnaire

Both from ethical and practical point of view, the researcher needs to provide sufficient Background information about the research and the questionnaire. Each questionnaire should have a cover page, on which some information appears about - the sponsor, the purpose, return address and date, confidentiality, voluntary responses and thanks.

4.5 CHECKLIST AND RATING SCALE

Checklist

A checklist is a type of informational tool used to reduce failure by compensating for potential limits of human memory and attention. It helps to ensure consistency and completeness in carrying out a task. A basic example is 'to do list'. A more advanced checklist which lays out tasks to be done according to time of a day or other factors. The checklist consists of a list of items with a place to check, or to mark yes or no.

Purpose

The main purpose of checklist is to call attention to various aspects of an object or situation, to see that nothing of importance is overlooked. For Example, if you have to go for outing for a week, you have to list what things you have to take with you. Before leaving home, if you will check your baggage with the list there will be less chance of forgetting to take any important things, like toothbrush etc. It ensures the completeness of details of the data. Responses to the

checklist items are largely a matter of fact, not of judgment. It is an important tool in gathering facts for educational surveys.

Uses

Checklists are used for various purposes. As it is useful in daily life, it is also useful in educational field in the following way:

- To collect facts for educational surveys.
- To record behaviour in observational studies.
- To use in educational appraisal, studies - of school buildings, property, plan, textbooks, instructional procedures and outcomes etc.
- To rate the personality.

Rating Scale

Rating scale is one of the enquiry form. Form is a term applied to expression or judgment regarding some situation, object or character. Opinions are usually expressed on a scale of values. Rating techniques are devices by which such judgments may be quantified. Rating scale is a very useful device in assessing quality, especially when quality is difficult to measure objectively. For Example, "How good was the performance?" is a question which can hardly be answered objectively. Rating scales record judgment or opinions and indicates the degree or amount of different degrees of quality which are arranged along a line in the scale. **For example:** How do you rate the behavior of a student?

Excellent, Very good, Good, Average, Below average, Poor, Very poor.

This is the most commonly used instrument for making appraisals. It has a large variety of forms and uses. Typically, they direct attention to a number of aspects or traits of the thing to be rated and provide a scale for assigning values to each of the aspects selected. They try to measure the nature or degree of certain aspects or characteristics of a person or phenomenon through the use of a series of numbers, qualitative terms or verbal descriptions.

Purpose of Rating Scale: Rating scales have been successfully utilized for measuring the following:

- Teacher Performance/Effectiveness
- Personality, anxiety, stress, emotional intelligence etc.
- School appraisal including appraisal of courses, practices and programmes.

Useful hints on Construction of Rating Scale: A rating scale includes three factors like:

1. The subjects or the phenomena to be rated.
2. The continuum along which they will be rated and
3. The judges who will do the rating.

All three factors should be carefully taken care by you when you construct the rating scale.

Use of Rating Scale

Rating scales are used for testing the validity of many objective instruments like paper pencil inventories of personality. They are also advantages in the following fields like:

- Helpful in writing reports to parents.
- Helpful in filling out admission blanks for colleges.
- Helpful in finding out student needs.
- Making recommendations to employers.
- Supplementing other sources of understanding about the child.
- Stimulating effect upon the individuals who are rated.

4.6 ACTION RESEARCH

In schools, action research refers to a wide variety of evaluative, investigative, and analytical research methods designed to diagnose problems or weaknesses, whether organizational, academic, or instructional and help educators develop practical solutions to address them quickly and efficiently. Action research may also be applied to programs or educational techniques that are not necessarily experiencing any problems, but that educators simply want to learn more about and improve. The general goal is to create a simple, practical, repeatable process of iterative learning, evaluation, and improvement that leads to increasingly better results for schools, teachers, or programs. Action research may also be called a cycle of action or cycle of inquiry, since it typically follows a predefined process that is repeated over time. A simple illustrative example:

- Identify a problem to be studied
- Collect data on the problem
- Organize, analyze, and interpret the data
- Develop a plan to address the problem
- Implement the plan
- Evaluate the results of the actions taken
- Identify a new problem
- Repeat the process

Action research can be defined as “an approach in which the action researcher and a client collaborate in the diagnosis of the problem and in the development of a solution based on the diagnosis”. In other words, one of the main characteristic traits of action research relates to collaboration between researcher and member of organization in order to solve organizational problems. In general the person who is directly facing the problem will be taking up the research activity. Action study assumes social world to be constantly changing, both, researcher and research being one part of that change.

Action research creates knowledge based on enquiries conducted within specific and often practical contexts. As articulated earlier, the purpose of action research is to learn through action that then leads on to personal or professional development.

Steps of Action Research

The following are main steps in action research:

1. Identification of Problem

A teacher should be sensitive towards job activities. The problem is isolated from the broad field. The investigation must realize the seriousness of the problem. Identification of the problem is the first step in action research.

2. Defining and Delimiting the Problem

After identifying the problem, it should be defined so that action and goal may be specified. The delimitation means to localize the problem in terms of class subject, group and period in which a teacher perceives the problem.

3. Analyzing Causes of the Problem

The causes of the problem are analyzed with the help of some evidences. The nature of the causes is also analyzed whether it is under the control or beyond the control of the investigator. This helps in formulating the action hypothesis.

4. Formulating the Action Hypotheses

The bases for the formulation action - hypotheses are the causes of the problem which are under the approach of the investigator. The statement of action hypothesis consists of the two aspects: action and goal. It indicates that the action should be taken for achieving the goal.

5. Design for Testing the Action Hypothesis

A design is developed for testing the most important action-hypothesis. Some actions may be taken and their results are observed. If the hypothesis is not accepted second design is developed for testing another hypothesis. In action research one hypothesis is tested at a time. The design of action research is flexible and can be changed at any time according to the convenience of the researcher.

6. Conclusion of Action Research Project

Accepting or rejecting the action hypothesis leads to draw some conclusions. The statement of conclusion indicates some prescription for the practical problem of school or classroom. The conclusions are useful in modifying and improving the current practices of school and classroom teaching.

The National Council of Research and Training has been taken interest in the action research projects. The extension departments of NCERT have been conducting seminars and workshops for in service teachers for imparting knowledge and skill of action research projects.

4.7 RESEARCH IN TEACHING LEARNING ENVIRONMENT AND PROFESSIONAL COMPETENCIES FOR RESEARCH

Research-based teaching means that students carry out research in their courses independently and with an open outcome. Teaching and learning focuses on the joint acquisition of new knowledge by lecturers and students. This requires lecturers to reflect on their role as teachers and learners. Learning environment refers to the diverse physical locations, contexts, and

cultures in which students learn. This definition recognises that students learn in many different ways in very different contexts. The ideal classroom is a positive place where a student can come to work toward specific goals set before them in the class objectives. The teacher is to be positive, organized, outgoing, confident, and compassionate. The instructor often sets the tone for the entire classroom.

Learning Environment

room conditions, how they position themselves in the classroom, how they move through the classroom and how the teacher's body language, expressed therein, influences lessons. A second focus has been whether changes in classroom architecture

Learning environments are constituted by the mediated nature of the student-world relation (i.e., the primary relation) and the other possible mediated relations that set the context of the primary relation. For example, the relationship between student and teacher is mediated by pedagogy (tools) and also by the rules of interactions between them. 'Learning to speak out' would be a dimension of the 'rules' that mediate the relation between students (subject) and teachers (community). 'Learning to learn...' is a dimension of the mediation of the subject-community relation by pedagogy... 'Learning to communicate...' is a dimension of the relationship between students and other members of the class, that is, mediation via the rules. Hence, this approach to learning simultaneously takes account not just of different nested and hierarchical levels of environmental units

Activity theory allows us to frame the contradictions between being a teacher and being the object of research on teaching. In research on teaching, teachers and the learning environments of their classroom are the constituent *objects* of the research activity system. As objects (objectified subjects), they are made accessible to analysis in various forms of representation including questionnaires, scale scores, interview transcripts, and videotapes. (Teachers and other individuals often fear of becoming the 'lab rats' or 'guinea pigs' of social research.) Simultaneously, teachers experience themselves as the objectified subjects in research and as subjective actors in the teaching activity system. There is a fundamental contradiction between these two activity systems, which teachers often perceive as conflict-laden relationships between two types of experience.

Professional Competencies for Research

Teacher research is practical, action-based research. It enables educators to follow their interests and their needs as they investigate what they and their students do. Teachers who practice teacher research find that it expands and enriches their teaching skills and puts them in collaborative contact with peers that have a like interest in classroom research

Teacher-Researchers should do

Teacher-researchers simultaneously act as participants and observers as they conduct research in their own classrooms. With these dual roles, they complete the following tasks:

- Develop research questions based on their own curiosity about teaching and learning in their classrooms.
- Systematically collect data and research various methods of conducting research.
- Analyze and interpret the data and the research methodology.
- Write about their own research.
- Share findings with students, colleagues, and members of the educational community.
- Discuss with colleagues relationships among practice, theory, and their own research.
- Examine their underlying assumptions about teaching and learning.
- Assume responsibility for their own professional growth.

The Effects of Teacher Research

Teacher research can change a teacher's practice, but it can also have a profound effect on the development of priorities for school wide planning and assessment efforts as well as contribute to the profession's body of knowledge about teaching and learning.

Teacher-research projects often yield findings and implications that result in:

- Increased sharing and collaboration across departments, disciplines, and grade levels.
- Increased dialogue about instructional issues and student learning.
- Enhanced communication between teachers and students.
- Improved performance of students.
- Revision of practice based on new knowledge about teaching and learning.
- Teacher-designed and teacher-initiated staff development.
- Development of priorities for school wide planning and assessment efforts.
- Contributions to the profession's body of knowledge about teaching and learning.

Provides Support for Teacher Research

Teachers to become involved in teacher research, they need additional time and resources to conduct, evaluate, and share their findings in meaningful ways. Fortunately in my school district, Fairfax County Public Schools, we have a number of resources available for teachers wishing to become involved in teacher research. The office of staff development and Planning (a division of Instructional Services) supports a network of teacher-researchers within our school system. The office provides staff development funds to teams of teacher-researchers to meet periodically during the school year as they support one another in their research.

Competencies comprise of skills, attitudes and knowledge. It is often described with its related term 'Capacity' which means the ability to do certain thing. Professional Competency is a pivotal aspect of carrying out any research work. It is important due to the following aspects: Rigor, Genuineness, Authenticity and Utility pertaining to any research endeavour.

Research Competencies that are to be Mapped:

- i. Before the topic is finalized-critical review of literature is a pre requisite. Use of effective search strategies and evaluation of the related literature. Concept mapping of the work and framing research questions are equally important in this arena.

- ii. Before conducting the actual Research-Use of sound and consistent methods for appropriateness in a given study and data gathering activities. Development of appropriate instruments for effective investigation/research work. Another feature of an effective research skill comprises of identifying the points of triangulations in data collection.

- iii. During data Collection-Document related competencies with primary data collection including activities relating to data coding and data entry. Other general competencies include data management, interpersonal skills and project management.

- iv. During Data Analysis-utilizing appropriate data analysis techniques consistent with the purpose and design of the study. Interpret and synthesize the findings in the light of the existing literature and theoretical framework. Apart from these, it is desirable to identify relevance for practice and future research/investigation.

- v. During report Writing-Maintaining internal consistency through all the chapters of the research/investigation/project work/study. To be capable for writing for publications.

- vi. During defending the research work-The researcher/investigator should have a wholesome knowledge of his/her research work. S/he should be honest, fair, responsible and capable of judging his/her work.

Certain special competencies in case of collaborative, qualitative and mixed method designed researches are also required. These are:

- i. Creating a vision and setting goals
- ii. Delegating responsibilities
- iii. Reading between the lines
- iv. Deal with words
- v. Visual literacy
- vi. Merging of data
- vii. Identify the points of explanation and expansion

Check Your Progress

- 1. What is questionnaire?

- 2. Explain about rating scale?

4.8 SUMMARY

In this unit it is dealt with the different tools of research used in Behavioral Sciences/ Social Sciences. Education being a multidisciplinary subject shares a combination of different types of research tools used in behavioral sciences/social sciences. Tools like questionnaire, checklist, rating scale and tests are dealt intensely in this unit. Another important aspect of research is action research. It is also presented in this unit along with the steps involved in action research. In order to conduct an effective and purposeful research/investigation one has to have requisite professional competencies-before, during and after research work. This aspect also dealt with its reflections in Educational Research

4.9 CHECK YOUR PROGRESS: MODEL ANSWERS

1. A questionnaire is a research instrument consisting of a series of questions for the purpose of gathering information from respondents
2. A rating scale is a set of categories designed to elicit information about a quantitative or a qualitative attribute

4.10 MODEL EXAMINATION QUESTIONS

I Shot Questions

1. Explain about tools of research
2. How many types of tests?
3. What is check list?
4. Enlist any five professional competencies for research.

II Essay questions

5. Describe about the action research.
6. Write about research in teacher learning environment and professional competencies for research.

4.11 GLOSSARY

TOOLS- a device or implement

TESTS- a procedure intended to establish the quality, performance

ENVIRONMENT- the surroundings or conditions in which a person, animal, or plant lives or operates.

PROFESSIONAL- a person engaged or qualified in a profession

4.12 FURTHER READINGS

1. Carter, V. G., Barr, A. S., Scates, D.E., (1937). The Methodology of Educational Research. American Journal of Sociology 42 (6), p958.
2. Denscombe, M., (1999). "The Good Research Guide" Viva Books Private Limited, New Delhi <http://researchbasics.education.uconn.edu/types-of-research/>
3. Dharankar, M. (2014). Retrieved from CASE_2014_Madhavi_Dharankar_YCMOU_Nashik on 08/03/18
4. McAshan, H.H., (1963). Elements of Educational Research. McGraw-Hill, New York.
5. Siddhu, K. S., (1992). Methodology of Research in Education, Sterling Publisher, New Delhi.
6. Singh, Y. K., (2006). Fundamentals of Research Methodology and Statistics, New Age International Publishers, New Delhi, 1st Ed.
7. Wikipedia: https://en.wikipedia.org/wiki/Achievement_test
8. MacLean, Marion S. & Mohr, Marian M. (1999). *Teacher-researchers at work*. Berkeley, Calif.: National Writing Project.
9. Mills, Geoffrey (2002). *Action research: A guide for the teacher researcher*. Upper Saddle River, N.J.: Merrill Prentice Hall.

BLOCK-III MEASUREMENT AND ANALYSIS OF DATA

Unit -5 Scale for Measurement

Unit-6 Correlation

UNIT -5 SCALE FOR MEASUREMENT

Structure

- 5.1 Objectives
- 5.2 Introduction
- 5.3 Scale for Measurement
 - 5.3.1 Nominal
 - 5.3.2 Ordinal,
 - 5.3.3 Interval and
 - 5.3.4 Ratio
- 5.4 Organization of Data
 - 5.4.1 Array and Grouped Distribution,
- 5.5 Measures of Central Tendency and Dispersion
 - 5.5.1 Mean, Median and Mode, Standard, Deviation and Quartile Deviation
- 5.6 Summary
- 5.7 Check Your Progress: Model Answers
- 5.8 Model Examination Questions
- 5.9 Glossary
- 5.10 Further Readings

5.1 OBJECTIVES

After Studying this unit, you will be able to:

- to understand Scale for Measurement
- to know about Nominal, Ordinal, Interval and Ratio
- to describe organization of data
- to discussed about Array, Grouped distribution,
- to analysed Measures of central tendency and Dispersion: Mean, Median and Mode,
- Standard, deviation and Quartile deviation

5.2 INTRODUCTION

Scales of measurement refer to ways in which variables or numbers are defined and categorized. Each scale of measurement has certain property which in turn determines the appropriateness for use in certain statistical analyses. The four scales of measurement are nominal, ordinal, interval and ratio which are presented as a part of this unit. In research measurement is very important. Data are collected through measurement and then these data are arranged in a meaningful way. After that they are analysed properly using many statistical techniques to find out the results and to draw conclusions from it. In this unit we will discuss about the arrangement of data in order and also their presentation in frequency distribution table form which is also known as grouped data. Finally, it is also discussed about different

measures of central tendencies and dispersion which are commonly employed in analyzing research data.

5.3 SCALE FOR MEASUREMENT

Measurement scales are used to categorize and/or quantify variables. This section describes the four scales of measurement that are commonly used in statistical analysis: nominal, ordinal, interval and ratio scales.

5.3.1 Nominal Scale

The nominal scale of measurement only satisfies the identity property of measurement. Values assigned to variables represent a descriptive category, but have no inherent numerical value with respect to magnitude.

Gender is an example of a variable that is measured on a nominal scale. Individuals may be classified as "male" or "female", but neither value represents more or less "gender" than the other. Religion and political affiliation are other examples of variables that are normally measured on a nominal scale.

5.3.2 Ordinal Scale

The ordinal scale has the property of both identity and magnitude. Each value on the ordinal scale has a unique meaning and it has an ordered relationship to every other value on the scale.

An example of an ordinal scale in action would be the results of class students' achievement given in the form of rank obtained in the test. We know that the rank order shows the students performance in hierarch of performance. But it doesn't reveal the difference between ranks is narrow or broad. Further, there is no rule that the distance between any two ranks is equal. Thus the intervals between the ranks are not uniform.

5.3.2 Interval Scale

The interval scale of measurement has the properties of identity, magnitude, and equal intervals. A perfect example of an interval scale is the Fahrenheit scale to measure temperature. The scale is made up of equal temperature units, so that the difference between 40 and 50 degrees Fahrenheit is equal to the difference between 50 and 60 degrees Fahrenheit.

With an interval scale, you know not only whether different values are bigger or smaller, you also know *how much* bigger or smaller they are. For example, suppose it is 60 degrees Fahrenheit on Monday and 70 degrees on Tuesday. You know not only that it was hotter on Tuesday, you also know that it was 10 degrees hotter.

5.3.4 Ratio Scale of Measurement

The ratio scale of measurement satisfies all four of the properties of measurement: identity, magnitude, equal intervals, and a minimum value of zero.

The weight of an object would be an example of a ratio scale. Each value on the weight scale has a unique meaning, weights can be rank ordered, units along the weight scale are equal to one another, and the scale has a minimum value of zero.

Weight scales have a minimum value of zero because objects at rest can be weightless, but they cannot have negative weight

In summary, **nominal** variables are used to “*name*,” or label a series of values. **Ordinal** scales provide good information about the *order* of choices, such as in a customer satisfaction survey. **Interval** scales give us the order of values and the ability to quantify *the difference between each one*. Finally, **Ratio** scales give us the ultimate order, interval values, plus the *ability to calculate ratios* since a “true zero” can be defined.

5.4 ORGANIZATION OF DATA

Organization of data refers to the systematic arrangement of collected figures (raw data), so that the data becomes easy to understand and more convenient for further statistical treatment . Data organization, in broad terms, refers to the method of classifying and organizing data sets to make them more useful. In research we get data from different tests, experiments and Surveys. These data are mainly numerical. When these data are collected in original form, they have little meaning for the investigator. For interpretation of the data so collected and for deriving conclusions data, have to be organized or arranged in a Systematic way. There are many ways for the organisation of data. For example Array and Grouped distribution are discussed here under.

5.4.1 Array and Grouped Distribution

An **array** is a systematic arrangement of objects, usually in rows and columns. In the context of organization of research data array is simplest way. It involves arranging data in an order such as ascending or descending order. It is also known as ordering of the given data. Similarly arranging the raw scores in rows and columns for further data processing is a part of it. For example the marks obtained by 20 students are as follows:

58, 76, 94, 75, 86, 76, 69, 58, 67, 86, 74, 67 59, 47, 59, 60,67, 76, 89, 65 and 70.

The above data is known as raw scores or raw data. This data if not organized will not be much useful or meaningful. Hence, the simplest way of organizing this data is to order it.

Ascending order is to arrange the scores from minimum to maximum scores which will give ready information such as minimum marks and maximum marks obtained etc. Similarly the same data can be arranged in a table form for further analysis. However, if number of scores is large it is desirable to arrange data in to frequency distribution table which is known as grouped data.

Grouped Distribution

Grouped data are data formed by aggregating individual observations of a variable into groups, so that a frequency distribution of these groups serves as a convenient means of summarizing or analyzing the data. When dealing with large number of cases, especially when certain scores are shared by several persons, the arithmetic may be simplified by taking a frequency distribution rate. In dealing with a large number of scores, especially if the scores have an average, one may use a frequency table.

Frequency distribution may be considered as a method of presenting a collection of group of scores in such a way to show the frequency in each group of scores or class.

Tabulating Measures or Scores

Data collected from tests and experiments may be classified in a systematic manner according to the following steps:

- (a) **Determine the Range.** Range is the gap between the highest and the lowest scores. The range for 25 scores given in Table 1: $86 - 61 = 25$
- (b) **Number and size of the Grouping.** Settle upon the number and size of the grouping to be used in making a classification. Commonly used grouping intervals are 3, 5, 10 units in length. A good rule is to select by trial a grouping unit which will yield from 5 to 15 categories.
- (c) In the first column of Table 2, the class intervals have been listed serially from the smallest scores at the bottom of the column to the largest scores at the top.
- (d) **Tally the Scores.** Tally the scores in their proper intervals as shown in Table 2. In column 2 each score was taken from data given in Table 1 and a tally mark (/) is put in front of the class-interval where it is supposed to fall. Each tally represents one score. Four tallies when crossed by another tally represent five scores.
- (e) When all 25 scores have been listed, total number of tallies (*i.e.* the frequency) on each class-interval is written in column (3), headed frequencies.
- (f) The sum of frequencies is called N. When the total frequency, within each class interval, has been tabulated opposite the proper interval as shown in column (3), the 25 scores are arranged in a frequency distribution.

The Tabulation of Scores of 25 Students on an Achievement Test

Table 1: The original scores ungrouped.

72	77	72	67	75
81	65	73	*86	78
67	76	70	76	82
83	63	72	72	79
*61	84	64	69	76

* Highest score * Lowest score Range = 86 - 61 = 25

Table-2: The above 25 scores grouped into a frequency distribution.

Class Interval (1)	Tallies (2)	f (frequencies) (3)
84—87		1
81—84		3
78—81		2
75—78		5
72—75		5
69—72		2
66—69		3
63—66		2
60—63		2
		25

5.5 MEASURES OF CENTRAL TENDENCY AND DISPERSION

After the data is tabulated into a frequency distribution the next step before us is to know the *central position* of the measures. These central positions are known as the measures of central tendency.

According to **C.V. Good**, the tendency of the observations in a distribution to cluster about a point on a scale, is known as the central tendency. These measures are useful for two reasons:

- (1) They provide an average which represents all the scores made by a group and thus provide a precise description of the performance of the group as a whole.
- (2) They enable us to compare two or more groups as regarding their performance on a particular test of achievement/ability or personality.

Types of Measures of Central Tendency

There are three types of the measures of Central Tendency which are generally used in research. They are:

- (1) The Mean or Arithmetic Mean.

(2) The Median and

(3) The Mode.

5.5.1 Mean, Median and Mode, Standard, Deviation and Quartile Deviation

Mean

The Arithmetic Mean. The Arithmetic mean is shortly known as mean denoted by capital (M). It is the simplest measure of central tendency calculated by adding all the scores and dividing the sum by the number of scores.

Statistically Mean is defined as a point on the distribution on which or around which the maximum number of cases lie or tend to lie.

(i) Calculation of the Mean from the Ungrouped Data:

When the number of scores is less we calculate the mean by a very simple formula, i.e.,

$$M = \sum X / N$$

Where

M denotes the Mean

Sigma (\sum) denotes the sum of scores

X denotes the scores and

N denotes the number of scores.

This means that we add the scores and divide the sum by the number of scores. This will be clear from the example given below.

Example: A test of English Vocabulary was administered on a group of 15 students of VIII Class. The number of correct responses given by them is as follows.

8, 6, 11, 7, 18, 13, 9, 14, 12, 10, 9, 12, 7, 13, 16 Find out the mean of the correct responses?

Solution: First we add all the scores arithmetically and get:

$$\sum X = 8 + 6 + 11 + 7 + 18 + 13 + 9 + 14 + 12 + 10 + 9 + 12 + 7 + 13 + 16 = 155, N = 15$$

$$\text{Mean (M)} = \sum X / N = 155/15 = 10.33$$

Thus the mean of the above group on the above test is 10.33.

Therefore, the average of correct responses given by the group is 10.33.

Calculation of the Mean from the Group Data

When the obtained scores are grouped in a frequency distribution the mean is calculated in a slightly different manner. Two methods are adopted to calculate the mean from the grouped

data. They are:

1. Long Method
2. Short Method (Calculation of Mean from the Assumed Mean).

Long Method of Calculating Mean from Group Data

Problem: Calculate the mean from the following data:

Class Interval (C.I)	Frequency (f)	Mid-Points (x)	(fx)
52-55	1	53.5	53.5
48-51	0	49.5	00.0
44-47	5	45.5	227.5
40-43	10	41.5	415.0
36-39	20	37.5	750.0
32-35	12	33.5	402.0
28-31	8	29.5	236.0
24-27	2	25.5	51.0
20-23	3	21.5	64.5
16-19	4	17.5	70.0
N = 65			$\Sigma fx = 2269.5$

The first step in this method is to calculate the mid-points of all the class intervals which are denoted by x . In the *next* step we multiply the x 's with the frequencies given in second column, corresponding mid- point in column three, and thus obtain the fx in col. IV. In the *third* step we add all these values in col. IV and thus obtain the value of Σfx .

Now we apply the formula for getting the value of Mean which for long method is as below:

$$M = \frac{\Sigma fx}{N}$$

By substituting the values from the table above, we get :

$$M = 2269.5 / 65 = 34.9$$

Therefore , the Mean value of given data is 34.9.

Short Method of Calculating Mean

In the long method of calculating mean, we have to follow a long process of multiplications and additions. Thus it proves a difficult task. To reduce these complications the statisticians have derived a short method of calculating mean. In this method, middle value of some class interval is assumed as mean, which is denoted by A.M. (Assumed Mean). There is no strict rule for this assumption but generally the Assumed Mean is taken in the middle of the distribution or the mid-point of the class interval which has the highest number of frequencies.

The method of calculating mean from the assumed mean is described below:

(C.I)	(f)	(X)	x	(fx)
Class intervals	frequency	Mid-point	Derivatives	(frequency X derivatives)
52-55	1	53.5	+ 4	4
48-51	0	49.5	+ 3	0
44-47	5	45.5	+ 2	10
40-43	10	41.5	+ 1	10
36-39	20	37.5	0	0
32-35	12	33.5	-1	-12
28-31	8	29.5	-2	-16
24-27	2	25.5	-3	- 6
20-23	3	21.5	-4	-12
16-19	4	17.5	-5	-20
	N = 65			- 42

$$\sum fx = - 42$$

$$\text{A.M.} = 37.5$$

Formula for calculating Mean from the assumed mean is:

$$M = \text{A.M.} + C \times i$$

where, A.M. = Assumed Mean, C = Correction and i = length of the class interval.

Now formula for finding out the value of correction (C) is:

$$\text{Correction (C)} = \frac{\sum fx}{N}$$

Substituting the values in the formula, we get

$$M = 37.5 + (-42/65) \times 4 = 37.5 - 2.60 = 34.9$$

In this method, if we see the table above, first three columns are the same as in the long method, the fourth column is changed. In this column we have taken the deviations of the class scores from the assumed mean, which is taken as the mid-point of the interval 36-39, *i.e.* 37.5. This class interval is almost in the middle of the distribution and hence Assumed Mean is 0 (zero). The next mid-point of 41.5 is having a deviation of + 1 as it is at a distance of one unit from the A.M. on the upper side and the mid-point of 33.5 has a deviation of -1 as it is at a distance of one unit on the lower.

Similarly the other deviations of + 2, +3, + 4 and - 2, - 3, - 4, - 5, are taken. Then the product of *fx* is taken in the fifth column and $\sum fx$ is calculated and by applying the formula discussed above the value of mean is calculated.

Median

Median is the middle most score of the given data when scores are arranged in order. When the scores are arranged in either ascending or descending order the median is exactly the central point

of that series. It divides the series into two equal parts. Exactly half of the cases fall below this point and the other half above it.

The formula for finding the Median of ungrouped data is $((N + 1) / 2)^{\text{th}}$ measure in order of size, if number of scores (N) is odd number. In case N is even number then the Median is the average of the two middle most scores after arranging the scores in order.

For example the median of 7, 11, 17, 12, 8, 14, 19, 16, 20?

Arranging the scores in order: 7, 8, 11, 12, 14, 16, 17, 19, 20

Median is $((9+1) / 2)^{\text{th}}$ score i.e. $10/2^{\text{th}} = 5^{\text{th}}$ score 14 is the median. Note that the scores must be arranged in order before tracing median.

Calculation of Median for the Grouped Data

When the scores are grouped into a frequency distribution the median defined as 50%*th* point in the distribution. The formula for finding out the median from the grouped data is:

$$\text{Median} = l + \left(\frac{N/2 - F}{fm} \right) \times i$$

where l = lower limit of the class interval in which the median lies.

$N/2$ = one half of the total number of scores.

F = Sum of total scores below l .

fm = Number of frequencies within the class interval in which the median lies.

i = length of the class interval.

To illustrate the use of the formula an example is solved below :

<i>CI</i> (Class Interval)	<i>f</i> (frequency)	<i>Cum f</i> (Cumulative frequency)
52-55	1	65
48-51	0	64
44-47	5	64
40-43	10	59
<hr/>		
<u>l 36-39 Mdn Class</u>	20 fm	49
32-35	12	29 F
28-31	8	17
24-27	2	9
20-23	3	7
16-19	4	4
	N = 65	

$$N / 2 = 32.5$$

As we see the 32.5th frequency of the total distribution is complete at a point which lies somewhere in the class interval of 36 to 39. This class interval is assumed as containing the Median (Median class).

Now by applying the formula, we get:

$$\text{Median} = l + \left(\frac{N/2 - F}{fm} \right) \times i$$

Where $l = 35.5$, *i.e.* the lower limit of the class interval in which the median lies.

$N/2 = 32.5$, $F = 29$, *i.e.*, total frequencies below the class interval in which the median lies.

$fm = 20$, *i.e.* number of frequencies with the class interval in which the median lies.

$i = 4$, *i.e.*, the length of the class interval.

Let us substitute these values in the median formula:

$$\begin{aligned} \text{Median} &= 35.5 + \left(\frac{32.5 - 29}{20} \right) \times 4 \\ &= 35.5 + (3.5 / 20) \times 4 \\ &= 32.5 + 1.75 \times 4 \\ &= 32.5 + 7 \\ &= 39.5 \end{aligned}$$

Therefore Median of given data is 39.5

Mode

In a simple ungrouped series of scores the ‘crude’ or empirical mode is that single score which occurs maximum number of times, *e.g.*, in the series, 7, 8, 8, 9, 10, 10, 11, 11, 12, 13, 13, 10 the most frequently occurring score is 10. Therefore, 10, will be the crude mode. If two or more number of scores are occurring equal number of times all those scores are considered as mode values of the data.

When the data is grouped into a frequency distribution the mode is generally taken as the mid-point of the class interval which contains largest frequency. However, in calculating mode from a frequency distribution we differentiate between true mode and crude mode. The True Mode is the point of greatest concentration in the distribution the formula for calculating the true mode is :

$$\text{Mode} = 3 \text{ Median} - 2 \text{ Mean.}$$

Mode of grouped data can be calculated using the following formula, when the data is grouped into a frequency distribution:

$$\text{Mode} = l + \frac{(f - f_1)}{(f - f_1) + (f - f_2)}$$

Where l = lower limit of Mode class (Class interval having highest frequency)

f = Frequency of mode class.

f_1 = Frequency of class interval preceding mode class.

f_2 = Frequency of class interval following mode class.

Importance of the various measures of Central Tendency:

Mean:

1. It provides the best estimate of average.
2. It makes the comparison of two different groups easy.
3. It is a more reliable measure in comparison to other measures of central tendency.

Median:

1. It is easy to understand and thus can be utilised easily.
2. It is more useful when there are extreme deviations of the scores.

Mode:

1. It is most easy to determine.
2. It gives the quick estimate of central tendency.

Measures of Dispersion

If we want to compare two different distributions on the basis of their means we shall not be able to make any accurate judgment, as the two distributions may have the same central tendencies, but they may cover wide areas. For example two samples of 50 may have their means as 37.5 each, but sample (A) may have its scores ranging from 15-65 and simple (B) may have scores ranging from 23 to 58. Now, if we judge them on the basis of mean we can say that both the groups are of same ability. But when we see the range of scores we find that group, (B) is definitely better than group (A), as the range of group (B) is shorter than the range of group (A) which shows that the group (B) is more homogeneous than group (A). Most of its members have the same ability.

Hence to know more accurately about the abilities of two different groups on a certain test, we must know the spread of their scores. The statisticians have derived different measures to give us the indices of spread of scores in a distribution. These measures are known as the *Measures of Variability* or Measures of dispersion.

There are four different Measures of dispersion, which are given below :

1. Range,
2. Quartile Deviation,
3. Average Deviation and
4. Standard Deviation

Range

Range may be defined simply as the interval between the highest and the lowest scores of the distribution. It is the simplest measure of dispersion which gives us a rough estimate of the spread of scores. Because this measure takes account of extreme scores it is not more reliable in such cases where N is very small or large gaps are present. Another two measures of dispersion which are used commonly in educational research are discussed hereunder.

Quartile Deviation

The quartile deviation which is denoted by ' Q ' is the one half of the scale distance between the 75th and 25th percentiles in a frequency distribution. The 25th percentile or first quartile or is the point on the scale below which the 25% of the cases lie and 75th percentile or third quartile or ' Q_3 ' is the point below which the 75% of cases lie. These two points are calculated almost in the same manner as the median (which is the 50th percentile) of the distribution.

$$\text{The Quartile Deviation (Q.D.)} = \frac{Q_3 - Q_1}{2}$$

Where Q_1 is first quartile and Q_3 is third quartile.

The values of Q_1 and Q_3 can be calculated by using the following formulas in similar manner to that of the median.

$$Q_1 = l_1 + \left(\frac{N/4 - F_1}{f_1} \right) \times i$$

Where l_1 the lower limit of the class interval in which the Q_1 lies.

F_1 = total frequencies below the class interval in which the Q_1 lies.

f_1 = number of frequencies with the class interval in which the Q_1 lies.

i = the length of the class interval.

$$Q_3 = l_3 + \left(\frac{3N/4 - F_3}{f_3} \right) \times i$$

Where l_3 the lower limit of the class interval in which the Q_3 lies.

F_3 = total frequencies below the class interval in which the Q_3 lies.

f_3 = number of frequencies with the class interval in which the Q_3 lies.

i = the length of the class interval.

Standard Deviation

The standard deviation is defined as *the square root of the mean of the squared deviations taken from the mean of the distribution*. The standard deviation or S.D. is the most stable measure of dispersion and is frequently employed in research work. Deviations in calculating S.D. are always taken from Mean and never from Median or Mode.

Calculation of S.D. from Ungrouped Data

Example: Calculate standard deviation of students of 7th class science subject whose marks are : 4, 6, 8, 10, 12, 14 and 16.

Sol: Formula to calculate standard deviation for ungrouped data is $\sqrt{\sum x^2/N}$

Where x is the deviation of scores from its average ($X - M$) and N is number of scores.

For the given data Average or Mean (M) = $(4 + 6 + 8 + 10 + 12 + 14 + 16) / 7 = 70/7 = 10$

$$\begin{aligned}\sum x^2 &= (4-10)^2 + (6-10)^2 + (8-10)^2 + (10-10)^2 + (12-10)^2 + (14-10)^2 + (16-10)^2 \\ &= (-6)^2 + (-4)^2 + (-2)^2 + (0)^2 + (2)^2 + (4)^2 + (6)^2 \\ &= 36 + 16 + 4 + 0 + 4 + 16 + 36 = 112\end{aligned}$$

$$\text{Therefore S. D.} = \sqrt{\sum x^2/N} = \sqrt{112/7} = \sqrt{16} = 4$$

Calculation of S.D. from Grouped Data

The only difference, in calculating S.D. from the grouped data, by long method is that here the deviations are taken from the actual mean, whereas in short method deviations were taken from the assumed mean. Let us see it with the help of an example below.

<i>I Class Interval</i>	<i>II f</i>	<i>III x</i>	<i>IV d = x - AM</i>	<i>V fd</i>	<i>VI fd²</i>
52-55	1	53.5	18.6	18.6	345.96
48-51	0	49.5	14.6	0.0	00.00
44-47	5	45.5	10.6	53.0	561.8
40-43	10	41.5	10.6	66.0	435.60
36-39	20	37.5	2.6	52.0	135.20
32-35	12	33.5	-1.4	-16.8	23.52
28-31	8	29.5	-5.4	-43.2	233.28
24-27	2	25.5	-9.4	-18.8	176.72
20-23	3	21.5	-13.4	-40.2	538.68
16-19	4	17.5	-17.4	-69.6	1211.04
	N = 65				$\sum fd^2 = 3661.8$

Mean (A.M.) of the above data is 34.9 (which can be calculated as done previously for grouped data).

$$\text{Formula to calculate S.D.} = \sqrt{\sum fd^2/N}$$

Where f = frequency of the class interval

d = deviation of class mid value (x) from its A.M. ($x - A.M.$)

N = Sum of frequencies.

$$\text{Therefore S. D.} = \sqrt{3661.8 / 65} = \sqrt{56.3} = 7.5$$

When to use the various measures of dispersion?

1. Use of Range:

- (a) When data are too scattered or too much concentrated so as to justify the computation of a more exact measure.
- (b) When the knowledge of total spread is only requirements.

2. Use of Q.D.:

- (a) When the median is the measure of Central Tendency.
- (b) When scores are so spread to influence the S.D. disproportionately.
- (c) When the concentration around the median is the basic interest.

3. Use of S.D.:

- (a) When data is normal.
- (b) When Mean is computed as a central tendency.
- (c) When more accuracy and stability is required.

Check Your Progress

1. What are different scales of measurement?

2. What are measures of central tendencies?

5.6 SUMMARY

This unit deal with scales for measurement as a part of measurement and analysis of educational data. There are four scales of measurement e.g. nominal, ordinal, interval and ratio. Ratio scale is the highest level of measurement whereas nominal scale is the simplest type of scale of measurement. Interval scale has no true zero and the data collected in many experiments of education fall under this scale. Data in the field of education and psychology are mostly numerical and for interpretation of the data their organisation is necessary. Data can be organised in many ways like rank order, frequency distribution etc. For the interpretation of data we have to know the central tendency of data. For this purpose we measure Mean, Median and Mode. These central tendencies provide us a central value of a set of scores as a whole but do not show how the individual scores are spread out. The tendency of the scores to deviate from average value is known as dispersion. There are mainly four measures of dispersion namely range, average deviation, quartile deviation and standard deviation. The Range, quartile deviation and standard deviation are discussed with examples.

5.7 CHECK YOUR PROGRESS: MODEL ANSWERS

1. The Four Scales of Measurement. Data can be classified as being on one of four scales: nominal, ordinal, interval or ratio. Each level of measurement has some important properties that are useful to know. For example, only the ratio scale has meaningful zeros
2. In statistics, a central tendency is a central or typical value for a probability distribution. It may also be called a centre or location of the distribution. Colloquially, measures of central tendency are often called averages.

5.8 MODEL EXAMINATION QUESTIONS

I Short Questions

1. What is Nominal Scale?
2. How to calculate Median for ungrouped data?
3. What are different scales of measurement?

II Essay Questions

4. What do you mean by measures of dispersion? When to use various measures of dispersion?
5. Explain how to calculate Mean for ungrouped data with an example.
6. What are measures of central tendencies? Explain the importance of various measures of central tendencies.

5.9 GLOSSARY

MEASUREMENT- the size, length

DATA- facts and statistics collected together for reference or analysis

5.10 FURTHER READINGS

1. Garrett, H.E. (1988). Statistics in Psychology and Education, Mc Graw Hill: Tokyo.
2. <https://www.mymarketresearchmethods.com/types-of-data-nominal-ordinal-interval-ratio/>
3. <https://stattrek.com/statistics/measurement-scales.aspx>
4. https://en.wikipedia.org/wiki/Grouped_data
5. Mangal, S.K. (2006). Statistics in Psychology and Education, Prentice Hall of India Pvt. Ltd. New Delhi.
7. Ferguson, G.A. (1980). Statistical Analysis in Psychology and Education, Mc Grow Hill Book Company : New York.
8. Sharma, R.A. (1988). Statistics in Education, Loyal Book Depot, Meerut.

UNIT-6 CORRELATION

Structure

- 6.1 Objectives
- 6.2 Introduction
- 6.3 Correlation
- 6.4 Product Moment and Rank Order Correlation
- 6.5 Graphic Representation of Data
- 6.6 Summary
- 6.7 Check Your Progress: Model Answers
- 6.8 Model Examination Questions
- 6.9 Glossary
- 6.10 Further Readings

6.1 OBJECTIVES

After Studying this unit, you will be able to:

- to understand Correlation
- to know about Product Moment and Rank Order Correlation
- to describe Graphic representation of Data

6.2 INTRODUCTION

Till now we have been discussing mainly such statistical computations, which represent the performance of an individual or of a group in a particular trait. But, it is considered more important to examine relationship of one variable to another along with measuring performance in each trait independently. Certain abilities are closely related, while certain others are relatively independent, for example we may be interested in knowing “how for the general intelligence of children affect their performance in the different school subjects”. For this we may try to find out correlations (relationship) between their scores on an intelligence test and their marks in the school examination. In this unit we will discuss about correlation methods and rank correlation method of calculating the correlation coefficient. Similarly graphical representation of data is helpful for understanding the data clearly and to compare the data. Commonly used graphical representation of data are also discussed in this unit with relevant graphs.

6.3 CORRELATION

Relationship between different variables which indicates correlation may be positive, zero, or negative. If the correlation is positive we say that individual getting high scores in one test is likely to get high score in the second. If the correlation is negative we say that individual getting high score in one test is likely to get low score in the second test. If the correlation is zero, which means the two variables are independent of each other and the score in one test will have no relation to that of the score in other test.

The coefficient of correlation may range from -1 through zero to +1. If the value of the coefficient of correlation comes to be -1 that shows the perfect negative relationship. If it is zero it mean no relationship at all. And if it is +1 it means that perfect positive relationship. However, in practical statistical computations any type of perfect relationship is not possible. The value generally falls somewhere in between -1 and +1.

6.4 PRODUCT MOMENT AND RANK ORDER CORRELATION

The correlation coefficient is of great value to research as a measure of relationship between test scores and other measures. So the statisticians have designed various methods of calculating the (r) coefficient of correlation for different kinds of data. The Product movement method and the Rank correlation Methods are most commonly used methods to calculate correlation coefficient. But many times it happens that the investigator does not have scores and must work with data in which difference can be expressed in ranks only or by classifying individual scores into of the several categories. Sometimes the relationship between two measures is non-linear and cannot be described by the product moment correlation. In such cases the method of Rank order correlation is employed.

Rank order or rank difference method of correlation takes account only of the position of the items in the series and do not consider gaps between adjacent scores. For example individuals who scores 65,64,63,52 will be ranked 1, 2, 3 and 4 although the difference between first three score is of 1 each of fourth from third is of 11. Therefore, accuracy may be lost in changing the scores into ranks, especially when there are number of ties. Even after such mathematical disadvantages, the rank order correlation rho (ρ) provides a quick and convenient estimate of correlation when the number of scores is less in number, say below 25 or when we only have ranks.

Calculation of Ranks Difference Correlation or Rho (ρ)

While calculating the rho (ρ) we first have two sets of scores and rank them either in ascending or descending order (generally we use descending order of merit). Then the next step is to take the difference (D) between the two ranks ($D=R_1 - R_2$). After this we take the squares of all the ranks differences and they are summed^{to} get $\sum D^2$. Then we find out the row (ρ) by applying the following formula:

$$\rho = 1 - [6 \sum D^2 / N (N^2 - 1)]$$

The method will be more clear from the example solved below:

Example 1: A group of 8th class children were given a test of achievement in English and Hindi. Their scores were as given below. Find out if the achievement in Hindi has any relation with that of their achievement in English.

Scores in English	Scores in Hindi	R ₁	R ₂	D=(R ₁ -R ₂)	D ²
8	6	6	8	-2	4
10	9	4	5	-1	1
6	5	8	9	-1	1
11	12	3	2	1	1
9	11	5	3	2	4
4	4	10	10	0	0
7	7	7	7	0	0
12	10	2	4	-2	4
5	8	9	6	3	9
13	13	1	1	0	0
N = 10					$\sum D^2 = 24$

$$\text{The rank correlation coefficient } (\rho) = 1 - [6 \times 24 / 10 (10^2 - 1)]$$

$$= 1 - [144 / 10 (100 - 1)]$$

$$= 1 - [144 / 10 (99)]$$

$$= 1 - [144 / 990]$$

$$= 1 - 0.14$$

$$= 0.86$$

The coefficient of correlation (ρ) for the above sets of scores is 0.86, which is very high and positive. This shows that the achievement in Hindi have a very close relation with achievement in English. A child who scores high in Hindi is likely to scores high in English.

Normally if the coefficient of correlation (ρ) value is less than 0.2 it is interpreted as no significant correlation, from 0.2 to less than 0.4 is slight correlation, 0.4 to less than 0.7 is high correlation and more than 0.7 is regarded as very high correlation. Further, it is to be noted if the ρ value is negative it must be interpreted as negative correlation. For example if $\rho = -0.56$ it indicates high negative correlation.

6.5 GRAPHIC REPRESENTATION OF DATA

Graphical Representation is a way of analyzing numerical data. It exhibits the relation between data, ideas, information and concepts in a diagram. It is easy to understand and it is one of the most important learning strategies. It always depends on the type of information in a particular domain. There are different types of graphical representation. There are four important methods of representing a frequency distribution graphically:

1. Frequency polygon
2. Histogram or Column diagram
3. Cumulative frequency graph
4. Cumulative frequency percentage curve or O give.

1. Frequency Polygon

A frequency polygon is a line graph representing the data. The score values are measured along the X-axis and the frequencies along Y-axis. The exact limits of the class interval are laid off at regular distances along the base-line from the origin and the frequencies against each interval are measured upon the Y-axis. The units are selected carefully to make the frequency polygon balanced and symmetrical. The general rule is to select X- and Y- units which will make the height of the figure approximately 75% of its width. The ratio of height to width may vary from 60-80% and the figures still have good proportions but it can rarely go below 50% and leave the figure well-balanced.

Example. Draw a frequency polygon for the following distribution of 50 Alpha scores.

Table -1: Alpha scores made by 50 college students.

Class intervals (CI)	Frequency (f)	Mid values
195—200	1	197.5
190—195	2	192.5
185—190	4	187.5
180—185	5	175
175—180	8	172.5
170—175	10	167.5
165—170	6	162.5
160—165	4	157.5
155—160	4	152.5
150—155	2	145
145—150	3	142.5
140—145	1	137.5
	N = 50	

The following diagram will be obtained by drawing a frequency polygon by joining the points marked by taking class mid value on X- axis and corresponding frequency on Y- axis.

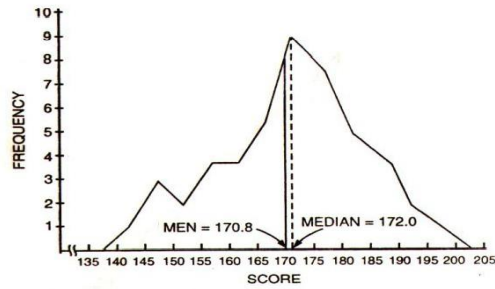


Figure- 1 : Frequency polygon

2. Histogram or Column Diagram

A Histogram is essentially a bar graph of a frequency distribution. In a frequency polygon all the scores within a given interval are represented by the mid-point of that interval while in a histogram the essential point is that scores are spread uniformly over their intervals. The measures within each interval of a histogram are represented by a right angle, the base of which equals the interval and the height of which equals the number of scores, that is, frequency within the interval. The following is histogram drawn for the data given in Table – 1.

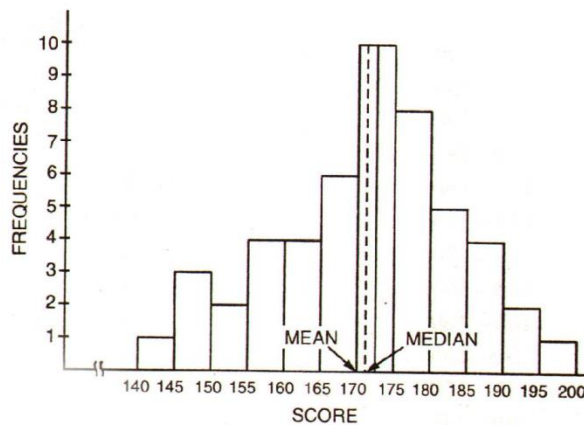


Figure- 2: Histogram

3. Cumulative Frequency Curve

A curve representing accumulated frequency is usually termed as Cumulative Frequency Curve. A ‘cumulative frequency’ is defined as frequencies accumulated progressively from the bottom of the distribution upwards. To illustrate this, we can take the following scores from Table- 2.

Table-2: Number of tender age wise.

Ages	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20
No. of Tenders	2	5	12	10	3

To construct the cumulative frequency curve lets prepare frequency table with cumulative frequencies. Mark points taking class upper limit on X- axis and cumulative frequency on Y- axis. By joining the points we get cumulative frequency curve. By calculating cumulative frequency the following table is obtained:

CI	No. of Tenders	Upper Bonding	Cumulating Frequency
0 - 4	2	4	2
4 - 8	5	8	$2 + 5 = 7$
8 - 12	12	12	$2+5+12 = 19$
12 - 16	10	16	$2+5+12+10=29$
16 - 20	3	20	$2+5+12+10+3=32$

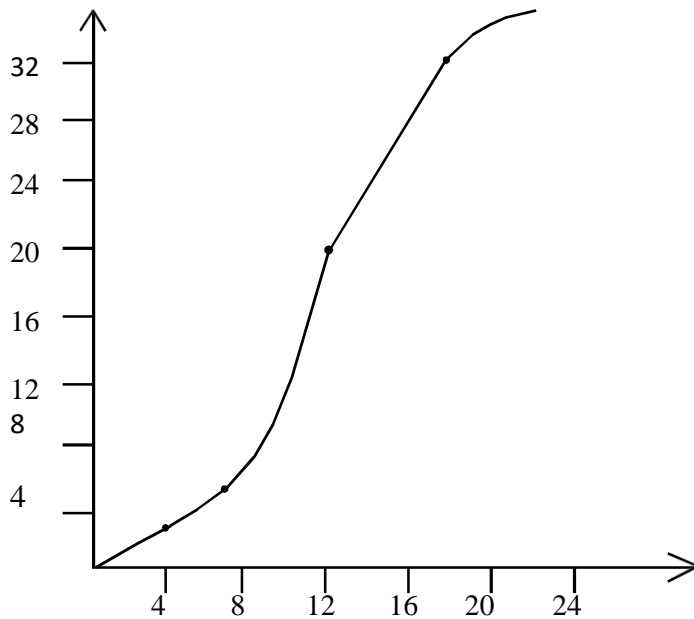


Figure- 3 : Cumulative Frequency Curve drawn for data given in table- 2.

O give

O give or cumulative percentage curve differs from the cumulative frequency curve in that frequencies are expressed as cumulative percents of frequency on the X-axis. In the following table -3 cumulative frequencies have also been expressed into cumulative percents.

The procedure for plotting O give is exactly similar to that for plotting cumulative frequency curve. In case of O give, instead of cumulative frequencies, the percentages of cumulative frequencies are plotted on the upper exact limits of each class interval.

Table - 3

Class Intervals	Upper Exact limits	f	cf	%age cf
41 - 43	43.5	1	86	100.0
38 - 40	40.5	4	85	98.8
35 - 37	37.5	5	81	94.2
32 - 34	34.5	8	76	88.4
29 - 31	31.5	14	68	79.1

26 - 28	28.5	17	54	62.8
23 - 25	25.5	9	37	43.0
20 - 22	22.5	13	28	32.6
17 - 19	19.5	8	15	17.4
14 - 16	16.5	3	7	8.1
11 - 13	13.5	4	4	4.7
8 - 10	10.5	0	0	0.0

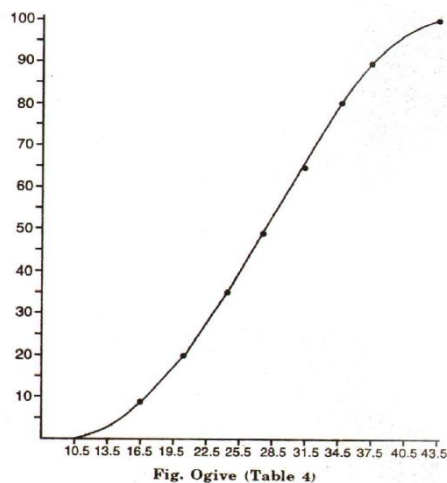


Fig. Ogive (Table 4)

Figure- 4: O give (Cumulative Percentage Curve) drawn for data given in table- 2.

Further, bar diagram and pie chart are also very commonly used to represent data for analysis.

Bar diagram

A bar graph (also known as a bar chart or bar diagram) is a visual tool that uses bars to compare data among categories. A bar graph may run horizontally or vertically. The important thing to know is that the longer the bar, the greater its value.

A bar graph shows comparisons among discrete categories. One axis of the chart shows the specific categories being compared, and the other axis represents a measured value. Some bar graphs present bars clustered in groups of more than one, showing the values of more than one measured variable.

Steps in construction of bar graphs/column graph:

1. On a graph, draw two lines perpendicular to each other, intersecting at 0.
2. The horizontal line is x-axis and vertical line is y-axis.
3. Along the horizontal axis, choose the uniform width of bars and uniform gap between the bars and write the names of the data items whose values are to be marked.
4. Along the vertical axis, choose a suitable scale in order to determine the heights of the bars for the given values. (Frequency is taken along y-axis).
5. Calculate the heights of the bars according to the scale chosen and draw the bars.

For example draw bar diagram for the following data:

Ages	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20
No. of Children	2	5	12	10	3

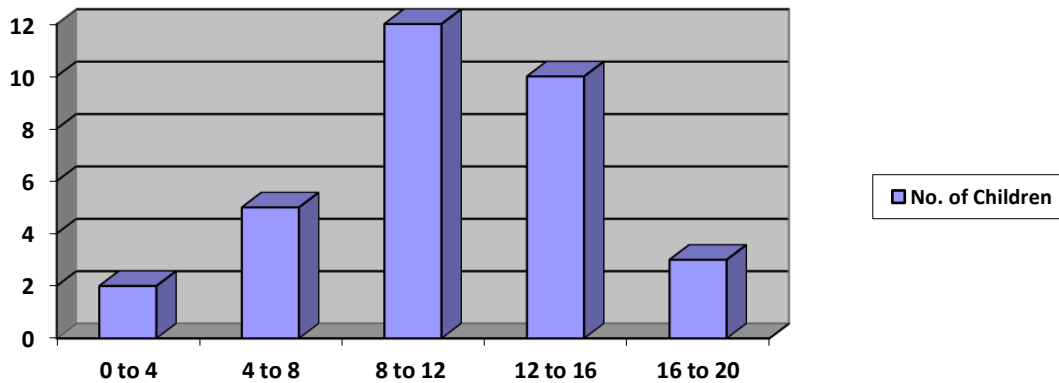


Figure- 5: Bar diagram showing number of children by their age group.

Pie Chart

A pie chart (or a circle chart) is a circular statistical graph, which is divided into sectors (slices) to illustrate numerical proportion. In a pie chart, the arc length of each slice (and consequently its central angle and area), is proportional to the quantity it represents. For example represent the following data in pie chart.

Steps to Draw a Pie chart: Following steps can be followed to draw pie chart manually.

1. Add all values of different components given to show in Pie diagram.
2. Calculate the sector angle of each component by using the following formula:

$$\text{Sector angle of a component} = \frac{\text{Component value}}{\text{Total components value}} \times 360^\circ$$

3. Draw a circle and mark a radius.
4. From the radius draw the sectors with obtained angle for each component.
5. Label the sectors and name the Pie chart appropriately.

Example: Expenses of a family on various items are given; show the data in a pie chart.

Item	Food	Travel	Health	Others	Savings
Expenditure%	20	15	20	25	20

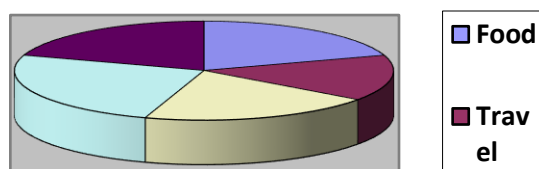


Figure- 6: Pie chart showing the expenses of a family on various items.

Check Your Progress

1. What is the meaning by correlation?

.....

2. What is frequency polygon?

.....

6.6 SUMMARY

In this unit we have how to find out relationship of one variable to another along with measuring performance in each trait independently. In view of this we have discussed about correlation methods and rank correlation method of calculating the correlation coefficient. Relationship between different variables which indicates correlation may be positive, zero, or negative. If the correlation is positive we say that individual getting high scores in one test is likely to get high score in the second. If the correlation is negative we say that individual getting high score in one test is likely to get low score in the second test. If the correlation is zero, which means the two variables are independent of each other and the score in one test

will have no relation to that of the score in other test.

Similarly graphical representation of data is helpful for understanding the data clearly and to compare the data. Graphical Representation is a way of analyzing numerical data. It exhibits the relation between data, ideas, information and concepts in a diagram. It is easy to understand and it is one of the most important learning strategies. It always depends on the type of information in a particular domain. Commonly used graphical representation of data is also discussed in this unit with relevant graphs.

6.7 CHECK YOUR PROGRESS: MODEL ANSWERS

1. Correlation is a term that is a measure of the strength of a linear relationship between two quantitative variables (e.g., height, weight). Positive correlation is a relationship between two variables in which both variables move in the same direction
2. Frequency polygons are a graphical device for understanding the shapes of distributions. They serve the same purpose as histograms, but are especially helpful for comparing sets of data. Frequency polygons are also a good choice for displaying cumulative frequency distributions.

6.8 MODEL EXAMINATION QUESTIONS

I Short Questions

1. What is frequency polygon?
2. What is bar diagram?
3. What is Pie chart?

II Essay Questions

4. How graphical representation of data does is useful in data presentation? Explain with an example.
5. What is frequency polygon? Explain with a diagram.
6. What do you mean by correlation? Explain the method of calculating rank correlation Coefficient with an example.

6.9 GLOSSARY

CORRELATION- a mutual relationship or connection between two or more things.

FREQUENCY- the rate at which something occurs over a particular period of time

DIAGRAM- represent (something) in graphic form.

6.10 FURTHER READINGS

1. Garrett, H.E. (1988). Statistics in Psychology and Education, Mc Graw Hill: Tokyo.
2. <https://www.mymarketresearchmethods.com/types-of-data-nominal-ordinal-interval-ratio/>
3. <https://stattrek.com/statistics/measurement-scales.aspx>
4. https://en.wikipedia.org/wiki/Grouped_data
5. Mangal, S.K. (2006). Statistics in Psychology and Education, Prentice Hall of India Pvt. Ltd. New Delhi.
6. Ferguson, G.A. (1980). Statistical Analysis in Psychology and Education, Mc Grow Hill Book Company : New York.
7. Sharma, R.A. (1988). Statistics in Education, Loyal Book Depot, Meerut.
8. Yakaiah, P. & Bhatia, K.K. (2003). Introduction to Educational Psychology, Ludhiana: Kalyani Publishers.

B.Ed.SE-D19 -V SEMESTER (NEW) EXAMINATION
Course: B.Ed.SE-D19 BASIC RESEARCH AND STATISTICS

Time: 1 ½ Hours

Max. Marks: 40

Mini. Marks: 16

Section -I

[Marks: 4 x 5 = 20]

Instructions to the Candidates:

- a) Answer any four of the following questions
- b) Each question carries 5 marks

1. Explain what is Educational research?
2. How to calculate Median for ungrouped data?
3. Discuss about research in special education.
4. What is the meaning by correlation?
5. What is frequency polygon?

Section -II

[Marks: 1 x 20 = 20]

Instructions to the Candidates

- a) Answer any one of the following questions
- b) Each question carries 20 marks

6. What are the methods of Research? Explain.
7. What are measures of central tendencies? Explain the importance of various measures of central tendencies