

Research Methodology

MEANING OF RESEARCH

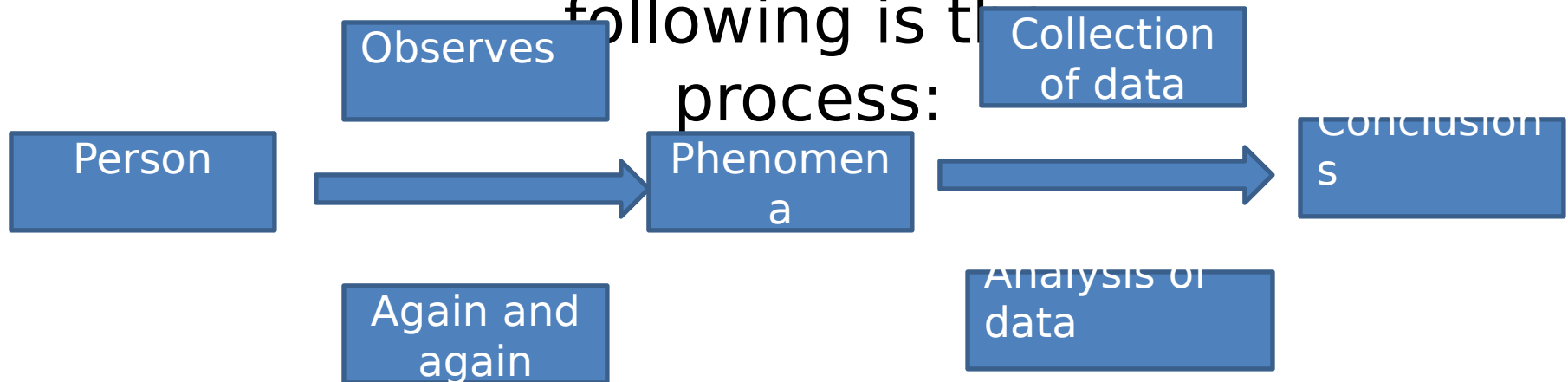
The term 'Research' consists of two words:

Research = Re + Search

'Re' means again and again and

'Search' means to find out something, the

following is the
process:



Research is refers to a **search** for knowledge.

Once can also define research as a **scientific and systematic** search for **relevant** information on a specific topic.

In fact, research is an **art of scientific** investigation.

The Advanced Learner's Dictionary of Current English meaning of research as “a **careful investigation or inquiry specially through** search for **new facts** in any branch of knowledge.”

Redman and Mory define research as a “**systematized effort to gain new knowledge.**”

Some people consider research as a **movement**

According to **Clifford Woody** research comprises **defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions;** and at last **carefully testing the conclusions to determine whether they fit the formulating hypothesis.**

In the Encyclopedia of Social Sciences define research as “**the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art.**”

It is the **pursuit of truth with the help of study, observation, comparison and experiment.** In short, the search for knowledge through **objective and systematic method** of finding solution to a

As such 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 up to reaching certain conclusions either in the form of solutions towards the concerned problem

OBJECTIVES OF 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**. RO as diminishing into a number of following broad grouping

1. To gain familiarity with a **phenomenon** or to **achieve new insights** into it (studies with this object in view are termed as *exploratory or formulative research studies*);
2. To show accurately the **characteristics of a particular individual, situation** or a **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*);

MOTIVATION IN RESEARCH

What makes people to undertake research?

The possible motives for doing research may be either one or more of the following:

1. Desire to get a **research degree** along with its consequential benefits;
2. Desire to **face the challenge in solving the unsolved problems**, i.e., concern over practical problems initiates research;
3. Desire to get intellectual joy of doing **some creative work**;
4. Desire to be of **service to society**;
5. Desire to **get respectability**.

Many more factors such as directives of government, employment conditions, interest about new things, desire to

TYPES OF RESEARCH

The basic types of research are as follows:

1. *Descriptive vs. Analytical*: *Descriptive research includes surveys and fact-finding enquiries of different kinds. The major purpose of descriptive research is description of the state of affairs as it exists at present. In social science and business research we quite often use the term Ex/post facto research for descriptive research studies. The main characteristic of this method is that the researcher has no control over the variables; he can only report what has happened or what is happening.*

In *analytical research*, on the other hand, the

2. Applied vs. Fundamental: Research can either be *applied (or action) research* or *fundamental (to basic or pure) research*.

Applied research aims at finding a solution for an immediate problem facing a society or an industrial/business organisation, whereas *fundamental research is mainly concerned with generalizations and with the formulation of a theory.*

“Gathering knowledge for knowledge’s sake is termed ‘pure’ or ‘basic’ research.”

Research concerning some natural phenomenon or relating to pure mathematics are examples of fundamental research. Similarly, research studies, concerning human behaviour carried on with a view to make generalizations about human behaviour, are also examples of fundamental research, **but** research aimed at certain conclusions (say, a solution) facing a concrete social or business problem is an example of applied research.

Thus, the central aim of applied research is to discover a solution for some

3. Quantitative vs. Qualitative: Quantitative research is based on the **measurement of quantity or amount**. It is applicable to phenomena that can be expressed in terms of **quantity**.

Qualitative research, on the other hand, is concerned with **qualitative phenomenon**, i.e., phenomena relating to or involving **quality or kind**. For instance, when we are interested in investigating the reasons **for human behaviour** (i.e., why people think or do certain things), we quite often talk of 'Motivation Research', an important type of **qualitative research**. This type of research aims at discovering the underlying motives and desires, using in depth interviews for the purpose.

Other techniques of such research are **word association tests**, **sentence completion tests**, **story completion tests** and similar other projective techniques.

Attitude or opinion research i.e., research designed to find out **how**

4. Conceptual vs. Empirical: *Conceptual research* is that related to some abstract idea(s) or theory.

It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones.

On the other hand, **empirical research** relies on **experience or observation alone**, often **without** due regard for **system and theory**. It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment. We can also call it as experimental type of research. In such a research it is necessary to get **at facts firsthand**, at their source, and actively to go about doing certain things to stimulate the production of desired information.

In such a research, the researcher must first provide himself with a **working hypothesis or guess** as to the probable results. He then works to get **enough facts** (data) to **prove or disprove his hypothesis**. He then sets up **experimental designs** which he thinks will manipulate the persons or the materials concerned so as to bring forth the desired information. Such research is thus characterized by the experimenter's control over the

Research can be classified from **three perspectives**:

1. *application of research study*
2. *objectives in undertaking the research*
3. *inquiry mode employed*

1.Application:

From the point of view of application, **there are two broad categories of research**:

- *pure research and*
- *applied research.*

Pure research involves *developing and testing theories and hypotheses* that are intellectually challenging to the researcher but may or may not have practical application at the *present time or in the future*. *The knowledge produced through pure research is sought in order to add to the existing body of research methods.*

Applied research is done to *solve specific, practical questions*; for policy formulation, administration and understanding of a phenomenon.

It can be **exploratory**, but is usually **descriptive**. It is almost always done on the basis of basic research. Applied research can be carried out by academic or industrial institutions.

2.Objectives:

From the view point of objectives, a research can be classified as

a-descriptive

b-correlational

c-explanatory

d-exploratory

A. Descriptive research attempts to describe systematically a situation, problem, phenomenon, service or programme, or provides information about , say, living condition of a community, or describes attitudes towards an issue.

B. Correlational research attempts to discover or establish the existence of a relationship/ interdependence between two or more aspects of a situation.

C. Explanatory research attempts to clarify why and how there is a relationship between two or more aspects of a situation or phenomenon.

D. Exploratory research is undertaken to explore an

Inquiry Mode:

From the process adopted **to find answer to research questions**

- the two approaches are:

- *Structured approach*
- *Unstructured approach*

Structured approach:

The structured approach to inquiry is usually classified as *quantitative research*. Here everything that forms the research process- objectives, design, sample, and the questions that you **plan to ask of respondents- is predetermined.**

It is more appropriate to determine **the *extent /amount* of a problem, issue or phenomenon** by quantifying the variation.

e.g. how many people have a particular problem? How many people hold a particular attitude?

Unstructured approach:

The unstructured approach to inquiry is usually classified as *qualitative research*.

This approach **allows flexibility** in all aspects of the research process.

It is more appropriate to explore **the nature** of a problem, *issue or phenomenon without quantifying it.*

Main objective is to **describe the variation** in a *phenomenon, situation or attitude.*

e,g, description of an observed situation, the historical enumeration of events, an explanation of different opinions different people have about an issue, description of working condition in a particular industry.

THE RESEARCH PROCESS

The research process is similar to undertaking a journey. For a research journey there are two important decisions to make-

- 1. What you want to find out about or what research questions (problems) you want to find answers to;***
- 2. How to go about finding their answers.***

There are practical steps through which you must pass in your research journey in order to find answers to your research questions.

At each operational step in the research process you are required to choose from a **multiplicity of methods, procedures and models of research methodology** which will help you to best achieve your objectives.

Steps in Research Process:

1. Formulating the Research Problem
2. Extensive Literature Review
3. Developing the objectives with
Development of working hypotheses
4. Preparing the Research Design including
Sample Design
5. Collecting the Data With Execution of the
project:
6. Analysis of Data
7. Generalization and Interpretation
8. Preparation of the Report or Presentation
of Results-Formal write ups to conclusions
reached.

Step1. Formulating the research problem:

It is the first and *most crucial step in the research process*

- Main function is to decide *what you want to find out about*.
- The way you formulate a problem determines almost every step that follows.

Sources of research problems

Research in social sciences revolves around four Ps:

- **People**- a group of individuals
- **Problems**- examine the existence of certain issues or problems relating to their lives;
to ascertain attitude of a group of people towards an issue
- **Programs**- to evaluate the effectiveness of an intervention
- **Phenomena**- to establish the existence of a regularity.

Every research study has **two aspects**:

1. Study population-

- People: individuals, organizations, groups, communities

(they provide you with the information or you collect information about them)

2. Subject area-

- Problems: issues, situations, associations, needs, profiles
- Program : content, structure, outcomes, attributes, satisfactions, consumers, Service providers, etc.
- Phenomenon: cause-and-effect relationships, the study of a phenomenon itself

(Information that you need to collect to find answers to your research questions) You can examine the professional field of your choice in the context of the four Ps in order to identify anything that looks interesting.

Considerations in selecting a research problem:

These help to ensure that your study will remain manageable and that you will remain motivated.

1. **Interest:** a research endeavour is usually time consuming, and involves

hard work and possibly unforeseen problems. One should select topic of great interest to sustain the required motivation.

2. **Magnitude:** It is extremely important to select a topic that you can manage

within the time and resources at your disposal. Narrow the topic down to something manageable, specific and clear.

3. **Measurement of concepts:** Make sure that you are clear about the indicators and measurement of concepts (if used) in your study.

4. **Level of expertise:** Make sure that you have adequate level of expertise for

the task you are proposing since you need to do the work yourself.

5. **Relevance:** Ensure that your study adds to the existing body of knowledge, bridges current gaps and is useful in policy formulation.

This will help you

to sustain interest in the study.

6. **Availability of data:** Before finalizing the topic, make sure that data are available

Steps in formulation of a research problem :

Working through these steps presupposes a **reasonable level of knowledge in the broad subject area** within which the study is to be undertaken.

Without such knowledge it is difficult to clearly and adequately 'dissect' a subject area.

Step 1 Identify a broad field or subject area of *interest to you*.

Step 2 *Divide the broad area into sub areas.*

Step 3 *Select what is of most interest to you.*

Step 4 Raise research questions.

Step 5 Formulate objectives.

Step 6 Assess your objectives

Step 2. Reviewing the literature:

- ✓ Essential preliminary task in order to notify yourself with the available

body of knowledge in your area of interest.

- ✓ **Literature review is integral part of full research process and makes**

valuable contribution to every operational step.

- ✓ Reviewing literature can be time-consuming, daunting and frustrating, but is also rewarding. **Its functions are:**

- a. Bring clarity and focus to your research problem;
- b. Improve your methodology;
- c. Broaden your knowledge;
- d. Contextualize your findings.

a. Bring clarity and focus to your research problem;

The process of reviewing the literature helps you to understand the subject area better and thus helps you to conceptualize your research problem clearly and accurately.

It also helps you to understand the relationship between your research problem and the body of knowledge in the area.

b. Improve your methodology: A literature review tells you if others have used procedures and methods similar to the ones that you are proposing, which procedures and methods have worked well for them, and what problems

c. Broaden your knowledge base in your research area:

It ensures you to read widely around the subject area in which you intend to conduct your research study.

It also helps you to understand how to findings of your study fit into the existing body of knowledge.

d. Contextualize your findings:

How do answers to your research questions compare with what others have found?

What contribution have you been able to make in to the existing body of knowledge?

How are your findings different from those of others?

Procedure for reviewing the literature:

1. search for existing literature in your area of study;
2. review the literature selected;
3. develop a theoretical framework;
4. develop a conceptual framework.

Search for existing literature:

-To effectively search for literature in your field of enquiry, it is imperative that you have in mind at least some idea of broad subject area and of the problem you wish to investigate, in order to set parameters for your search.

-Next compile a bibliography for this broad area.

Sources are:

1. books
2. journals

BOOKS

comprise a central part of any bibliography.

Advantage-material published generally is of good quality and the findings are integrated with other research to form a coherent body of knowledge.

Disadvantage-material is not completely up to date, as it can take a few years between the completion of a work and publication in the form of a book.

JOURNALS

Journals provide you with the most up-to-date information, even though there is a gap of two to three years between the completion of a research project and the publication in a journal.

As with books, you need to prepare a list of journals for identifying literature relevant to your study. This can be done as follows:

- locate the hard copies of the journal that are appropriate to your study;
- use the internet
- look at the index of research abstracts in the relevant field to identify and read the articles.

THE BIBLIOGRAPHY

- The bibliography should give a clear, complete description of the sources that were used while preparing the report.
- It is an alphabetical list as per the author's surname.

For a Book

Surname of author, name or two initials, Title taken from title page-underlined or in italics, Edition (if more than one), volume if more than one, place of publication, publishers, date on title page or copyright date.

e.g. Kothari, C.R., *Research Methodology-Methods and Techniques*,

2nd E, 1989, New Delhi :

Step 3 The formulation of objectives:

- Objectives are the goals you set out to attain in your study.
- They inform a reader what you want to attain through the study.
- It is extremely important to word them clearly and specifically.

Objectives should be listed under two headings:

- a) main objectives (aims);
- b) sub-objectives.

The **main objective** is an overall statement of the thrust of your study.
The **sub-objectives** are the specific aspects of the topic that you want to investigate within the main framework of your study.
It is also a statement of the main associations and relationships that you seek to discover or establish.

- They should be numerically listed.
- Wording should clearly, completely and specifically Communicate to your readers your intention.
- Each objective should contain only one aspect of the

General objective

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General objective of this project is to modify pedal bicycle to solar assisted passenger tricycle with improving a load capacity in order to minimize the problem of transportation.

Specific Objectives

- • To select components required for solar energy application in tricycle.
- • To design various parts necessary for modification.
- • To modify pedal bicycle into solar powered tricycle with fully functional prototype.

➤ • To construct simple passenger shield to protect

The objectives should start with words such as

‘to determine’,
‘to find out’,
‘to ascertain’,
‘to measure’,
‘to explore’ etc.

The wording of objectives determines the type of research (**descriptive, correlation and experimental**) and **the type of research design** you need to adopt to achieve them.

e.g.

Descriptive studies:

- *To describe the types of incentives provides by Hotel XYZ to employees in Ethiopia.*
- *To find out the opinion of the employees about the medical facilities provided by five star hotels in Ethiopia.*

Correlational studies:

- To ascertain the *impact of training on employee retention.*
- To compare the effectivenesss of different loyalty programmes on repeat clientele.

Hypothesis -testing studies:

- To ascertain if an increase in working hours will increase the incidence of rug/alcohol abuse.
- To demonstrate that the provision of company accommodation to employees in

1. Objectives of the Research Study:

Objectives identified to answer the research questions have to be listed making sure that they are:

- a) numbered, and
- b) statement begins with an action verb.

2. Methods of Data Collection:

There are two types of data

Primary Data— collected for the first time

Secondary Data—those which have already been collected and analyzed by someone else.

Research Methods

*Research methods may be understood as all those **methods/techniques that are used for conduction of research.***

*Research methods or techniques, thus, **refer to the methods the researchers use in performing research operations.***

In other words, all those methods which are used by the researcher during the course of studying his research problem are termed as research methods.

Keeping this in view, research methods can be put into the following groups:

1. **In the first group** we include those methods which are concerned with the collection of data. These methods will be used where **the data already available are not sufficient** to arrive at the required solution;
2. **The second group** consists of those statistical techniques which are **used for establishing relationships between the data and the unknowns;**
3. **The third group** consists of those methods which are used

Research methodology

It is a way to systematically solve the research problem.

*It may be understood as a science of studying **how research is done scientifically.***

In it we study the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them.

It is necessary for the researcher to know not only the research methods/techniques **but also the methodology.**

❖ ***when we talk of research methodology we not only talk of the research methods*** but also consider the *logic behind the methods* we use in the context of our research study and *explain why* we are using *a particular method or technique* and why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others.

Why a research study has been undertaken,
how the research problem has been defined,
what way and why the hypothesis has been formulated,
what data have been collected and what particular method has been adopted,
why particular technique of analyzing data has been used and a host of similar other questions are usually answered
when we talk of research methodology concerning a research problem or study.

MEANING AND DEFINITION OF METHOD

Method is a style of conducting a research work which is determined by the nature of the problem.

M.Verma has defined the term “**Method** is only in the abstract as logical entities that we can distinguish between **matter and methods**,

The common types of **matter** may be three types, hence all the **methods** can be classified under three heads

1. Theoretical problem – survey, experimental method.
2. Factual problem – Historical, case study and genetic methods.
3. Application problem – Action Research.

“Method refers to **the formal structure of the sequence of acts** commonly denoted by instruction.

The term method covers both **strategy and tactics** of teaching and involves the choice of what is to be taught, and the order in which it is to be taught.”

Method is more general, it includes **techniques** .

The research **techniques are ways of implementing a method**. Different techniques may be employed within the same method.

Webster defined **methodology** as “***the science of method or arrangement***”

Method is defined as “**orderliness and**

TYPES OF RESEARCH METHODS

George J. Mouly has classified research **methods** into **three basic types**: 1.**Survey**, 2.**historical** and 3.**experimental** methods.

1. Survey Method

It is concerned with the **present** and attempts to determine the **status of the phenomena** under investigation.

This **Survey Method** has been further **classified** into **four categories**:

(a) **Descriptive survey** (b) **Analytical survey** (c) **School survey** and (d) **Genetic survey**.

(a) **Descriptive survey is of three types:**

- a1-Survey testing method,
- a2-Questionnaire survey method,
- a3-Interview survey method.

(b) **Analytical survey is of five types:**

- b1-Documentary frequency,
- b2-Observational survey,
- b3-Rating survey,
- b4-Critical incident,
- b5-Factor analysis.

2. Historical Method

This method is concerned with the **past** and which attempts to trace the past as a **means for seeing the present prospective.**

The historical method can be classified into three types:

- (a) *Historical,*
- (b) *Legal, and*
- (c) *Documentary.*

3. Experimental Method

It is oriented towards the **discovery/finding of basic relationship among a phenomena as means of predicting and eventually, controlling their occurrence.**

The experimental method has been further classified into four types as given below:

- (a) *Simple experimental designs,*
- (b) *Multio-variate analysis,*
- (c) *Case study and*

NORMATIVE SURVEY METHOD

The word 'survey' has been derived from the words 'sur' or 'sor' and 'veeir' or 'veior' which means 'over' and 'see' respectively.

Normative survey deals with “**what is**” ?.

It **describes** and **interprets** what exists at **present**.

In a normative survey we are concerned **with conditions or relationships that exist, practices that prevail, beliefs**, points of view or attitudes that are held, processes that are going on, influences that are being felt, and trends that are developing.

Writers have used various terms like 'Normative' 'descriptive' 'survey' 'status' or

PURPOSE AND USES OF SURVEY METHOD

The major purpose of survey method in research is to tell “**what is**”? i.e., to describe the **problem or phenomenon**, but many surveys go beyond a simple description of the **existing situation**.

For example, the survey dealing with curriculum courses help us in obtaining information not only about the strength and weaknesses of the current curriculum but **also can elicit recommendations for change**.

Descriptive surveys, or normative surveys are often carried out as preliminary step to be followed by researcher employing **more strong control and more objective methods**.

Descriptive surveys or studies also serve as **direct sources** of valuable knowledge concerning human behavior.

Information's which the Survey Methods Collect

The survey methods of survey studies collect the following three types of information.

The informations are:

- (i) of *what exists*,
- (ii) of *what we want*, and
- (iii) of *how to get there*.

The information of **what exists** is gathered by studying and analyzing important aspects of **present situation**.

The information of **what we want**, is obtained by **clarifying goods, goals, and objectives** possibly through a study of the conditions existing else where or what experts consider to be desirable.

The Information of **how to get these** are collected through discovering the possible means of **achieving the goals on the basis of the experiences** of

Characteristics of the Survey Method

The following are the main characteristics of the survey method of research:

1. The survey method gathers data from a relatively large number of cases at a particular time.
2. *It is essentially cross-sectional.*
3. It is not concerned with the characteristics of individuals.
4. *It involves clearly defined problem.*
5. It requires experts imaginative planning.
6. *It Involves definite objectives.*
7. It requires careful analysis and interpretation of the data gathered.
8. It requires logical and skilful reporting of the findings.
9. Surveys vary greatly in complexity.
10. It does not seek to develop an organised body of scientific principles.
11. It provides information 'useful to the solution of local problems

TYPES OF SURVEY STUDIES

There are **three criteria for classifying** the survey research:

(a) ***Nature of variables***

a1 – Status survey

a2 – Survey research

(b) ***Group Measured***

b1 – Sample

b2 – Population

(c) ***Sources of data collection***

c1 – Questionnaire

c2 – Interview

c3 – Controlled observations survey.

DESCRIPTIVE STUDIES

Descriptive research is concerned with the **present** and attempts to determine the status of the phenomenon under investigation.

The Nature of Descriptive Research

The nature of descriptive research can be explained with reference to other type of research.

(a) Descriptive and Historical Research (Longitudinal or cross sectionals)

A clear distinction can be drawn between survey studies and historical studies on the basis of time, **the latter deals with past, the former with present.**

(b) Descriptive and Experimental Research

Descriptive research as are oriented toward **the determination of the status of a given phenomenon** rather than toward the isolation of causative factors accounting for its existence.

It is based on cross-sectional samples, the sample should be representative of the population.

Descriptive research involves large sample and experimental research includes small sample. **Descriptive research investigates trend of characteristics of population.** This is less scientific and complicated.

(c) Descriptive and Case Study

Purpose of Descriptive Research

The following are the main objectives of descriptive research:

1. To identify present conditions and point to present needs.
2. To study immediate status of a phenomenon.
3. Facts findings.
4. To examine the relationships of traits/ behavior and characteristics (trends and patterns).

The **descriptive survey** is more realistic than experimental research. Descriptive researches are oriented towards the **descriptive of the present status of a given phenomenon.**

Special Problems of Descriptive Research

1. The problem of sampling, to select representative sample (size of the sample).
2. The validity of the measuring instruments. Validity of the tool is crucial to the validity of the findings of study.

Types of Descriptive Research

- (a) Survey Testing,*
- (b) The questionnaire, and*
- (c) Interview.*

Survey Testing: Survey testing researches are concerned with academic and psychological problems in which academic and psychological tests are administered for data collection.

(a) Selection of tests

1. How the test defines the variable and the investigator should also define the variable in the same way.
2. Validity of the tool.
3. simplicity for administration, scoring and interpretation.

(b) Construction of Tests.

It may be possible that appropriate tool is not available for measuring

the same variable. Hence, **the researcher has to construct the tool.** He has to estimate reliability and validity of the tool, it is not essential that norm should be

Characteristics of Survey Testing Research: The following are major characteristics:

1. Descriptive-survey-test research are relatively more scientific and accurate.
2. It provides more accurate data.
3. The data are subjected to parametric treatments.
4. The sample is usually of large size the error of measurement and sampling error is put to the minimum.
5. The findings are authentic and accurate.
6. The conclusions are realistic.
7. It provides the deep insight to the psychometric methods of test construction.

Collection of Data

Most educational research will lead to the gathering of data by means of some standardized test or self-constructed research tools.

It should provide objective data for interpretation of results achieved in the study.

The data may be obtained by administering questionnaires, testing, personal observations, interviews and many other techniques of collecting quantitative and qualitative evidence.

The researcher must know how much and what kind of data collection will take place and when. He must also be sure that the types of data obtainable from the selected instruments will be usable in whatever statistical model he will later use to bring out the significance of the study.

The data collection is the accumulation of specific evidence that will enable the researcher to properly analyze the results of all activities by his research design and procedures.

NEED FOR DATA COLLECTION

The data are needed in a research work to serve the following purposes:

1. Collection of data is very essential in any educational research to provide a solid foundation for it.
2. It is something like the **raw material** that is used in the production of data. Quality of data determines the quality of research.
3. It provides a **definite direction** and **definite answer** to a research inquiry. Whatever inquiry has to give a definite answer to an investigation. Data are very essential for a scientific research.
4. The data are needed to validate the various arguments in research findings.
5. The main purpose of data collection is to verify the hypotheses.
6. Statistical data are used in two basic problems of any investigation:
 - *Estimation of population parameters, which helps in drawing generalization.*
 - *The hypotheses of any investigation are tested by data collection procedure.*

MEANING OF DATA

Data means observations or evidences.

The scientific educational researches require the data by means of some **standardized research tools or self-designed instrument**. Data are both qualitative and quantitative in nature.

Score is the numerical description of an individual with regard to some characteristics or variables.

Measurement process is employed to quantify a variable. Data are collected for both variables as well as attributes. These are gathered in terms of frequency and scores. It depends on the type of instrument employed for its measurement.

Generally tests yield the data in the **form of scores and questionnaires** provide the data in the form of frequency.

Data and facts are used in educational research, therefore, it is essential to understand them clearly.

DIFFERENCE BETWEEN FACTS AND DATA

1. The facts are organized in their original form whereas data are organized in systematic order.
2. The facts do not have any coherence of system whereas data have an organic unity like body.
3. The facts are difficult to interpret. The interpretation of facts is usually subjective and employs the imagination of the researcher. Data can be interpreted easily and most objectively.
4. The facts are mysterious /secretive in nature we have to explore the facts but data have no mystery at all.
5. The facts are descriptive /expressive in nature whereas data are explanatory.
6. The facts are not amenable to objective statistical treatments whereas data can be easily subjected to in objective statistical treatment.
7. The facts may not be directly the basis of findings or research conclusions, but data are directly linked with research conclusions.
8. The facts are usually too broad and are not linked and a purposive way whereas data are always collected with a sense of purpose.

NATURE OF DATA

The research studies in behavioural science or mainly concerned with the characteristics or traits. Thus, tools are administered to quantify these characteristics, but all traits or characteristics can not be Quantified.

The data can be classified into two broad categories:

1. Qualitative data or attributes.
2. Quantitative data or variables.

1. Qualitative Data or Attributes: The characteristics or traits for which **numerical value can not be assigned**, are called attributes, e.g. motivation, confidence, honesty integrity etc.

2. Quantitative Data or Variables: The characteristics or traits for which **numerical value can be assigned**, are called variables, e.g. Achievement Intelligent, Aptitude/ Height, Weight etc.

The distinction is based on the process of measurement rather than on the properties inherent in the phenomenon or trait, for

generally properties considered qualitative can be

Quantification is the process of assigning numerical values to the trait of the subjects of sample which normally would be quantitative. This can be done by :

a) Observations or information by first hand experience.

It is used in small children and animals.

b) Systematic collection and analysis of factual data.

This is done in historical research.

c) Scales and inventories are designed to explore or reveal the interests, attitude and personality. It is used in the case of study and survey research.

d) Questionnaire, interview and opinionaire are designed to gain information. This is employed in survey research.

e) Educational and psychological tools are administered to quantify the variables more accurately.

These tools are used in scientific research studies.

Various types of research tools are employed to collect the data. These tools yield different types of data.

CONSTANTS

A constant is all characteristic or condition that is the same for all the observed units or sample subjects of a study.

A variable, on the other hand is a characteristic which takes on different values for different sample subjects or for all the observed units.

The use of variable and constant has been illustrated with the help of the following example.

Suppose a study is conducted for determining the effect of three different teaching methods upon the achievement in secondary mathematics. Each of three ninth grade maths sections in the same school, are taught by the same teacher, is taught using one of the methods. Both boys and girls are included in each method.

In this study grade level, school and teacher are recognized as constants.

VARIABLES

The variables are those which vary from person to person and can be quantified by employing measuring instrument. The sample or group variation can be ascertained in terms of numerical values. The characteristic or the trait in the behavioural science which can be quantified is termed as variable.

Variables can be classified into two categories:

1. Continuous variables.
 2. Discrete variables.
1. Continuous variables are those for which fractional value exists and have meaning e.g. age, weight, achievement, where 14.5 years, 62.75 kgs and 45.50 scores or any other fractional of a whole unit is logical and measurable within the precision of the instrument used.
 2. Discrete variables are those on the other hand, which exist only in units not the fractional value (usually units of one) e.g. 30 boys, 25 girls, 40 Indians and 24 Americans

VARIATE

The variable is quantified by using an instrument. The quantified variable is termed as variate. When sample subjects I.Q.s or scores of achievement are collected, it is known as variate. The statistical analysis involves variate analysis: uni-variate, bi-variate, multi-variate analysis. It is evident that data collection means to convert variables into variates so that data can be subjected to an appropriate

QUANTIFICATION OF VARIABLE

Statistical analysis for obtaining the results.

Quantification is the process of assigning numeral value to the extend or amount of a variable of an individual. The quantification is done by employing the process of measurement. This process yields data and scores.

Many studies in education produce data for the verification of research hypotheses so as to draw conclusions. Some other studies in education produce evidences that require evaluation by subjective methods which do not readily permit the use of statistical analysis are termed as qualitative data. These qualitative data may be converted first into their quantitative data. The statistical techniques may be applied to test the significance of data. If qualitative data cannot be converted into quantitative data

CHARACTERISTICS OF QUANTITATIVE DATA

The quantitative data are collected by administering the research tools. These should possess the following characteristics:

1. The quantitative data should be collected through standardized tests. If self-made test is used it should be reliable and valid.
2. They are highly reliable and valid. Therefore, generalization and conclusions can be made easily with certain level of accuracy.
3. The obtained results through quantitative data can be easily interpreted with scientific accuracy. The level of significance can also be determined.
4. The scoring system of quantitative data is highly objective.
5. The use of quantitative data is always based upon the purpose of the study. The specific psychometric tests are used in difficult investigation.
6. The inferential statistical can be used with the help of quantitative data.

TYPES OF DATA

There are four basic ways of quantifying the variables. They are also called levels of measurement or scales of measurement.

These are commonly referred to as:

1. Nominal scale,
2. Ordinal or rank scale,
3. Equal-interval scale, and
4. Ratio scale.

1. Nominal Scale

The nominal scale is the least precise or crude of the four basic scales of measurement. It simply implies the classification of an item into two or more categories without any extent or magnitude. There is no particular order assigned to them.

The frequency or numbers are used to give a name to something that may be used for determining per cent, mode. For example boys and girls; pass and fail; rural and urban.

In classroom observation the measurement is done at nominal scale. The teaching and instruction are organized considering the mode of the students, because teacher cannot pace with each and every student in his teaching and learning process.

2. Ordinal Scale

The ordinal scale is more precise scale than the nominal scale. It allows the teacher to assign values by placing of arranging the observations in relative rank order. No value is assigned to the distances to the positions of ranking. This scale assigns observations to categories by number and arranges them in some logical order. It does not require the relationship of equivalence but also requires one observation to be greater or lesser than the other.

This scale is used frequently in the schools for prize distribution and to provide the motivation by the technique of competition. In asking the questions teacher considers the place of students in the class.

3. Equal Interval Scale

The equal interval scale is more precise and refined scale than nominal and ordinal scales. This scale has all the characteristics and relationship of the ordinal scale, besides which distances between any two numbers on the scale are known. The zero point and the unit of measurement used on the scale are arbitrary assumed. A linear relationship is established in the equal-interval scale.

The equal-interval scale has the greater use in teaching-learning situation, educational administration, educational guidance and counselling and educational research. The effectiveness of any instructional procedure, can be evaluated precisely by collecting the data on this scale. The measurement in education is usually done on equal interval scale. The dependable inferences are drawn in educational research by collecting evidences on equal interval scale.

These three types of data are mainly used in behavioural researches.

Thes

<i>Subject</i>	<i>Nominal Sex</i>	<i>Ordinal Achievement in ranks</i>	<i>Equal-interval Achievement in scores</i>
A	Boy	3rd	64
B	Girl	1st	76
C	Girl	2nd	68
D	Boy	5th	58
E	Girl	4th	60

These scales have not absolute 'zero'. The group performance is the

4. Ratio Scale

Ratio scale has the properties of equal-interval scale plus two additional characteristics:

- a) *This scale has a true, rather than arbitrary 'zero'. It is possible to indicate the complete absence of property.* The zero point on a centimeter scale indicates the absence of height. However, the zero point on a Fahrenheit temperature scale does not indicate the absence of temperature; this is a scale with zero defined arbitrarily.
- b) *The ratio scale numerals have the qualities of real numbers, and can be added, subtracted, multiplied; or divided.* A may be so many units greater than B and may also be so many times as great as B. Fifteen grams is three times five grams and fifteen grams is ten more than five grams.

Proceeding from nominal to ratio scale in order each type makes possible more information about the property described. If the variable permit its application, the type of scale provide the maximum amount of information should be used.

DATA COLLECTION

In the behavioural science data are collected by administering various types of research tools of the human sample subjects. The different traits and characteristics are quantified by using measurable instruments. These research tools provide different types of data. It is very essential for a research worker to understand the trait, tools and type of data. This has been

<i>No.</i>	<i>Level</i>	<i>Properties</i>		<i>Assumptions</i>	<i>Examples</i>	<i>Statistics</i>
1.	Nominal Scale	Classification Equate Non-equate	(1)	All members of a set are assigned the same numeral, and no two sets are assigned the same numeral.	Car registration plate numbers Simple questionnaire and interviews data gathered on an all or none basis	Mode Coefficient of association
2.	Ordinal Scale	Classification Order Equate Non-equate	(1) (2)	As above Objects can be rank ordered on the basis of an operationally defined characteristic or property	Moh's scale of hardness Most psychological and educational test scores.	Mode Median Percentiles Coefficient of association Ranking coefficient

3.	Interval Scale	Classification Order equal Units Equate Non-equate Add subtract Multiply divide	(1) (2) (3)	As above As above Distances on the scale represent equal intervals	Temperature scales Very well validated intelligence tests, etc.	Mode Median Mean Percentile Range Standard Deviation Average deviation
4.	Ratio Scale	Classification Order Equal Units Absolute Zero Equate Non-equate Add subtract Multiply divide	(1) (2) (3) (4)	As above As above As above Scale has an absolute or natural Zero	Common, scales of length, Mass and time Some scale of loudness	Standard score Coefficient of association Ranking Coefficient Simple partial and multiple correlation.

A Classification of Scales of Measurement and Common Statistics

Types of Data With Reference to the Traits

<i>Trait</i>	<i>Tool</i>	<i>Type of Data</i>
1. Intelligence	Psychological tests	Equal-interval scale
2. Achievement	Educational tests	"
3. Aptitude	Psychological tests	"
4. Attitude	Scales	Ordinal scale
5. Interest	Inventories	Equal interval scale
6. Personality	"	"
7. Adjustment	"	"
8. Opinions of feelings	Questionnaire or Opinionnaire	Nominal scale

There are other types of research tools which are used to collect the data. For example, 'observation technique' is most frequently used to collect the data which yields the data at nominal scale and also at equal-interval scale.

In the following table research tools have been classified with regard to scale for measurement and types of statistics may be

<i>Scale</i>	<i>Tools of Research</i>	<i>Statistics</i>
1. Nominal Scale	Questionnaire Interview Schedule Observation	Modal, frequency percentage Simple statistics X^2 -Test and 'C'
2. Ordinal scale	Scale observation Rank scale	Median, Spearman's rank correlation X^2 test Median test etc.
3. Equal-interval scale	Psychological and educational tests Observation scale	Mean, Sd. Pearson's correlation 't' test and 'f' test etc.
4. Ratio scale	Physical measurement	Arithmetic mean Pearson's correlation Mathematics is used.

The types of data depend on nature of research tool employed for this purpose. Statistical techniques are virtually selected by considering the nature of research tool and data collected at nominal, ordinal or equal

Ethical considerations in Collection of Data

Any researcher who involves human sample subjects in his research has certain responsibilities towards them. Since the activities of the sample subjects are often closely associated with data collection process, it is appropriate to consider ethical considerations.

The following points have to be considered in process of data collection:

1. The researcher must protect the dignity and welfare of human sample subjects.
2. The human sample subjects freedom to decline participation must be respected, and the confidentiality of research data must be maintained.
3. The researcher must guard against violation or invasion of privacy.
4. The responsibility for maintaining ethical standard remains with the individual researcher and the principal investigator or supervisor is also responsible for actions of his scholars.

Precautions in Data Collection

In the data collection the following precautions should be observed:

1. The data must be relevant to the research problem.
2. It should be collected through formal or standardized research tools.
3. The data should be such as these can be subjected to statistical treatment easily.
4. The data should have minimum measurement error.
5. The data must be tenable for the verification of the hypotheses.
6. The data should be such as parameters of the population may be estimated for inferential purpose.
7. The data should be complete in itself and also comprehensive in nature.
8. The data should be collected through objective procedure.
9. The data should be accurate and precise.
10. The data should be reliable and valid.
11. The data should be such that these can be presented and interpreted easily.
12. The scoring procedure of the research tool should be easy and objective.

ORGANIZATION OF DATA

After the data have been collected. it must be organized and analyzed to draw proper **conclusion**.

The mass of data collected through the use of various tools, however reliable, valid and adequate it may be is yet but raw. It needs to be systematized and organized i.e. edited classified and tabulated. before it can serve any worthwhile purpose.

Editing implies the checking of gathered data for accuracy, utility and completeness.

Classifying refers to the dividing of the information into different categories classes or heads, for the use.

Tabulating denotes the recording of the classified material in accurate mathematical terms e.g. marking and counting frequency tallies for different items on which Information is gathered. Tabulation is a tedious and painstaking process and must be accurate.

Before, tabulating all raw data should be tested on the basis of the purpose for which they are gathered and only the useful and usable data should be tabulated.

PROCESSING AND ANALYSING DATA

Processing and analysing data involves a number of closely related operations which are performed with the purpose of summarizing the collected data and organizing these in a manner that they answer the research questions (objectives).

The Data Processing *operations are:*

- 1. Editing** - a process of examining the collected raw data to detect errors and omissions and to correct these when possible.
- 2. Coding:** Coding refers to the process of assigning numerals or other symbols to answers so that responses can be put into a limited number of categories or classes.
- 3. Classification-** a process of arranging data in groups or classes on the basis of common characteristics.
Depending on the nature of phenomenon involved
 - a) Classification according to attributes:** *here data is analysed on the basis of common characteristics*

Such classification can be either:

Simple classification: where we consider only one attribute, and divide the universe into two classes—one class consisting of items possessing the given attribute and the other class consisting of items which do not possess the given attribute.

Table 1. Hotel Employees with MBA Degree

	<u>Yes</u>	<u>No</u>	<u>Total</u>
MBA Degree	<u>21</u>	<u>9</u>	<u>30</u>

Manifold classification: Here we consider two or more attributes

simultaneously, and divide the data into a number of classes

Table 2. Educational Qualification of Hotel

	<u>Yes</u>		<u>No</u>		<u>Total</u>	
	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>
MBA Degree	12	9	3	6	15	15
B.Sc. H&HA	15	15	0	0	15	15

b) Classification according to class -intervals: is done with data relating to income, age, weight, tariff, production, occupancy etc. Such quantitative data are known as the *statistics of variables* and are classified on the basis of class -intervals.

e.g. persons whose income are within Rs 2001 to Rs 4000 can form one

group or class, those with income within Rs 4001 to Rs 6000 can form another group or class and so on. The

number of items which fall in a given class is known as

Income Range	Frequency	%
Rs.1001-2000	10	50
Rs.2001-3000	8	40
Rs.3001-4000	2	10
Total	20	100

- 4. Tabulation**-Tabulation is the process of summarizing raw data and displaying the same in compact form for further analysis. It is an orderly arrangement of data in columns and rows. Tabulation is essential because:
- a) It conserves space and reduces explanatory and descriptive statement to a minimum.
 - b) It facilitates the process of comparison.
 - c) It facilitates the summation of items and the detection of errors and omissions.
 - d) It provides the basis for various statistical computations.

Tabulation may also be classified as simple and complex tabulation. Simple tabulation generally results in one-way tables which supply answers to questions about one characteristic of data only.

Complex tabulation usually results on two-way tables (which give information about two inter-related characteristics of data), three -way tables or still higher order tables, also known as manifold tables.

Need for Analysis of Data or Treatment of Data

After Administering And Scoring Research Tools Scripts, data collected and organized. The collected data are known as 'raw data.'

Analysis of data means to make the raw data meaningful or to draw some results from the data after the proper treatment. The 'null hypotheses' are tested with the help of analysis data so to obtain some significant results. Thus, the analysis of data serves the following main functions:

1. To make the raw data meaningful,
2. To test null hypothesis,
3. To obtain the significant results,
4. To draw some inferences or make generalization, and
5. To estimate parameters.

Data Analysis Methods

1. Qualitative Data Analysis:

Qualitative data analysis is a very personal process with few rigid rules and procedures. For this purpose, the researcher needs to go through a process called *Content Analysis*.

Content Analysis means analysis of the contents of an interview in order to identify the main themes that emerge from the responses given by the respondents. This process involves a number of steps:

Step 1. Identify the main themes. *The researcher needs to carefully go through the descriptive responses given by respondents to each question in order to understand the meaning they communicate.*

Step 2. Assign codes to the main themes: *If the researcher wants to count the number of times a theme has occurred in an interview, he/she needs to select a few responses to an open- ended question and identify the main themes.*

Step 3. Classify responses under the main themes: *Having identified the themes Next step is to go through the transcripts of all the interviews and classify the responses under the different themes.*

Step 4. Integrate themes and responses into the text of your report: *Having identified responses that fall within different themes, the next step is to integrate into the text of your report*

2. Quantitative Data Analysis

This method is most suitable for large well designed and well administered surveys using properly constructed and worded questionnaire.

Data can be analysed either *manually or with the help of a computer*.

Manual Data Analysis: *This can be done if the number of respondents is reasonably small, and there are not many variables to analyse.*

However, this is useful only for calculating frequencies and for simple cross tabulations.

Manual data analysis is extremely time consuming. The easiest way to do this is to code it directly onto large graph paper in columns.

Detailed headings can be used or question numbers can be written on each column to code information about the question.

Data Analysis Using a Computer: If you want to analyse data using computer, you should be familiar with the appropriate program. In this area, knowledge of computer and statistics plays an important role.

The most common software is SPSS for windows. However, data input can be long and laborious process, and if data is entered incorrectly, it will influence the final results.

Layout of the Research Report

The layout of the report means as to what the research report should contain.

A comprehensive layout of the research report should comprise :

a) preliminary pages;

b) the main text; and

c) the end matter. Let us deal with them separately.

Each category has been outlined further as follows:

a) Preliminary Section

1. Title page

2. Preface or
acknowledgements

3. Table of content

4. List of tables (if any)

5. List of figures (if any).

b) Main Body of Report or Textual Body

1. Introduction

- (a) Statement of the problem*
- (b) Objectives of the study*
- (c) Hypotheses to be tested*
- (d) Significance of the problem*
- (e) Assumptions and delimitations.*
- (f) Definitions of Important terms used.*

2. Review of related literature.

3. Design of the study

- (a) Method and procedure used*
- (b) Tools of research or sources of data*
- (c) Techniques of data collection*
- (d) Description of techniques used.*

4. Analysis and presentation of data

- (a) Analysis of data*
- (b) Tables and interpretation*
- (c) Figures and interpretation.*

5. Conclusions

- (a) Discussion of results*
- (b) Main Findings and inferences*
- (c) Implication of the findings and limitations*
- (d) Suggestions for further studies.*

c) Reference Section

1. Bibliography
2. Appendices (if any)
3. Index or glossary (if any)

Assignment

1. Define the term method.
2. Define types of research.
3. Distinguish between methods of research and methodology of research.
4. Define the term Data, How it is different from facts?
5. Differentiate between qualitative data and quantitative data.
6. Explain processing of data.

***The
End***