

# Research Methodology

MLISc. (Master of Library and Information Science)

Paper VI



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**MLISc., SYLLABUS (ONE YEAR)**  
**PAPER VI RESEARCH METHODOLOGY**

**Unit : I**

**Research:** concept, meaning, Need and purpose Types of research - Pure, Applied, Inter disciplinary Research

**Unit : II      Research Design**

- Identification of problem
- Formulation and testing of Hypothesis
- Steps in Research Design
- Sampling techniques and types.

**Unit : III      Research Methods .**

- Historical, descriptive, Survey,
- Experimental, case study, scientific,
- Data collection : tools and techniques
- Data Representation – Tables, Charts, graphs.

**Unit : IV      Statistical Techniques and tools. -**

- Data Analysis and Interpretation.
- Use of SPSS
  
- Statistical Measures – Parametric and Non-parametric Methods

**Unit : V**

- Research Reports and Trends in LIS Research.
- Research Report Writing : Structure and Content , Style Manuals,
- Trends in Library and Information Science Research

Total No. of Questions : 10]

[Total No. of Pages : 01

**M.L.I.Sc. DEGREE EXAMINATION, MAY – 2015**

**Master of Library Information Science**

**Research Methodology (Paper – VI)**

**Time : 3 Hours**

**Maximum Marks : 75**

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*Answer any Five questions.*

*All questions carry equal marks.*

- Q1)* Explain the need and purpose of research.
- Q2)* How are hypotheses formulated?
- Q3)* What are the tools used in research?
- Q4)* State the merits and demerits of case study method of research.
- Q5)* Describe the interpretation and presentation of results.
- Q6)* Examine the methods employed to collect data.
- Q7)* Explain the sources of identifying research problem.
- Q8)* Give an account of various methods of sampling.
- Q9)* Bring out the research in LIS in India.
- Q10)* What are the essentials of a good research report?



# UNIT- I

The study of conducting research is Research methodology. The word Research is composed of two syllables viz. 'Re' and 'Search'. "Re" means 'Again or over again or a new'; "Search" means 'to examine closely and carefully or to try and test'. These two words together form a careful, systematic, patient study and investigation in some field of knowledge undertaken to establish facts and principles.

Research is a movement from unknown to the known. It is a scientific enquiry into a subject to generate new knowledge. There are various methods of research and techniques.

In this unit the concept and meaning of research is explained in the first lesson. Second lesson dealt with importance and significance of research. There are broadly two types of researches viz. Pure and Applied researches. Applied Research is primarily committed to promote advancement of the society while Pure Research establishes facts and principles. These are explained in detail in the third lesson. Fourth lesson explains the importance of research methods and problems encountered by Indian researchers.

# UNIT- I

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## Lesson - 1 Concept and Meaning of Research

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### Structure

- 1.0 Objectives
- 1.1 Introduction
- 1.2 Fundamentals of Research
- 1.3 Definitions of research
- 1.4 Objectives of Research
- 1.5 Motivations of Research
- 1.6 Research Approaches
  - 1.6.1 Quantitative approach
  - 1.6.2 Qualitative approach
- 1.7 Research Funding
  - 1.7.1 Government funded research
  - 1.7.2. Private funded research
- 1.8 Sum Up
- 1.9 Self-Assessment Questions
- 1.10 References

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### 1.0 Objectives

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- After reading this lesson, you will be able
- ✓ to understand the concept and meaning of research
  - ✓ to know the fundamentals of research
  - ✓ to know the definitions and objectives of research
  - ✓ to understand the motivations and approaches of research
  - ✓ to know various funding agencies of research

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### 1.1 Introduction

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The word *research* is derived from the Middle French "*recherche*", which means "to go about seeking", the term itself being derived from the old French term "*recherche*" a compound word from "re" and "cherchier", or "sercher", meaning 'search'. Research comprises "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of human beings, culture and society, and the use of this stock of knowledge to devise new applications." It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories. A research project may also be an expansion on past work in the field. To test the validity of instruments, procedures, or experiments, research may replicate elements of prior projects, or the project as a whole. The primary purposes of basic research are documentation, discovery, interpretation, or the research and development of methods and systems for the advancement of human knowledge. Approaches to research depend on epistemologies,

which vary considerably both within and between humanities and sciences. In this lesson an attempt has been made to examine the concept, fundamentals and objectives of research and state various funding agencies of research.

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## **1.2. Fundamentals of Research:**

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A researcher first of all should keep in mind some of the basic concepts or fundamentals while doing research. They are as follows....

1. Researcher do not use bias or prior knowledge. He imagine for creating own idea. The selected tool should be appropriate for the research problem and condition. To make decision based on real data without bias.
2. Researcher needs to know the theories in the past, but might not trust them as the ones forever. The theories that we have learned have been adjusted and modified by previous people.
3. In technology fields which people focus on invention and application, research points might be on selection of appropriate tools in mathematics and basic science.
4. Researcher might verify and evaluate data. If the results are not verified no one believes the research findings. Researchers have to evaluate the proposed idea in order to know the numerical results.
5. Everything has some merits and demerits....Nothing has only good views. Hence, the proposed method for solving the research problem has to trade off. Researcher must discuss the limitation and impact for safety of further study on the particular.
6. Public will accept the information when it has reason and cause, Reason might match with results, Results without reason cannot be believed.

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## **1.3 Definitions of research**

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

(a) A broad definition of research is given by MartynShuttleworth - "In the broadest sense of the word, the definition of research includes any gathering of data, information and facts for the advancement of knowledge."

(b) As per Creswell - "Research is a process of steps used to collect and analyse information to increase our understanding of a topic or issue". It consists of three steps: Pose a question, collect data to answer the question, and present an answer to the question.

(c) The Merriam-Webster Online Dictionary defines research in more detail as "a studious inquiry or examination especially investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws".

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## **1.4 Objectives of Research**

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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:

- To gain familiarity with a phenomenon or to achieve new insights into it.
- To portray accurately the characteristics of a particular individual situation or a group.
- To determine the frequency with which something occurs or with which it is associated with something else.
- To test a hypothesis of a causal relationship between variables.

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## **1.5 Motivations of Research**

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What makes people to undertake research? This is a question of fundamental importance. The possible motives for doing research may be either one or more of the following:

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

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## **1.6 Research Approaches**

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The above description of the types of research brings to light the fact that there are two basic approaches to research, viz., quantitative approach and the qualitative approach.

**1.6.1 Quantitative approach** involves the generation of data in quantitative form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion. This approach can be further sub-classified into inferential, experimental and simulation approaches to research.



- **Inferential approach:** The purpose of this approach to research is to form a data from which to infer characteristics or relationships of population. This usually means survey research where a sample of population is studied to determine its characteristics, and it is then inferred that the population has the same characteristics.
- **Experimental approach:** It is characterised by much greater control over the research environment and in this case some variable are manipulated to observe their effect on other variables.
- **Simulation approach:** It involves the construction of an artificial environment within which relevant information and data can be generated. This permits an observation of the dynamic behaviour of a system under controlled conditions.

**1.6.2 Qualitative approach** to research is concerned with subjective assessment of attitudes, opinions and behaviour. Research in such a situation is a function of researcher's insights and impressions. Such an approach to research generates results either in non-quantitative form or in the form which are not subjected to rigorous quantitative analysis. Generally, the techniques of focus group interviews, projective techniques and depth interviews are used. All these are explained at length in chapters that follow.

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## **1.7 Research funding:**

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Research funding is a term generally covering any funding for scientific research, in the areas of both "hard" science and technology and social science. The term often connotes funding obtained through a competitive process, in which potential research projects are evaluated and only the most promising receive funding. Such processes, which are run by government, corporations or foundations, allocate scarce funds. Most research funding comes from two major sources, corporations and government. Some small amounts of scientific research are carried out by charitable foundations, especially in relation to developing cures for diseases such as cancer, malaria and AIDS. According to OECD, around two-thirds of research and development in scientific and technical fields is carried out by industries, and 20 per cent and 10 per cent respectively by universities and government. Comparatively, in countries with less GDP, such as Portugal and Mexico the industry contribution is significantly lower. The US government spends more than other countries on military Research and Development, although the proportion has fallen from around 30 per cent in the 1980s to under 20. Government funding for medical research amounts to approximately 36 per cent in the U.S. The government funding proportion in certain industries is higher, and it dominates research in social science and humanities. Similarly, with some exceptions government provides the bulk of the funds for *basic* scientific research. In commercial research and development, all but the most research-oriented corporations focus more heavily on near-term commercialization possibilities rather than "blue-sky" ideas or technologies.

### **1.7.1 Government-funded research:**

Government-funded research can either be carried out by the government itself, or through grants by research councils to academic and other researchers outside the government. Critics of basic research are concerned that research funding for the sake

of knowledge itself does not contribute to a great return. However, scientific innovations often foreshadow or inspire further ideas unintentionally. For example, NASA's quest to put a man on the moon inspired them to develop better sound recording and reading technologies. NASA's research was furthered by the music industry, who used it to develop audio cassettes. Audio cassettes, being smaller and able to store more music, quickly dominated the music industry and increased the availability of music. An additional distinction of government-sponsored research is that the government does not make a claim to the intellectual property, whereas private research-funding bodies sometimes claim ownership of the intellectual property that they are paying to have developed. Consequently, government-sponsored research more often allows the individual discoverer to file intellectual property claims over their own work.

### **1.7.2. Private funded research:**

Private funding for research comes from philanthropists, crowd-funding, private companies, non-profit foundations, and professional organizations. Philanthropists and foundations have been known to pour millions of dollars into a wide variety of scientific investigations, including basic research discovery, disease cures, particle physics, astronomy, marine science, and the environment. Many large technology companies spend billions of dollars on research and development each year to gain an innovative advantage over their competitors, though only about 42 per cent of this funding goes towards projects that are considered substantially new, or capable of yielding radical breakthroughs.

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### **1.8. Sum Up:**

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Thus 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. It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories. The primary purposes of basic research are documentation, discovery, interpretation, or the research and development of methods and systems for the advancement of human knowledge. Approaches to research depend on epistemologies, which vary considerably both within and between humanities and sciences.

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### **1.9 Self-Assessment Questions:**

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- 1) State the definitions and objectives of research
- 2) Examine the motivations and approaches of research
- 3) Describe the various sources of research funding
- 4) Answer a brief note on the following
  - i) Meaning of research
  - ii) Fundamentals of research
  - iii) Concept of research

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### **1.10. References**

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2. Bailey, Kenneth D., "*Methods of Social Research*," New York, 1978.
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# UNIT - I

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## Lesson - 2 Forms, Importance and Significance of Research

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### Structure

- 2.0 Objectives
- 2.1 Introduction
- 2.2 Forms of research
- 2.3 Purpose of Research
  - 2.3.1. Exploratory
  - 2.3.2. Descriptive
  - 2.3.3. Explanatory
- 2.4 Importance of Research
- 2.5 Significance of Research
- 2.6 Sum Up
- 2.7 Self Assessment Questions
- 2.8 Selected Readings

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### 2.0 Objectives

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After reading this lesson, you will be able

- ✓ To know various forms of research
- ✓ To know the purpose of research
- ✓ To understand the importance and significance of research, and
- ✓ To identify various steps in conducting research

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### 2.1 Introduction

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Finding a solution for research problems for various areas of knowledge is varying. The approach and strategies of research in pure sciences, humanities and others are different. The intensities of these approaches and strategies are changing from one body of knowledge to the other. In this lesson an attempt has been made to list out the various forms of research and has been described the purpose of research, importance and the significance research.

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## 2.2 Forms of Research

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The following are the various forms of research

**i) Scientific research**

Scientific research relies on the application of the scientific method, a harnessing of curiosity. This research provides scientific information and theories for the explanation of the nature and the properties of the world. It makes practical applications possible. Scientific research is funded by public authorities, by charitable organisations and by private groups, including many companies. Scientific research can be subdivided into different classifications according to their academic and application disciplines. Scientific research is a widely used criterion for judging the standing of an academic institution, such as business schools, but some argue that such is an inaccurate assessment of the institution, because the quality of research does not tell about the quality of teaching.

**ii) Research in the humanities**

Research in the humanities involves different methods such as for example hermeneutics and semiotics, and a different, more relativist epistemology. Humanities scholars usually do not search for the ultimate correct answer to a question, but instead of explore the issues and details that surround it. Context is always important, and context can be social, historical, political, cultural or ethnic. An example of research in the humanities is historical research, which is embodied in historical method. Historians use primary sources and other evidence to systematically investigate a topic, and then to write histories in the form of accounts of the past.

**iii) Artistic research**

Artistic research, also seen as 'practice-based research', can take form when creative works are considered both the research and the object of research itself. It is the debatable body of thought which offers an alternative to purely scientific methods in research in its search for knowledge and truth.

**iv) Other types of research:**

All other types of research are variations of one or more of the above stated approaches, based on either the purpose of research, or the time required to accomplish research, on the environment in which research is done, or on the basis of some other similar factor. From the point of view of time, we can think of research either as one-time research or longitudinal research. In the former case the research is confined to a single time-period, whereas in the latter case the research is carried on over several time-periods. Research can be field-setting research or laboratory research or simulation research, depending upon the environment in which it is to be carried out. Research can as well be understood as clinical or diagnostic research. Such research follows case-study method or indepth approaches to reach the basic causal relations. Such studies usually go deep into the causes of things or events that interest us, using very small samples and very deep probing data gathering devices. The research may be exploratory or it may be formalised. The objective of exploratory research is the development of hypotheses rather than their testing, whereas formalized research

studies are those with substantial structure and with specific hypotheses to be tested . Historical research is that which utilizes historical sources like documents, remains, etc. to study events or ideas of the past, including the philosophy of persons and groups at any remote point of time. Research can also be classified as conclusion-oriented and decision-oriented. While doing conclusion- oriented research, a researcher is free to pick up a problem, redesign the enquiry as he proceeds and is prepared to conceptualize as he wishes. Decision-oriented research is always for the need of a decision maker and the researcher in this case is not free to embark upon research according to his own inclination. Operations research is an example of decision oriented research since it is a scientific method of providing executive departments with a quantitative basis for decisions regarding operations under their control.

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### **2.3. Purpose of Research:**

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Social research serves many purposes. Three of the most common and useful purposes, however, are exploration, description, and explanation. Many studies can and often do have more than one of these purposes, however each have different implications for other aspects of research design .

#### **2.3.1. Exploration**

A great deal of social research is conducted to explore a topic or familiarize oneself with a topic. This typically occurs when a researcher becomes interested in a new topic or when the subject of study itself is relatively new. Often times, exploratory research is done through the use of focus groups or small group discussions, which are frequently used in market research.

Exploratory studies are typically done for three purposes: to satisfy the researcher's curiosity and desire for better understanding, to test the feasibility of undertaking a more extensive study, and to develop the methods to be employed in any subsequent studies.

Exploratory studies can be extremely valuable in social research. They are essential when a researcher is breaking new ground and they typically yield new insights into a topic for research. They are also a source for grounded theory.

Exploratory studies do have a few downsides, however. The main shortcoming is that they rarely provide satisfactory answers to research questions, although they can hint at the answers and provide direction as to which research methods could provide definitive answers. The reason why exploratory studies themselves are rarely definitive is because the people studied in exploratory research may not be typical of the larger population of interest. That is, the sample is likely not a representative one.

#### **2.3.2. Description:**

Another major purpose of social research is to describe situations and events. The researcher observes and then describes what he or she observed. One great example of descriptive social research is the U.S. Census. The goal of the census is to

describe accurately and precisely several characteristics of the U.S. population, including race or ethnicity, age, sex, household size, income, etc. Other examples of descriptive social research studies include the calculation of crime rates for various cities, the computation of age-gender profiles of populations by demographers, and a product-marketing survey that describes who uses, or would use, a certain product. Many qualitative studies set out with the primary goal of description. For example, an ethnography might try to detail the culture of a particular society. At the same time, however, such studies are rarely purely descriptive purposed. Researchers usually go on to examine why the observed patterns exist and what the implications are.

### **2.3.3. Explanatory:**

A third major purpose of social research is to explain things. While descriptive studies attempt to answer the *what, when, where, and how*, explanatory studies attempt to answer the *why*. For example, reporting the status libraries of different cities is descriptive. Identifying the variables that explain why some cities have number of libraries than others involves explanation. While there are three distinct purposes of social science research, most studies will have elements of all three.

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## **2.4. Importance of Research:**

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Research is actually an act of studying something carefully and extensively in order to attain deep knowledge in the same. For being successful, research should be systematic, arranged, summarised and recorded properly. Research is not only a process that is limited to the field of science. It can, as well, cater to people and scholars from artistic, historic or any other field where an individual is willing to do extensive study to get relevant information. Research can be creative, exploring or just reassuring in nature. Each one of us does some or the other research in our lifetime for sure. Research can affect a subject both positively and negatively and can be constructive or destructive in nature.

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## **2.5 Significance of Research**

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Research provides all necessary information in field work, study or operation before we begin working on it. For example, most companies do research before beginning a project in order to get a basic idea about the things they will need to do for the project. Research also helps them get acquainted with the processes and resources involved and reception from the market. This information helps in the successful outcome of the project. Sometimes, there are in-built problems in a process or a project that is hard to discover. Research helps us find the root cause and associated elements of a process. The end result of such a research invokes a demand for change and sometimes is successful in producing changes as well.

Only through research can new inventions and discoveries come into life. Research has made ground breaking discoveries and development in the field of health, nutrition, food technology and medicine. These things have improved the life expectancy and health conditions of human race in all parts of the world and helped eradicate diseases like polio, smallpox completely. Diseases that were untreatable are now history, as new and new inventions and research in the field of medicine have led to the advent of drugs that not only treat the once-incurable diseases, but also prevent them from recurring. It has been proved time and again that many of established facts

and known truths are just cover ups. Research is needed to investigate and expose these and bring out the truth.

Research about our planets history and human history has enabled us to learn and understand more about our forefathers and helped us learn from their mistakes and absorb good things from their life. Research about the planet's history and existence has told us a lot about how things will shape up in years to come and how we need to respect our planet and work closely together to stop global warming and other scenarios of destruction. This helps us in understanding the work of artists in literature, paintings, sculptures and everything that can be attributed with artistic touch. If no research is conducted into any of these, we will never be able to understand any of these as per the artist's imagination. Also, a lot of great artistic work is hidden in the shadows of history, which needs to be drawn out.

In addition to what has been stated above, the significance of research can also be understood keeping in view the following points:

- To philosophers and thinkers, research may mean the outlet for new ideas and insights,
- To literary men and women, research may mean the development of new styles and creative work,
- To analysts and intellectuals, research may mean the generalization of new theories,
- To those students who are to write a Ph.D. thesis, research may mean a careerism or a way to attain a high position in the social structure, and
- To professionals in research methodology, research may mean a source of livelihood.

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## **2.6. SumUp:**

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Thus, research is the fountain of knowledge for the sake of knowledge and an important source of providing guidelines for solving different business, government 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.

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## **2.7. Self-Assessment Questions:**

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1. Write about various forms of research.
2. State and explain the purpose of research
3. Describe the importance and significance of research
  - a) Scientific research
  - b) Artistic research

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## **2.8 References**

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# UNIT - I

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## Lesson - 3 Pure and Applied Research

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### Structure

- 3.0 Objectives
- 3.1 Introduction
- 3.2 Pure and Applied research
  - 3.2.1. Pure Research
  - 3.2.2 Applied Research
- 3.3 Steps in conducting research
  - 3.3.1 Observations and Formation of the topic
  - 3.3.2 Hypothesis
  - 3.3.3 Conceptual definition
  - 3.3.4 Operational definition
  - 3.3.5 Gathering Data
  - 3.3.6 Analysis of Data
  - 3.3.7 Data Interpretation
  - 3.3.8 Test, revising of hypothesis
  - 3.3.9 Conclusion
- 3.4 Interdisciplinary Research
- 3.5 Sum Up
- 3.6 Self Assessment Questions
- 3.7 References

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### 3.0 Objectives

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After reading this lesson, you will be able:

- ✓ to understand the difference between pure and applied research
- ✓ to identify various steps in conducting research
- ✓ to know the meaning of the interdisciplinary research

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### 3.1 Introduction

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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. It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories. In this lesson, an attempt has been made to distinguish pure and applied research and note the steps in conducting research.

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### 3.2 Pure and Applied Research

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#### 3.2.1 Pure research

Basic research or pure research or fundamental research is a systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena without specific applications or products in mind. It includes all branches of

science and engineering. Basic research has been described as arising out of curiosity. It lays the foundation for advancements in knowledge that lead to applied gains later on, occasionally as a result of unexpected discoveries. The International Council for Science, in a December 2004 position statement, urged support for and adequate public investment in basic research, stating that basic science, innovation, and development are intertwined. Pure research advances fundamental knowledge about the human world. It focuses on refuting or supporting theories that explain how this world operates, what makes things happen, why social relations are a certain way, and why society changes. Pure research is the source of most new scientific ideas and ways of thinking about the world. It can be exploratory, descriptive, or explanatory, however, explanatory research is the most common.

Pure research generates new ideas, principles and theories, which may not be immediately utilised, though are the foundations of modern progress and development in different fields. Today's computers could not exist without the pure research in mathematics conducted over a century ago, for which there was no known practical application at that time. Pure research rarely helps practitioners directly with their everyday concerns. Nevertheless, it stimulates new ways of thinking about deviance that have the potential to revolutionise and dramatically improve how specialists deal with a problem. A new idea or fundamental knowledge is not generated only by pure research, but pure research can build new knowledge. In any case, pure research is essential for nourishing the expansion of knowledge.

### **3.2.2 Applied research**

Applied research is a form of systematic inquiry involving the practical application of science. It accesses and uses some part of the research communities' accumulated theories, knowledge, methods, and techniques, for a specific, often state, business, or client-driven purpose. Applied research deals with solving practical problems and generally employs empirical methodologies. Because applied research resides in the messy real world, strict research protocols may need to be relaxed. For example, it may be impossible to use a random sample. Thus, transparency in the methodology is crucial. Implications for interpretation of results brought about by relaxing an otherwise strict canon of methodology should also be considered.

Empirical evidence is a source of knowledge acquired by means of observation or experimentation. Empirical evidence is information that justifies a belief in the truth or falsity of an empirical claim. In the empiricist view, one can only claim to have knowledge when one has a true belief based on empirical evidence. This stands in contrast to the rationalist view under which reason or reflection alone is considered to be evidence for the truth or falsity of some propositions. The senses are the primary source of empirical evidence. Although other sources of evidence, such as memory, and the testimony of others ultimately trace back to some sensory experience, they are considered to be secondary, or indirect.

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### **3.3 Steps in conducting research:**

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Generally, research is understood to follow a certain structural process. Though step order may vary depending on the subject matter and researcher. The following steps are usually part of most formal research, both basic and applied:

**3.3.1 Observations and Formation of the topic:**

This step consists of the subject area of one's interest and following that subject area to conduct subject related research. The subject area should not be randomly chosen since it requires reading a vast amount of literature on the topic to determine the gap in the literature the researcher intends to narrow. A keen interest in the chosen subject area is advisable. The research will have to be justified by linking its importance to already existing knowledge about the topic.

**3.3.2 Hypothesis:**

Hypothesis is a testable prediction which designates the relationship between two or more variables.

**3.3.3 Conceptual definition:**

In this step one has to provide description of concepts by relating it to other concepts used in the research problem.

**3.3.4 Operational definition:**

This step will take care of the details in regards to defining the variables and how they will be measured/assessed in the study.

**3.3.5 Gathering of data:**

This step consist of identifying a population and selecting samples, gathering information from and/or about these samples by using specific research instruments in the research problem. The instruments used for data collection must be valid and reliable.

**3.3.6 Analysis of data:**

Involves breaking down the individual pieces of data in order to draw conclusions about it.

**3.3.7 Data Interpretation:**

This can be represented through tables, figures and pictures, and then described in words.

**3.3.8 Test, revising of hypothesis:**

After completion of the research study and data analysis the stating hypothesis will be tested and conform or rewrite the alternative hypothesis if the stating hypothesis has been rejected.

**3.3.9 Conclusion, reiteration if necessary**

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## **3.4 Interdisciplinary research**

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Interdisciplinary research has a collaborative focus and blends and integrates research between disciplines. Researchers from two or more disciplines work together and create a shared discourse about the research problem. Sometimes this offers a vantage point from which to interrogate the core assumptions of a discipline and to trace or even redraw its boundaries. Library science (often termed library studies or library and information science) is an interdisciplinary or multidisciplinary field that applies the practices, perspectives, and tools of management, information technology, education, and other areas to libraries; the collection, organization, preservation, and dissemination of information resources; and the political economy of information. The

first American school for library science was founded by Melvil Dewey at Columbia University in 1887. It is an aspect of the broader field of librarianship.

Historically, library science has also included archival science. This includes how information resources are organized to serve the needs of select user group, how people interact with classification systems and technology, how information is acquired, evaluated and applied by people in and outside of libraries as well as cross-culturally, how people are trained and educated for careers in libraries, the ethics that guide library service and organization, the legal status of libraries and information resources, and the applied science of computer technology used in documentation and records management.

There is no generally agreed-upon distinction between the terms library science, librarianship, and library and information science, and to a certain extent they are interchangeable, perhaps differing most significantly in connotation. The term library and information science (LIS) is most often used; most librarians consider it as only a terminological variation, intended to emphasize the scientific and technical foundations of the subject and its relationship with information science. LIS should not be confused with information theory, the mathematical study of the concept of information. Library and information science can also be seen as an integration of the two fields' library science and information science, which were separate at one point. Library philosophy has been contrasted with library science as the study of the aims and justifications of librarianship as opposed to the development and refinement of techniques.

Recent studies surveying research trends in the years 2002-'06 at various information science departments worldwide has found that a clear trend was identified in Masters theses and doctoral dissertations of social aspects of information moving into the spotlight. Many studies and research findings indicate that there is a relatively clear division of research topics between the studies conducted in various information studies departments and those conducted in other departments that study information. The LIS scholars focus on the information user, other fields, headed by business administration, computer science, education and communication, focus on the system, on information technology, the information industry and the management of information.

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### **3.5 Sum Up:**

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Basic research or pure research or fundamental research is a systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena without specific applications or products in mind. It includes all branches of science and engineering. Applied research is a form of systematic inquiry involving the practical application of science. It accesses and uses some part of the research communities' accumulated theories, knowledge, methods, and techniques, for a specific, often state, business, or client-driven purpose. Applied research deals with solving practical problems and generally employs empirical methodologies. Interdisciplinary research has a collaborative focus and blends and integrates research between disciplines.

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### **3.6 Self Assessment Questions:**

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1. Distinguish between pure and applied research
2. What are the steps in conducting research
  - a) Interdisciplinary research
  - b) Hypothesis

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### 3.7 References

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# UNIT- I

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## Lesson - 4 Scientific method and Research methodology

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### Structure

- 4.0 Objectives
- 4.1 Introduction
- 4.2 Scientific Method and Research
- 4.3 Importance of research methods to solve research problems
- 4.4 Indian researchers and their problems
- 4.5 Sum Up
- 4.6 Self-Assessment Questions
- 4.7 References

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### 4.0 Objectives

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After reading this lesson, you will be able

- ✓ to understand the research and scientific methods
- ✓ to know the importance of research methods to done research
- ✓ to understand the motivations and approaches of research
- ✓ to know the problems of Indian researchers

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### 4.1 Introduction:

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Research methods may be understood as all those methods or 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. Since the object of research, particularly the applied research, it to arrive at a solution for a given problem, the available data and the unknown aspects of the problem have to be related to each other to make a solution possible. Here an attempt has been made to explain the need for scientific method for conducting research and importance of research methods to done research. Further, it is described the major problems faced by the Indian researcher.

### Types of research methods:

The following are the main three types of research methods. They are.....

- i. **The first type:**

It includes those research methods or statistical techniques which are concerned with the collection of data. These methods are used where the data already available are not sufficient to analyse the research problem.

**ii. The second type:**

It consists of those statistical techniques which are used for establishing relationships between the data and the unknown variables.

**iii. The third type:**

It consists of research methods or statistical techniques which are used to evaluate the accuracy of the results obtained.

**Distinction between research methodology and methods:**

Research methodology 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 or techniques but also the methodology. Researchers not only need to know how to develop certain indices or tests, how to calculate the mean, the mode, the median or the standard deviation or chi-square, how to apply particular research techniques, but they also need to know which of these methods or techniques, are relevant and which are not, and what would they mean and indicate and why. Researchers also need to understand the assumptions underlying various techniques and they need to know the criteria by which they can decide that certain techniques and procedures will be applicable to certain problems and others will not. All this means that it is necessary for the researcher to design his methodology for his problem as the same may differ from problem to problem.

The scope of research methodology is wider than that of research methods. Thus, 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, in 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 analysing 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.

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**4.2 Scientific Method and Research:**

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“Research without scientific method is fruits less tree and flowers less plant”. For a clear perception of the term research, one should know the meaning of scientific method. The two terms, research and scientific methods are closely related. Research, as we have



already stated, can be termed as “an inquiry into the nature of, the reasons for, and the consequences of any particular set of circumstances, whether these circumstances are experimentally controlled or recorded just as they occur. Further, research implies the researcher is interested in more than particular results; he is interested in the repeatability of the results and in their extension to more complicated and general situations. On the other hand, the philosophy common to all research methods and techniques, although they may vary considerably from one science to another, is usually given the name of scientific method. In this context, Karl Pearson writes, “The scientific method is one and the same in the branches and that method is the method of all logically trained minds ... the unity of all sciences consists alone in its methods, not its material; the man who classifies facts of any kind whatever, who sees their mutual relation and describes their sequences, is applying the Scientific Method and is a man of science.”

Scientific method is the pursuit of truth as determined by logical considerations. The ideal of science is to achieve a systematic interrelation of facts. Scientific method attempts to achieve “this ideal by experimentation, observation, logical arguments from accepted postulates and a combination of these three in varying proportions.” In scientific method, logic aids in formulating propositions explicitly and accurately so that their possible alternatives become clear. Further, logic develops the consequences of such alternatives, and when these are compared with observable phenomena, it becomes possible for the researcher or the scientist to state which alternative is most in harmony with the observed facts. All this is done through experimentation and survey investigations which constitute the integral parts of scientific method.

Experimentation is done to test hypotheses and to discover new relationships if any, among variables. But the conclusions drawn on the basis of experimental data are generally criticised for faulty assumptions, poorly designed experiments, badly executed experiments or faulty interpretations. As such the researcher must pay all possible attention while developing the experimental design and must state only probable inferences. The purpose of survey investigations may also be to provide scientifically gathered information to work as a basis for the researchers for their conclusions.

#### **Scientific method and basic postulates:**

The scientific method is based on certain basic postulates. They are.....

- It presupposes ethical neutrality,
- It results into probabilistic predictions,
- It relies on empirical evidence,
- It utilizes relevant concepts,
- It is committed to only objective considerations,
- Its methodology is made known to all concerned for critical scrutiny and for use in testing the conclusions through replication and,
- It aims at formulating most general axioms or what can be termed as scientific theories.

Thus, the scientific method encourages a rigorous, impersonal mode of procedure dictated by the demands of logic and objective procedure. Accordingly, scientific method implies an objective, logical and systematic method, i.e., a method free from personal bias or prejudice, a method to ascertain demonstrable qualities of a phenomenon capable of being verified, a method wherein the researcher is guided by the rules of logical reasoning, a method wherein the investigation proceeds in an orderly manner and a method that implies internal consistency.

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#### **4.3 Importance of research methods to solve research problems:**

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The study of research methodology gives the researcher the necessary training in gathering material and arranging or card-indexing them, participation in the field work when required, and also training in techniques for the collection of data appropriate to particular problems, in the use of statistics, questionnaires and controlled experimentation and in recording evidence, sorting it out and interpreting it. In fact, importance of knowing the methodology of research or how research is done stems from the following considerations:

- ❖ The knowledge of methodology provides good training especially to the new research worker and enables him to do better research. It helps him to develop disciplined thinking or a 'bent of mind' to observe the field objectively. Hence, those aspiring for careerism in research must develop the skill of using research techniques and must thoroughly understand the logic behind them.
- ❖ Knowledge of how to do research will inculcate the ability to evaluate and use research results with reasonable confidence. In other words, we can state that the knowledge of research methodology is helpful in various fields such as government or business administration, community development and social work where persons are increasingly called upon to evaluate and use research results for action.
- ❖ When one knows how research is done, then one may have the satisfaction of acquiring a new intellectual tool which can become a way of looking at the world and of judging everyday experience. Accordingly, it enables us to make intelligent decisions concerning problems facing us in practical life at different points of time. Thus, the knowledge of research methodology provides tools to take at things in life objectively.

In this scientific age, all of us are in many ways consumers of research results and we can use them intelligently provided we are able to judge the adequacy of the methods by which they have been obtained. The knowledge of methodology helps the consumer of research results to evaluate them and enables him to take rational decisions.

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#### **4.4 Problems Encountered by Researchers in India**

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Researchers in India, particularly those engaged in empirical research, are facing several problems. Some of the important problems are as follows:

**1. The lack of a scientific training in the methodology of research:**

It is a great impediment for researchers in our country. There is paucity of competent researchers. Many researchers take a leap in the dark without knowing research methods. Most of the work, which goes in the name of research is not methodologically sound. Research by many researchers and even to their guides, is mostly a scissor and paste job without any insight shed on the collated materials. The consequence is obvious, viz., the research results, quite often, do not reflect the reality or realities. Thus, a systematic study of research methodology is an urgent necessity. Before undertaking research projects, researchers should be well equipped with all the methodological aspects. As such, efforts should be made to provide short duration intensive courses for meeting this requirement.

**2. Lack of coordination among various research bodies:**

There is insufficient interaction between the university research departments on one side and business establishments, government departments and research institutions on the other side. Great deals of primary data of non-confidential nature remain untouched by the researchers for want of proper contacts. Efforts should be made to develop satisfactory liaison among all concerned for better and realistic researches. There is need for developing some mechanisms of a university and industry interaction programme so that academicians can get ideas from practitioners on what needs to be researched and practitioners can apply the research done by the academics.

**3. Information supplied by the business people are not matched:**

Most of the business units in India do not have the confidence that the materials supplied by them to researchers will not be misused and as such they are often reluctant in supplying the needed information to researchers. The concept of secrecy seems to be sacrosanct to business organisations in the country so much so that it proves an impermeable barrier to researchers. Thus, there is the need for generating the confidence that the data obtained from a business unit will not be misused.

**4. Overlapping of research studies one another:**

Research studies overlapping one another are undertaken quite often for want of adequate information. This results in duplication and fritters away resources. This problem can be solved by proper compilation and revision, at regular intervals, of a list of subjects on which and the places where the research is going on. Due attention should be given toward identification of research problems in various disciplines of applied science which are of immediate concern to the industries.

**5. Absence of code of conduct for researchers:**

There is no a clear and transparent code of conduct for researchers and inter-university and interdepartmental rivalries are also quite common. Hence, there is need for developing a code of conduct for researchers which, if adhered sincerely, can win over this problem. Many researchers in India also face the difficulty of

adequate and timely secretarial assistance, including computer assistance. This causes unnecessary delays in the completion of research studies. All possible efforts are made in this direction so that efficient secretarial assistance is made available to researchers and that too well in time. University Grants Commission must play a dynamic role in solving this difficulty.

**6. Information from libraries are not easily accessed:**

Library management and functioning is not satisfactory at many places and much of the time and energy of researchers are spent in tracing out the books, journals, reports, etc., rather than in tracing out relevant material from them. There is also the problem that many of our libraries are not able to get copies of old and new Acts or Rules, reports and other government publications in time. Thus, efforts should be made for the regular and speedy supply of all governmental publications to reach our libraries.

**7. Information or data are not timely published or available:**

There is the difficulty of timely availability of published data from various government and other agencies doing this job in our country. Researcher also faces the problem on account of the fact that the published data vary quite significantly because of differences in coverage by the concerning agencies. There may, at times, take place the problem of conceptualization and also problems relating to the process of data collection and related things.

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#### **4.5 Sum Up:**

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Thus, research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. It is necessary for the researcher to know not only the research methods or techniques but also the methodology. Further, the scientific method encourages a rigorous, impersonal mode of procedure dictated by the demands of logic and objective procedure. Accordingly, scientific method implies an objective, logical and systematic method, i.e., a method free from personal bias or prejudice, a method to ascertain demonstrable qualities of a phenomenon capable of being verified, a method wherein the researcher is guided by the rules of logical reasoning, a method wherein the investigation proceeds in an orderly manner and a method that implies internal consistency. The knowledge of methodology helps the consumer of research results to evaluate them and enables him to take rational decisions.

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#### **4.6 Self-Assessment Questions:**

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1. How scientific method is closely related to research methodology?
2. Describe the importance of research methods to solve research problems
3. Explain the problems faced by Indian researchers
4. Write a short note on the following:
  - a. Types of research methods

- b. Research methods
- c. Research methodology
- d. Scientific method
- e. Experimental method

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## UNIT- II

A research problem is an area of concern where there is a gap in the knowledge base needed. It is a question that a researcher wants to answer or a problem that a researcher wants to solve. The research problem is a general statement of an issue meriting research. Identification of a research problem is the first and most important step in research process. The first lesson in this unit explains definition and sources of research problem and how to identify the same.

The second lesson discusses identification of variables, formulation of hypotheses and its testing methods. Research design is the overall plan for connecting the conceptual research problems to the pertinent and achievable empirical research. Research designs are plans and procedures for research that span the decisions from broad assumption to detailed methods of data collection, analysis and presentation. Third lesson of this unit explains everything about research design.

After designing the research, the first and foremost job work of a researcher is to collect the data. Generally all items in any field of study constitute a universe. Many a time it is not possible to examine every item in the population, and sometimes it is possible to obtain sufficiently accurate results by studying only a part of total population. Sampling is concerned with the selection of a subset of individuals from within a statistical population to estimate characteristics of the whole population. The fourth lesson of this unit explains various sampling techniques and their deployment depending upon the research problem.

## UNIT – II

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# LESSON – 1

## IDENTIFICATION OF RESEARCH PROBLEM

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### STRUCTURE

#### 1.0 Aim and Objectives

#### 1.1 Introduction

#### 1.2 Defining the Research Problem

#### 1.3 Selecting the Problem

#### 1.4 Necessity of defining the problem

#### 1.5 Technique involved in defining a problem

##### 1.5.1 Statement of the problem in a general way

##### 1.5.2 Understanding the nature of the problem

##### 1.5.3 Surveying the available literature

##### 1.5.4 Developing the ideas through discussions

##### 1.5.5 Rephrasing the research problem

#### 1.6 Sum Up

#### 1.7 Self-Assessment Questions

#### 1.8 References

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### 1.0 AIM AND OBJECTIVES:

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After reading this lesson, you will be able

- ✓ to understand the definitions and selection of research problem
- ✓ to know the necessity of defining the research problem
- ✓ to know how to identify the research problem
- ✓ to understand techniques involved in defining a research problem

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### 1.1 INTRODUCTION:

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In research process, the first and foremost step happens to be that of selecting and properly defining a research problem. A researcher must find the problem and formulate it so that it becomes susceptible to research. Like a medical doctor, a researcher must examine all the symptoms concerning a problem before he can diagnose correctly. To define a problem correctly, a researcher must know: what a research problem is. For that a research problem,

in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same. In this lesson, an attempt has been made to understand the definitions, selection and the necessity of defining the research problem. Further, it is explained how to identify the research problem and to understand the techniques involved in defining a research problem.

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## 1.2 DEFINING THE RESEARCH PROBLEM

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Research design has been defined by different social scientists in different terms.

(i) Miller has defined “Designed research as the planned sequence of the entire process involved in conducting design is a catalogue of the various phases and facts relating to the formulation of a research effort. It is an arrangement of the essential conditions for collection and analysis of data in a form that aims to combine relevance to research purpose”.

(ii) According to F.N. Kerlinger, ‘Research Design’ is the plan, structure, and strategy of investigation conceived so as to obtain answers to research questions and to control ‘variance’. The terms, plan, structure and strategy need to be defined further to make the structure and procedure of research design more clearly. The ‘plan’ includes everything to be done by the investigator in research procedure that is from writing the hypothesis, defining the hypothesis operationally and collecting data to the final analysis of data.

Thus, it means the overall scheme or programme of research. The term structure is taken to mean more specifically the outline scheme or the paradigm of the specific research project. By paradigm we mean a structure or a guiding model that regulates the operationalisation of the variables. Operationalization of variables means outlining them or defining them in terms of the indices or indicators, and specifying their relationship or juxtaposition to each other. When we draw diagrams that outline the variables and their relation and juxtaposition we build structural schemes for accomplishing operational research purposes. The term ‘strategy’ refers to the methods to be used to gather and analyse the data. After fixing up the objectives of the research project one has to specify the procedures and methods of investigation. One has also to apprehend the problems that may emerge and decide the steps to be taken to tackle the problem.

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## 1.3 SELECTING THE RESEARCH PROBLEM

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The research problem undertaken for study must be carefully selected. The task is a difficult one, although it may not appear to be so. Help may be taken from a research guide in this connection. Nevertheless, every researcher must find out his own salvation for research problems cannot be borrowed. A problem must spring from the researcher’s mind like a plant springing from its own seed. If our eyes need glasses, it is not the optician alone who decides about the number of the lens we require. We have to see ourselves and enable him to prescribe for us the right number by cooperating with him. Thus, a research guide can at the most only help a researcher choose a subject. However, the following points may be observed by a researcher in selecting a research problem or a subject for research:

- a) Subject which is overdone should not be normally chosen, for it will be a difficult task to throw any new light in such a case.
- b) Controversial subject should not become the choice of an average researcher.
- c) Too narrow or too vague problems should be avoided.
- d) The subject selected for research should be familiar and feasible so that the related research material or sources of research are within one’s reach.



- Even then it is quite difficult to supply definitive ideas concerning how a researcher should obtain ideas for his research.
- e) The importance of the subject, the qualifications and the training of a researcher, the costs involved and the time factors are few other criteria that must also be considered in selecting a problem.
  - f) The selection of a problem must be preceded by a preliminary study. This may not be necessary when the problem requires the conduct of a research closely similar to one that has already been done.

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## **1.4 NECESSITY OF DEFINING RESEARCH PROBLEM**

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Quite often we all hear that a problem clearly stated is a problem half solved. This statement signifies the need for defining a research problem. The problem to be investigated must be defined unambiguously for that will help to discriminate relevant data from the irrelevant ones. A proper definition of research problem will enable the researcher to be on the track whereas an ill-defined problem may create hurdles. Questions like: What data are to be collected? What characteristics of data are relevant and need to be studied? What relations are to be explored? What techniques are to be used for the purpose? and similar other questions crop up in the mind of the researcher who can well plan his strategy and find answers to all such questions only when the research problem has been well defined. Thus, defining a research problem properly is a prerequisite for any study and is a step of the highest importance. In fact, formulation of a problem is often more essential than its solution. It is only on careful detailing the research problem that we can work out the research design and can smoothly carry on all the consequential steps involved while doing research.

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## **1.5 TECHNIQUE INVOLVED IN DEFINING RESEARCH PROBLEM**

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Let us start with the question: What does one mean when he/she wants to define a research problem? The answer may be that one wants to state the problem along with the bounds within which it is to be studied. In other words, defining a problem involves the task of laying down boundaries within which a researcher shall study the problem with a pre-determined objective in view. How to define a research problem is undoubtedly a herculean task. However, it is a task that must be tackled intelligently to avoid the perplexity encountered in a research operation. The usual approach is that the researcher should himself pose a question and set-up techniques and procedures for throwing light on the question concerned for formulating or defining the research problem. But such an approach generally does not produce definitive results because the question phrased in such a fashion is usually in broad general terms and as such may not be in a form suitable for testing. Defining a research problem properly and clearly is a crucial part of a research study and must in no case be accomplished hurriedly. However, in practice this is frequently overlooked which causes a lot of problems later on. Hence, the research problem should be defined in a systematic manner, giving due weight-age to all relating points. The technique for the purpose involves the undertaking of the following steps generally one after the other:

### **1.5.1 STATEMENT OF THE PROBLEM IN A GENERAL WAY:**

First of all the problem should be stated in a broad general way, keeping in view either some practical concern or some scientific or intellectual interest. For this purpose, the researcher must immerse himself thoroughly in the subject matter concerning which he wishes to pose a problem. In case of social research, it is considered advisable to do some field observation and as such the researcher may undertake some sort of preliminary survey or what is often called *pilot survey*. Then the researcher can himself state the problem or he can seek the guidance of the guide or the subject expert in accomplishing this task. Often, the

guide puts forth the problem in general terms, and it is then up to the researcher to narrow it down and phrase the problem in operational terms. In case there is some directive from an organisational authority, the problem then can be stated accordingly. The problem stated in a broad general way may contain various ambiguities which must be resolved by cool thinking and rethinking over the problem. At the same time the feasibility of a particular solution has to be considered and the same should be kept in view while stating the problem.

### **1.5.2 UNDERSTANDING THE NATURE OF THE PROBLEM:**

The next step in defining the problem is to understand its origin and nature clearly. The best way of understanding the problem is to discuss it with those who first raised it in order to find out how the problem originally came about and with what objectives in view. If the researcher has stated the problem himself, he should consider once again all those points that induced him to make a general statement concerning the problem. For a better also keep in view the environment within which the problem is to be studied and understood.

### **1.5.3 SURVEYING THE AVAILABLE LITERATURE:**

All available literature concerning the problem at hand must necessarily be surveyed and examined before a definition of the research problem is given. This means that the researcher must be well-conversant with relevant theories in the field, reports and records as also all other relevant literature. He must devote sufficient time in reviewing of research already undertaken on related problems. This is done to find out what data and other materials, if any, are available for operational purposes. "Knowing what data are available often serves to narrow the problem itself as well as the technique that might be used. This would also help a researcher to know if there are certain gaps in the theories, or whether the existing theories applicable to the problem under study are inconsistent with each other, or whether the findings of the different studies do not follow a pattern consistent with the theoretical expectations and so on. All this will enable a researcher to take new strides in the field for furtherance of knowledge i.e., he can move up starting from the existing premise. Studies on related problems are useful for indicating the type of difficulties that may be encountered in the present study as also the possible analytical shortcomings. At times such studies may also suggest useful and even new lines of approach to the present problem.

### **1.5.4 DEVELOPING THE IDEAS THROUGH DISCUSSIONS:**

Discussion on concerning problem often produces useful information. Various new ideas can be developed through such an exercise. Hence, a researcher must discuss his problem with his colleagues and others who have enough experience in the same area or in working on similar problems. This is quite often known as an *experience survey*. People with rich experience are in a position to enlighten the researcher on different aspects of his proposed study and their advice and comments are usually invaluable to the researcher. They help him sharpen his focus of attention on specific aspects within the field. Discussions with such persons should notably be confined to the formulation of the specific problem at hand, but should also be concerned with the general approach to the given problem, techniques that might be used, possible solutions, etc.

### 1.5.5 REPHRASING THE RESEARCH PROBLEM:

Finally, the researcher must sit to rephrase the research problem into a working proposition. Once the nature of the problem has been clearly understood, the environment has been defined, discussions over the problem have taken place and the available literature has been surveyed and examined, rephrasing the problem into analytical or operational terms is not a difficult task. Through rephrasing, the researcher puts the research problem in as specific terms as possible so that it may become operationally viable and may help in the development of working hypotheses.

In addition to what has been stated above, the following points must also be observed while defining a research problem:

- Technical terms and words or phrases, with special meanings used in the statement of the problem, should be clearly defined.
- Basic assumptions or postulates (if any) relating to the research problem should be clearly stated.
- A straight forward statement of the value of the investigation (i.e., the criteria for the selection of the problem) should be provided.
- The suitability of the time period and the sources of data available must also be considered by the researcher in defining the problem.
- The scope of the investigation or the limits within which the problem is to be studied must be mentioned explicitly in defining a research problem.

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### 1.6 SUM UP:

It may be concluded that the task of defining a research problem, very often, follows sequential pattern and the problem is stated in a general way, the ambiguities are resolved, thinking and rethinking process result in a more specific formulation of the problem so that it may be a realistic one in terms of the available data and resources and is also analytically and meaningful. All these results in a well-defined research problem, that is not only meaningful from an operational point of view, but is equally capable of paving the way for the development of working on hypotheses and for means of solving the problem itself.

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### 1.7 SELF-ASSESSMENT QUESTIONS:

1. Define research problem? Write about the necessity of defining a research problem?
2. What are the techniques involved in research problem
  - a) Selection of research problem
  - b) Pilot Survey

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# UNIT - II

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## Lesson - 2 Formulation and Testing of Hypothesis

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### Structure

- 2.0 Objectives
- 2.1 Introduction
- 2.2 Definition of hypothesis
- 2.3 Meaning of Hypothesis testing
- 2.4 Concepts concerning testing of hypotheses
- 2.5 The level of significance
- 2.6 Sum Up
- 2.7 Self-Assessment Questions
- 2.8 References

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### 2.0 Objectives:

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After reading this lesson, you will be able:

- ✓ To know the definitions of hypothesis
- ✓ to know what is hypothesis testing
- ✓ to understand null and alternate hypotheses
- ✓ to understand the level of significance

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### 2.1 Introduction:

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A statistical hypothesis test is a method of statistical inference using data from a scientific study. In statistics, a result is called statistically significant if it has been predicted as unlikely to have occurred by chance alone, according to a pre-determined threshold probability, the significance level. The phrase "test of significance" was coined by statistician Ronald Fisher. These tests are used in determining what outcomes of a study would lead to a rejection of the null hypothesis for a pre-specified level of significance. This can help to decide whether results contain enough information to cast doubt on conventional wisdom and given that conventional wisdom has been used to establish the null hypothesis. The critical region of a hypothesis test is the set of all outcomes which cause the null hypothesis to be rejected in favor of the alternative hypothesis. Statistical hypothesis testing is sometimes called confirmatory data analysis, in contrast to exploratory data analysis, which may not have pre-specified

hypotheses. In this lesson an attempt has been made to define the hypothesis and describe the concepts and test the significance level of hypothesis.

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## **2.2 Definition of Hypothesis:**

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A tentative solution suggested to a problem is called a hypothesis. McGuigan has defined hypothesis as a testable statement of a potential relationship between two or more variables. A hypothesis is usually framed depending on one or more of the following sources:

- i) Facts established by previous investigations in the related areas,
- ii) Through the investigator's experience and observation, and
- iii) Through the investigator's reasoning, insight and logical derivation from a theory.

For any reason, if the investigator cannot make use of any of the above sources to frame a hypothesis, he will have to resort to 'Null hypothesis' which assumes 'no relationship' between the variables under consideration. McGuigan suggested the following criteria to frame a good hypothesis.

- The hypothesis must be an adequate answer to the specific problem that demanded an answer.
- The hypothesis should have logical simplicity.
- The hypothesis should be expressed in a quantified form or be susceptible to convenient quantification.
- The hypothesis must be verifiable.
- The hypothesis must be stated in such a way as to allow it to be refuted.

Hypothesis is usually considered as the principal instrument in research. Its main function is to suggest new experiments and observations. In fact, many experiments are carried out with the deliberate object of testing hypotheses. Decision-makers often face situations wherein they are interested in testing hypotheses on the basis of available information and then take decisions on the basis of such testing. In social science, where direct knowledge of population parameters is rare, hypothesis testing is the often used strategy for deciding whether a sample data offer such support for a hypothesis that generalisation can be made. Thus hypothesis testing enables us to make probability statements about population parameters. The hypothesis may not be proved absolutely, but in practice it is accepted if it has withstood a critical testing. Before we explain how hypotheses are tested through different tests meant for the purpose, it will be appropriate to explain clearly the meaning of a hypothesis and the related concepts for better understanding of the hypothesis testing techniques.

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## **2.3 Meaning of hypothesis testing:**

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In general, when one talks about hypothesis, one simply means a mere assumption or some supposition to be proved or disproved. But for a researcher hypothesis is a formal question that researcher intends to resolve. Thus a hypothesis may be defined as a proposition or a set of proposition set forth as an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation or accepted as highly probable in the light of established facts. Quite often a research hypothesis is a predictive statement,

capable of being tested by scientific methods, that relates an independent variable to some dependent variable.

These are hypotheses capable of being objectively verified and tested. Thus, we may conclude that a hypothesis states what we are looking for and it is a proposition which can be put to a test to characteristics of hypothesis: Hypothesis must possess the following characteristics:

- Hypothesis should be clear and precise.
- Hypothesis should be capable of being tested.
- Hypothesis should state relationship between variables.
- Hypothesis should be consistent with most known facts.
- Hypothesis should be amenable to testing within a reasonable time.
- Hypothesis must explain the facts that gave rise to the need for explanation.
- Hypothesis should be limited in scope and must be specific
- Hypothesis should be stated as far as possible in most simple terms.

## 2.4 Concepts concerning testing of hypotheses

Basic concepts in the context of testing of hypotheses need to be explained.

### ❖ Null hypothesis and alternative hypothesis:

In the context of statistical analysis, we often talk about null hypothesis and alternative hypothesis. If we are to compare I Statement with II Statement about its superiority and if we proceed on the assumption that both Statements are equally good, then this assumption is termed as the null hypothesis. As against this, we may think that the I Statement is superior or the II Statement is inferior, we are then stating what is termed as alternative hypothesis.

- The null hypothesis is generally symbolised as  $H_0$ , and
- The alternative hypothesis is symbolised as  $H_1$

Suppose we want to test the hypothesis that the population mean ( $\mu$ ) is equal to the hypothesized mean ( $\mu_0$ ) = 100. Thus we would say that the null hypothesis is that the population mean is equal to the hypothesized mean 100 and symbolically we can express as:

<b><math>H_0 : \mu = \mu_0 = 100</math></b>
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If our sample results do not support this null hypothesis, we should conclude that something else is true. What we conclude rejecting the null hypothesis is known as alternative hypothesis. In other words, the set of alternatives to the null hypothesis is referred to as the alternative hypothesis. If we accept  $H_0$ , then we are rejecting  $H_1$  and if we reject  $H_1$ , then we are accepting  $H_0$ . For  $H_0: \mu = \mu_0 = 100$ , we may consider three possible alternative hypotheses in the following Table.

<b>TABLE</b>	
<b>Alternative Hypothesis</b>	<b>To be read as</b>

$H_1: \mu \neq \mu_0$	The alternative hypothesis is that the population mean is not equal to 100 i.e., it may be more or less than 100
$H_1 : \mu > \mu_0$	The alternative hypothesis is that the population mean is greater than 100
$H_1 : \mu < \mu_0$	The alternative hypothesis is that the population mean is less than 100

The null hypothesis and the alternative hypothesis are chosen before the sample is drawn. In the choice of null hypothesis, the following considerations are usually kept in view: Alternative hypothesis is usually the one which one wishes to prove and the null hypothesis is the one which one wishes to disprove. Thus, a null hypothesis represents the hypothesis we are trying to reject, and alternative hypothesis represents all other possibilities.

If the rejection of a certain hypothesis when it is actually true involves great risk, it is taken as null hypothesis because then the level of significance which is chosen very small. Null hypothesis should always be specific hypothesis i.e., it should not state about or approximately a certain value. Generally, in hypothesis testing we proceed on the basis of null hypothesis, keeping the alternative hypothesis in view. Because the assumption that null hypothesis is true, one can assign the probabilities to different possible sample results, but this cannot be done if we proceed with the alternative hypothesis. Hence the use of null hypothesis is quite frequent.

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## 2.5 The level of significance:

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This is a very important concept in the context of hypothesis testing. It is always some percentage which should be chosen with great care, thought and reason. In case we take the significance level at 5 per cent, then this implies that  $H_0$  will be rejected when the sampling result has a less than 0.05 probability of occurring if  $H_0$  is true. In other words, the 5 per cent level of significance means that researcher is willing to take as much as a 5 per cent risk of rejecting the null hypothesis when  $H_0$  happens to be true. Thus the significance level is the maximum value of the probability of rejecting  $H_0$  when it is true and is usually determined in advance before testing the hypothesis.

- **Decision rule:** This rule is further known as testing of hypothesis. Given a hypothesis  $H_0$  and an alternative hypothesis  $H_1$ , we make a rule which is known as decision rule according to which we accept  $H_0$  ( i.e., reject  $H_1$ ) or reject  $H_0$  (i.e., accept  $H_1$ ). For instance, if ( $H_0$  is that a certain lot is good (there are very few defective items in it) against  $H_1$  that the lot is not good (there are too many defective items in it), then we must decide the number of items to be tested and the criterion for accepting or rejecting the hypothesis. We might test 10 items in the lot and plan our decision saying that if there are none or only 1 defective item among the 10, we will accept  $H_0$  otherwise we will reject  $H_0$ (or accept  $H_1$ ). This sort of basis is known as decision rule.

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## 2.6 Sum Up:

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A statistical hypothesis test is a method of statistical inference using data from a scientific study. In statistics, a result is called statistically significant if it has been predicted as unlikely to have occurred by chance alone, according to a pre-determined threshold probability, the significance level. Hypothesis is usually considered as the principal instrument in research. Its main function is to suggest new experiments and observations. Further, we may conclude that a hypothesis states what we are looking for and it is a proposition which can be put to a test to characteristics of hypothesis.

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### 2.7 Self-Assessment Questions:

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1. Define the hypothesis and explain the meaning of hypothesis
2. Describe the null and alternative hypothesis with suitable examples
  - a) Level of significance
  - b) Decision rule

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# UNIT - II

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## Lesson - 3 Steps in Research Design

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### Structure

- 3.0 Objectives
- 3.1 Introduction
- 3.2 Meaning of research design
- 3.3 Need for research design
- 3.4 Research design and features
- 3.5 Research design and important concepts
  - 3.5.1. Extraneous variable
  - 3.5.2. Dependent and independent variables
  - 3.5.3. Research hypothesis
  - 3.5.4. Experimental and non-experimental hypothesis-testing research
- 3.6 Research design for various types of research studies
  - 3.6.1 Exploratory research studies
  - 3.6.2 Descriptive and diagnostic research studies
  - 3.6.3 Hypothesis-testing research studies
- 3.7 Sum Up
- 3.8 Self-Assessment Questions
- 3.9 References

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### 3.0 Objectives:

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After reading this lesson, you are be able

- ✓ to know the meaning of and need for research design
- ✓ to find out features of a good research design
- ✓ to know important concepts relating to research design
- ✓ to understand the research design for various types of research studies

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### 3.1 Introduction:

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In research process, after identifying a research problem the next step is to design the research project, popularly known as the research design. Research design is needed because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money. A good design is often characterised by adjectives like flexible, appropriate, efficient, and economical. Generally, the design which minimises bias and maximises the reliability of the

data collected and analysed is considered a good design. In this lesson, an attempt has been made to state the meaning of and need for research design and find out features of a good research design. Further it is explained the important concepts relating to research design and the categorisation of research design.

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### **3.2 Meaning of research design:**

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Decisions regarding what, where, when, how much, by what means concerning an investigation constitute a research design. "A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure". In fact, the research design is the conceptual structure within which research is conducted and constitutes the blueprint for the collection, measurement and analysis of data. As such the research design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data. More explicitly, the design decisions happen to be in respect of:

- What is the study about and being made and where will the study be carried out?
- What type of data is required and where can the data be found?
- What periods of time will the study include and what will be the sample design and techniques of data collection?
- How will the data be analysed and style of writing the report?

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### **3.3 Need for research design**

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Research design is needed because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money. Research design stands for advance planning of the methods to be adopted for collecting the relevant data and the techniques to be used in their analysis, keeping in view the objective of the research and the availability of staff, time and money. Preparation of the research design should be done with great care as any error in it may upset the entire project. Research design, in fact, has a great bearing on the reliability of the results arrived at and as such constitutes the firm foundation of the entire edifice of the research work. Even then the need for a well thought out research design is at times not realised by many. The importance which this problem deserves is not given to it. As a result many researches do not serve the purpose for which they are undertaken. In fact, they may even give misleading conclusions. Thoughtlessness in designing the research project may result in rendering the research exercise futile. It is, therefore, imperative that an efficient and appropriate design must be prepared before starting research operations. The design helps the researcher to organize his ideas in a form whereby it will be possible for him to look for flaws and inadequacies. Such a design can even be given to others for their comments and critical evaluation. In the absence of such a course of action, it will be difficult for the critic to provide a comprehensive review of the proposed study.

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### **3.4 Research design and features:**

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A good research design is often characterised by adjectives like flexible, appropriate, efficient, and economical. Generally, the design which minimises bias and maximises the reliability of the information collected and analysed is considered a good design. The design which gives the smallest experimental error is supposed to be the best design in many investigations. Similarly, a design which yields maximal information and provides an opportunity for considering many different aspects of a problem is considered most appropriate and efficient research design in respect of many research problems. Thus, the question of good research design is related to the purpose or objective of the research problem and also with the nature of the problem to be studied. A design may be quite suitable in one case, but may be found wanting in one respect or the other in the context of some other research problem. One single design cannot serve the purpose of all types of research problems. A research design appropriate for a particular research problem, usually involves the consideration of the following factors:

- the sources of obtaining information and the availability and skills of the researcher,
- the objective of the problem to be studied and the nature of the problem to be studied, and
- the availability of time and money for the research work.

If the research study happens to be an exploratory or a formulate one, wherein the major emphasis is on discovery of ideas and insights, the research design most appropriate must be flexible enough to permit the consideration of many different aspects of a phenomenon. But when the purpose of a study is accurate description of a situation or of an association between variables accuracy becomes a major consideration and a research design which minimises bias and maximises the reliability of the evidence collected is considered a good design. Studies involving the testing of a hypothesis of a causal relationship between variables require a design which will permit inferences about causality in addition to the minimisation of bias and maximisation of reliability. But in practice it is the most difficult task to put a particular study in a particular group, for a given research may have in it elements of two or more of the functions of different studies. It is only on the basis of its primary function that a study can be categorised either as an exploratory or descriptive or hypothesis-testing study and accordingly the choice of a research design may be made in case of a particular study. Besides, the availability of time, money, skills of the research staff and the means of obtaining the information must be given due weightage while working out the relevant details of the research design such as experimental design, survey design, sample design and the like.

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### **3.5 Research design and important concepts:**

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Before describing the different research designs, it will be appropriate to explain the various concepts relating to designs so that these may be better and easily understood.

#### **3.5.1. Extraneous variable:**

Independent variables that are not related to the purpose of the study, but may affect the dependent variable are termed as extraneous variables. Suppose the researcher wants to test the hypothesis that there is a relationship between public interest and establishment of public libraries. In this case public interest is an independent variable and establishment of public libraries is a dependent variable. Govt. Policy on public libraries may as well affect the establishment of public libraries, but since it is not related to the purpose of the study undertaken by the researcher, it will be termed as an extraneous variable. Whatever effect is noticed on dependent variable as a result of extraneous variable(s) is technically described as an 'experimental error'. A study must always be so designed that the effect upon the dependent variable is attributed entirely to the independent variable(s), and not to some extraneous variable or variables.

### **3.5.2. Dependent and independent variables:**

A concept which can take on different quantitative values is called a variable. As such the concepts like weight, height, income are all examples of variables. Qualitative phenomena are also quantified on the basis of the presence or absence of the concerning attributes. Phenomena which can take on quantitatively different values even in decimal points are called 'continuous variables'. But all variables are not continuous. If they can only be expressed in integer values, they are non-continuous variables or in statistical language 'discrete variables'. Age of library is an example of continuous variable, but the number of books in that library is an example of non-continuous variable. If one variable depends upon or is a consequence of the other variable, it is termed as a dependent variable, and the variable that is antecedent to the dependent variable is termed as an independent variable.

$$Q=f(X)$$

where,

Q=Dependent variable

X=Independent variable

### **3.5.3 Research hypothesis:**

When a prediction or a hypothesised relationship is to be tested by scientific methods, it is termed as research hypothesis. The research hypothesis is a predictive statement that relates an independent variable to a dependent variable. Usually a research hypothesis must contain, at least, one independent and one dependent variable. Predictive statements which are not to be objectively verified or the relationships that are assumed but not to be tested are not termed research hypotheses.

### **3.5.4 Experimental and non-experimental hypothesis-testing research:**

When the purpose of research is to test a research hypothesis, it is termed as hypothesis-testing research. It can be of the experimental design or of the non-experimental design. Research in which the independent variable is manipulated is termed 'experimental hypothesis-testing research' and a research in which an independent variable is not manipulated is called 'non-experimental hypothesis-testing research'.

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## **3.6 Research design for various types of research studies:**

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Research design for various types of research studies are described here under

### **3.6.1 Exploratory research studies:**

These studies are also termed as formulate research studies. The main purpose of such studies is that of formulating a problem for more precise investigation or of developing the working hypotheses from an operational point of view. The major emphasis in such studies is on the discovery of ideas and insights. As such the research design appropriate for such studies must be flexible enough to provide opportunity for considering different aspects of a problem under study. Inbuilt flexibility in research design is needed because the research problem, broadly defined initially, is transformed into one with more precise meaning in exploratory studies, which fact may necessitate changes in the research procedure for gathering relevant data. The survey of concerning literature happens to be the most simple and fruitful method of formulating precisely the research problem or developing hypothesis. Hypotheses stated by earlier workers may be reviewed and their usefulness be evaluated as a basis for further research. It may also be considered whether the already stated hypotheses suggest new hypothesis. In this way the researcher should review and build upon the work already done by others, but in cases where hypotheses have not yet been formulated, his task is to review the available material for deriving the relevant hypotheses from it.

### **3.6.2 Descriptive and diagnostic research studies:**

Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group whereas diagnostic research studies determine the frequency with which something occurs or its association with something else. The studies concerning whether certain variables are associated are examples of diagnostic research studies. As against this, studies concerned with specific predictions, with narration of facts and characteristics concerning individual, group or situations are all examples of descriptive research studies. Most of the social research comes under this category. From the point of view of the research design, the descriptive as well as diagnostic studies share common requirements and as such we may group together these two types of research studies. In descriptive as well as in diagnostic studies, the researcher must be able to define clearly, what he wants to measure and must find adequate methods for measuring it along with a clear definition of 'population' he wants to study. Since the aim is to obtain complete and accurate information in the said studies, the procedure to be used must be carefully planned. The research design must make enough provision for protection against bias and must maximise reliability, with due concern for the economical completion of the research study. The design in such studies must be rigid and not flexible and must focus attention on the formulating the objective of the study, designing the methods of data collection, selecting the sample, collecting the data, processing and analysing the data and reporting the findings.

### **3.6.3 Hypothesis-testing research studies:**

Hypothesis-testing research studies are those where the researcher tests the hypotheses of causal relationships between variables. Such studies require procedures that will not only reduce bias and increase reliability, but will permit drawing inferences about causality. Usually experiments meet this requirement. Hence, when we

talk of research design in such studies, we often mean the design of experiments. Professor R.A. Fisher's name is associated with experimental designs. Beginning of such designs was made by him when he was working at Rothamsted Experimental Station. As such the study of experimental designs has its origin in agricultural research. Professor Fisher found that by dividing agricultural fields or plots into different blocks and then by conducting experiments in each of these blocks, whatever information is collected and inferences drawn from them, happens to be more reliable. This fact inspired him to develop certain experimental designs for testing hypotheses concerning scientific investigations. Today, the experimental designs are being used in researches relating to phenomena of several disciplines. Since experimental designs originated in the context of agricultural operations, we still use, though in a technical sense, several terms of agriculture in experimental designs.

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### 3.7 Sum Up:

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Thus, a research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. In fact, the research design is the conceptual structure within which research is conducted and constituted the blueprint for the collection, measurement and analysis of data. Research design is needed because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money. A good research design is often characterised by adjectives like flexible, appropriate, efficient, and economical. Generally, the design which minimises bias and maximises the reliability of the information collected and analysed is considered a good design.

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### 3.8. Self-Assessment Questions:

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1. Describe the important concepts of research design.
2. Explain research design for various types of research studies?
3. Write a short note on the following
  - a) Extraneous variable
  - b) Research hypothesis
  - c) Descriptive and diagnostic research studies

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# UNIT - II

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## Lesson 4. Sampling Technics and Types

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### Structure

- 4.0 Objectives
- 4.1 Introduction
- 4.2 Implications of a sample design
- 4.3 Steps in sample design
- 4.4 Criteria for selecting a sampling procedure
- 4.5 Characteristics of a good sample design
- 4.6 Major Types of Sampling Techniques
- 4.7 Sum Up
- 4.8 Self Assessment Questions
- 4.9 References

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### 4.0 Objectives:

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After reading this lesson, you will be able

- ✓ to understand the implications and steps in sample design
- ✓ to know the criteria for selecting a sampling procedure
- ✓ to identify the characteristics of a good sample design
- ✓ to know the major types of sample techniques

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### 4.1 Introduction:

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After designing the research, the first and foremost job work of a researcher is to collect the data and choose the appropriate sampling method. Generally all items in any field of study constitute a universe. The complete enumeration of all items in the population is known as a census method. It can be presumed that in such an inquiry, when all items are covered, no element is left and highest accuracy is obtained. But in practice this may not be true. Even the slightest element of bias in such an inquiry will get larger and larger as the number of observation increases. Besides, this type of inquiry involves a great deal of time, money and energy. Further, many a time it is not possible to examine every item in the population, and sometimes it is possible to obtain sufficiently accurate results by studying only a part of total population. In such cases there is no utility of census surveys. When field studies are undertaken in practical life,

considerations of time and cost almost invariably lead to a selection of respondents i.e., selection of only a few items. The respondents selected should be as representative of the total population as possible in order to produce a miniature cross-section. The selected respondents constitute what is technically called a sample and the selection process is called sampling technique. The survey so conducted is known as sample survey. For instance, if the population size be  $Z$  and a part of its size is  $z$  which is less than  $Z$ . The sample population is selected according to some rule for studying some characteristic of the population. Here an attempt is made to assess the implications and steps in sample design, and describe the criteria for selecting a sampling procedure and the characteristics of a good sample design. Further it is elaborated the major types of sample techniques.

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## 4.2 Implications of a sample design

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A sample design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure for the researcher would adopt in selecting items for the sample. Sample design may as well lay down the number of items to be included in the sample i.e., the size of the sample. Sample design is determined before data are collected. There are many sample designs from which a researcher can choose. Some designs are relatively more precise and easier to apply than others. Researcher must select and prepare a sample design which should be reliable and appropriate for selected research study.

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## 4.3 Steps in sample design

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In preparing sampling design, the researcher must pay attention to the following points:

(i) **Type of universe:** The first step in preparing any sample design is to clearly define these set of objects, technically called the Universe, to be studied. The universe can be finite or infinite. In finite universe the number of items is certain, but in case of an infinite universe the number of items is infinite, i.e., we cannot have any idea about the total number of items.

(ii) **Sampling unit:** A decision has to be taken concerning a sampling unit before selecting sample. Sampling unit may be a geographical one such as state, district, village, etc., or a construction unit such as house, flat, etc., or it may be a social unit such as family, club, school, etc., or it may be an individual. The researcher will have to decide one or more of such units that he has to select for his study.

(iii) **Source list:** It is also known as 'sampling frame' from which sample is to be drawn. It contains the names of all items of a universe. If source list is not available, researcher has to prepare it. Such a list should be comprehensive, correct, reliable and appropriate. It is extremely important for the source list to be as representative of the population as possible.

(iv) **Size of sample:** This refers to the number of items to be selected from the universe to constitute a sample. This is a major problem before a researcher. The size of sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which fulfils the requirements of efficiency, representativeness, reliability

and flexibility. While deciding the size of sample, researcher must determine the desired precision as also an acceptable confidence level for the estimate. The size of population variance needs to be considered as in case of larger variance usually a bigger sample is needed. The size of population must be kept in view for this also limits the sample size.

(v) **Parameters of interest:** In determining the sample design, one must consider the question of the specific population parameters which are of interest. For instance, we may be interested in estimating the proportion of persons with some characteristic in the population, or we may be interested in knowing some average or the other measure concerning the population. There may also be important sub-groups in the population about whom we would like to make estimates. All this has a strong impact upon the sample design we would accept.

(vi) **Budgetary constraint:** Cost considerations, from practical point of view, have a major impact upon decisions relating to not only the size of the sample but also to the type of sample. This fact can even lead to the use of a non-probability sample.

(vii) **Sampling procedure:** Finally, the researcher must decide the type of sample he will use i.e., he must decide about the technique to be used in selecting the items for the sample. In fact, this technique or procedure stands for the sample design itself. There are several sample designs out of which the researcher must choose one for his study.

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#### 4.4 Criteria of selecting a sampling procedure

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In this context one must remember that two costs are involved in a sampling analysis viz., the cost of collecting the data and the cost of an incorrect inference resulting from the data. Researcher must keep in view the two causes of incorrect inferences viz., systematic bias and sampling error. A systematic bias results from errors in the sampling procedures, and it cannot be reduced or eliminated by increasing the sample size. At best the causes responsible for these errors can be detected and corrected. Usually a systematic bias is the result of one or more of the following factors:

- **Inappropriate sampling frame:** If the sampling frame is inappropriate i.e., a biased representation of the universe, it will result in a systematic bias.
- **Defective measuring device:** If the measuring device is constantly in error, it will result in systematic bias. In survey work, systematic bias can result if the questionnaire or the interviewer is biased.
- **Non-respondents:** If we are unable to sample all the individuals initially included in the sample, there may arise a systematic bias. The reason is that in such a situation the likelihood of establishing contact or receiving a response from an individual is often correlated with the measure of what is to be estimated.

- **Indeterminacy principle:** Sometimes the researcher find that individuals act differently when kept under observation than what they do when kept in non-observed situations.
- **Natural bias in the reporting of data:** Natural bias of respondents in the reporting of data is often the cause of a systematic bias in many inquiries. People in general understate their incomes if asked about it for tax purposes, but they overstate the same if asked for social status or their affluence. In brief, while selecting a sampling procedure, researcher must ensure that the procedure causes a relatively small sampling error and helps to control the systematic bias in a better way.

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#### **4.5 Characteristics of a good sample design**

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The chief characteristics of a good sample are stated here under. They are.....

- Sample design must result in a truly representative sample.
- Sample design must be such which results in a small sampling error.
- Sample design must be viable in the context of funds available for the research study.
- Sample design must be such that systematic bias can be controlled in a better way.
- Sample should be such that the results of the sample study can be applied, in general, for the universe with a reasonable level of confidence.

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#### **4.6 Major types of sample techniques**

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Various sample techniques are based on two important factors, namely,

- The representation basis, and
- The element selection technique.

On the representation basis, the sample may be probability sampling or it may be non-probability sampling. Probability sampling is based on the concept of random selection, whereas non-probability sampling is 'non-random' sampling. On element selection basis, the sample may be either unrestricted or restricted. When each sample element is drawn individually from the population at large, then the sample so drawn is known as 'unrestricted sample', whereas all other forms of sampling are covered under the term 'restricted sampling'.

##### **❖ Probability sampling:**

Probability sampling is also known as 'random sampling' or 'chance sampling'. Under this sampling design, every item of the universe has an equal chance of inclusion in the sample. It is, so to say, a lottery method in which individual units are picked up from the whole group not deliberately but by some mechanical process. Here it is blind chance alone that determines whether one item or the other is selected. The results obtained from probability or random sampling can be assured in terms of probability i.e., one can

measure the errors of estimation or the significance of results obtained from a random sample, and this fact brings out the superiority of random sampling design over the deliberate sampling design. Random sampling ensures the law of Statistical Regularity which states that if on an average the sample chosen is a random one, the sample will have the same composition and characteristics as the universe. This is the reason why random sampling is considered as the best technique of selecting a representative sample.

Random sampling from a finite population refers to that method of sample selection which gives each possible sample combination an equal probability of being picked up and each item in the entire population to have an equal chance of being included in the sample. This applies to sampling without replacement i.e., once an item is selected for the sample, it cannot appear in the sample again. Further it gives each element in the population an equal probability of getting into the sample; and all choices are independent of one another. It gives each possible sample combination an equal probability of being chosen.

#### ❖ **Random sample from a finite universe**

One may note that it is easy to draw random samples from finite populations with the aid of random number tables only when lists are available and items are readily numbered. But in some situations it is often impossible to proceed in the way we have narrated above. For example, if we want to estimate the mean height of trees in a forest, it would not be possible to number the trees, and choose random numbers to select a random sample. In such situations what we should do is to select some trees for the sample haphazardly without aim or purpose, and should treat the sample as a random sample for study purposes.

#### ❖ **Random sample from an infinite universe**

So far we have talked about random sampling, keeping in view only the finite populations. But the random sampling in context of infinite populations is a big question. It is relatively difficult to explain the concept of random sample from an infinite population. However, a few examples will show the basic characteristic of such a sample. In brief, one can say that the selection of each item in a random sample from an infinite population is controlled by the same probabilities and that successive selections are independent of one another.

#### ❖ **Complex random sampling designs**

Probability sampling under restricted sampling techniques, as stated above, may result in complex random sampling designs. Such designs may as well be called 'mixed sampling designs' for many of such designs may represent a combination of probability and non-probability sampling procedures in selecting a sample. Some of the popular complex random sampling designs are as follows:

##### **(i) Systematic sampling:**

In some examples, the most practical way of sampling is to select every  $n^{\text{th}}$  item on a list. Sampling of this type is known as systematic sampling. An element of randomness is introduced into this kind of sampling by using random numbers to pick up the unit with which to start.

**(ii) Stratified sampling:**

If a population from which a sample is to be drawn does not constitute a homogeneous group, stratified sampling technique is generally applied in order to obtain a representative sample. Under stratified sampling the population is divided into several sub-populations that are individually more homogeneous than the total population and then researchers select items from each stratum to constitute a sample.

**(iii) Cluster sampling:**

If the total area of interest happens to be a big one, a convenient way in which a sample can be taken is to divide the area into a number of smaller non-overlapping areas and then to randomly select a number of these smaller areas or clusters, with the ultimate sample consisting of all units in these small areas or clusters. Thus in cluster sampling the total population is divided into a number of relatively small subdivisions which are themselves clusters of still smaller units and then some of these clusters are randomly selected for inclusion in the overall sample.

**(iv) Area sampling:**

If clusters happen to be some geographic subdivisions, in that case cluster sampling is better known as area sampling. In other words, cluster designs, where the primary sampling unit represents a cluster of units based on geographic area, are distinguished as area sampling. The plus and minus points of cluster sampling are also applicable to area sampling.

**(v) Multi-stage sampling:**

Multi-stage sampling is a further development of the principle of cluster sampling. Suppose a research scholar from library science department wants to investigate the working efficiency of libraries in India and he wants to take a sample of few libraries for this purpose. The first stage is to select large primary sampling unit such as states in a country. Then he may select certain districts and interview all libraries in the chosen districts. This would represent a two-stage sampling design with the ultimate sampling units being clusters of districts. If instead of taking a census of all libraries within the selected districts, he selects certain towns and interviews all libraries in the chosen towns.

**(vi) Sampling with probability proportional to size:**

In case the cluster sampling units do not have the same number or approximately the same number of elements, it is considered appropriate to use a random selection process where the probability of each cluster being included in the sample is proportional to the size of the cluster. For this purpose, researchers have to list the number of elements in each cluster irrespective of the method of ordering the cluster. Then they must sample

systematically the appropriate number of elements from the cumulative totals. The actual numbers selected in this way do not refer to individual elements, but indicate which clusters and how many from the cluster are to be selected by simple random sampling or by systematic sampling.

**(vii) Sequential sampling:**

This sampling design is somewhat complex sample design. The ultimate size of the sample under this technique is not fixed in advance, but is determined according to mathematical decision rules on the basis of information yielded as survey progresses. This is usually adopted in case of acceptance sampling plan in context of statistical quality control.

❖ **Non-probability sampling:**

Non-probability sampling is that sampling procedure which does not afford any basis for estimating the probability that each item in the population has of being included in the sample. Non-probability sampling is also known by different names such as:

- Deliberate sampling,
- Purposive sampling and
- Judgement sampling.

In this type of sampling, items for the sample are selected deliberately by the researcher; his choice concerning the items remains supreme. In other words, under non-probability sampling the organisers of the inquiry purposively choose the particular units of the universe for constituting a sample on the basis that the small mass that they so select out of a huge one will be typical or representative of the whole. However, in such a sampling, there is no assurance that every element has some specifiable chance of being included. Sampling error in this type of sampling cannot be estimated and the element of bias, great or small, is always there. As such this sampling design is rarely adopted in large inquiries of importance.

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**4.7 Sum Up:**

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From a brief description of the various sample designs presented above, theory can say that normally one should resort to simple random sampling because under it bias is generally eliminated and the sampling error can be estimated. But purposive sampling is considered more appropriate when the universe happens to be small and a known characteristic of it is to be studied intensively. There are situations in real life under which sample designs other than simple random samples may be considered better and as such the same may be used. In a situation when random sampling is not possible, then we have to use necessarily a sampling design other than random sampling. At times, several methods of sampling may well be used in the same study.

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**4.8 Self Assessment Questions:**

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1. What do you mean by 'Sample Design'? What points should be taken into consideration by a researcher in developing a sample design.



2. Why probability sampling is generally preferred in comparison to non-probability sampling? Explain the procedure of selecting a simple random sample.
3. Write a short note on the following
  - a. Restricted and unrestricted sampling;
  - b. Systematic and stratified sampling;
  - c. Cluster and area sampling.
  - d. Non probability sampling

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## 2.9 References

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## UNIT- III

Research is a systematic, rigorous investigation of a situation or a problem in order to generate new knowledge or validate existing knowledge. Research can be classified in many different types on the basis of the methodology of research , the knowledge it creates, the user group, the research problem it investigates etc,. Basic research is done for knowledge enhancement, and it does not have immediate commercial potential. The main motivation of Basic or Fundamental research is to expand man's knowledge, not to create or invent something. Basic research lay down the foundation for the applied research. Applied research is designed to solve practical problem of the modern world, rather than to acquire knowledge for knowledge sake. The goal of applied research is to improve the human condition. It focuses on analysis and solving social and real life problems.

So selection of research method depends up on the research problem undertaken. The first lesson of this unit explains Historical, Descriptive and Survey methods of research. Detailed discussion of Experimental and Case study methods of research is given in the second lesson. Third lesson will enlighten you on Scientific method of research. Fourth and fifth lessons explain various data collection and presentation techniques.

# UNIT 3

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## LESSION-1 HISTORICAL, DESCRIPTIVE AND SURVEY RESEARCH

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### Structure

#### 3.0. Aims & Objectives

#### 3.1 Introduction to Historical Method

- 3.1.1 Definition
- 3.1.2 Characteristics of historical method:
- 3.1.3 Source of Historical data
- 3.1.4 Steps Involved in Historical Research
- 3.1.4 Element of Historical Research:
- 3.1.5 Historical method in LIS Research
- 3.1.6 Summation
- 3.1.7 Questions to be answered
- 3.1.8 References

#### 3.2 Descriptive Method

- 3.2.0 Aim and Objectives of the Study
- 3.2.1 Introduction to Descriptive Research
- 3.2.2 Definition of Descriptive Research:
- 3.3.3Steps in Descriptive Research
- 3.3.4 Documentary analysis
- 3.3.5 Summation
- 3.3.6 Questions to be answered
- 3.3.7 References

#### 3.3 Survey Method

- 3.3.0 Aims and Objective
- 3.3.1 Introduction to Survey Method
- 3.3.2 Definition of the survey
- 3.3.3 Objective of Survey Method
- 3.3.4. Characteristic of Survey:
- 3.3.5 Types of Surveys
- 3.3.6. Library Survey
- 3.3.7. Summation
  
- 3.3.8. Questions to be answered
  
- 3.3.9 References

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### 3.0. Aims and Objectives of the study

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- After studying the unit, you should be able to understand the Historical Research, Descriptive research and Survey research
- The Researcher Know the how to research the Past Present Future Events
- How to approach the people consulations the locality

- Sources of Historical Data

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### 3.1 Introduction to Historical Research

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. History helps us to study the society, its structure function and processes. Economists use the historical method as an aid in visualizing the economy of a society as a dynamic organism and its structures and function as steadily growing or undergoing changes and transformation.

Any research which makes use of observation based on past events is known as research in historical approach. The main aim of historical research is to apply the method of reflective thinking to social and economic problems still unsolved by means of discovery of past trends of events, facts and attitudes. It traces lines of development in human thought and action in order to reach some basis for social activity. The historical method conducts critical evaluation and interpretation of historical documents and records in such a manner those general laws, trends or hypothesis can be framed. Historical Research is essential for both basic and applied research in social sciences.

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#### 3.1.1 Definition:

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In a modern society, howsoever we may try we cannot escape history. It forms an integral part of life. It affects our day-to-day living at all times. In taking a decision in daily life, we often base it on our past experiences.

**Partner Defines** “History as commonly understood, may refer to events themselves or the record of events”. She further adds, “History may be interpreted very broadly, to include nature as well as man. There is a history of the process of evolution, as Darwin made clear, but in general usage history refers to the study of man and what happened to him”

**Daniels defines** History is” the past experience of mankind. More exactly, history is the memory of that past experience as it has been preserved, largely in written records” Thus, it is the product of historians’ work in reconstructing the flow of events derived from the sources of information putting it into a narrative account.

**According to Walter R.Borg** “Historical research is the systematic and synthesis objectives location. Evaluation synthesis of evidence in order to establish facts and draw conclusions concerning past events”

**According to Redcliffe Browne** “Historical method may be defined as a system in which present day events are studied with reference to the events that took place in the past”

**Robert G.Murdic** says that “Historical research is concerned with establishing the occurrence of unique events. Although one phase of historical research consist only of determining of past event the ultimate phase deals with interpretation of such events in the past and present the establishment of pattern of relationship and the starting point of projecting trends.”

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#### 3.1.2 Characteristics of Historical Method:

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1. Historical method is universal in the professions when the physician secures the case history from the patient, when the lawyers ask the client to tell the whole story from beginning. Many genetic biographical and case studies in psychology are essentially historical in approach. Darwin theory of evolution is an excellent example of the historical research. Geology is the study of the earth development and historical anthropology is the key to the understanding of social origins and social evolution". In Economics historical method is being used since its beginning. Malthusian theory of population theories of business cycles are excellent examples, which were propounded with the help of historical method.
2. Historical method involves very deep and intensive investigation of material that already exists
3. Historical facts cannot be repeated in an accurate fashion as can be done in laboratory observations
4. Only such problems when are based on historical records can be investigated by following this approach
5. Historical approach to research the application of scientific method to historical problems
6. Historical research involves very intensive use of library materials and scholarly patience is required on the part of the researcher to look into the historical records
7. In the historical approach to research hypothesis may or may not be formulated depending upon the nature of the research
8. The interpretation of research data entirely depends upon the researcher himself and shall depend upon how objectively he carries out his job of interpreting the historical evidence
9. Social scientists use the historical approach as an aid in visualizing society as a dynamic organization

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### **3.1.3 Sources of Historical Data**

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Generally there are the following major sources of historical information before a social researcher:

1. Books and magazines
2. Assessable documents, papers and literature
3. Cultural and Analytical history materials
4. Memories, personal letters and accounts,
5. Personal sources of authentic observers and witnesses

6. Dairies and confessions
7. Autobiographies
8. Sacred Archives
9. Statistical Materials
10. Diplomatic Agreements
11. An artistic materials painting, portraits, charts maps, etc

It should always be kept in mind that all historical details are not authentic and you could not be fully relied upon. In historical research, it is essential that the data are reliable, relevant and adequate for the study

According to P.V.Young historical data are reliable and adequate for social research;

1. When they are presented as complex of social forces
2. When social phenomena meaningfully depict
3. When set of inter-relationship psychological, economic, educational, political, religious contribute to a unified whole a configuration or complex pattern

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### **3.1.4 Element of Historical Research:**

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There are seven elements in the Historical Research

1. Choice of a problem
2. Collection of materials
3. Classification of materials
4. Formulation of tentative conclusions
5. External criticism of source of data
6. Internal criticism to determine the meaning of data
7. Establishment and grouping of facts for interpretation

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### 3.1.4 Steps Involved in Historical Research

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The main steps involved in historical research are discussed below:

- a) **Selection of the Problem:** The first important problem of the historical research is the selection of an appropriate topic of research as all kinds of problems cannot be studied through historical method. The selection of a suitable topic depends on the researcher intelligence, calibre, skill, aptitude, interest, training, courage imagination and deep knowledge of the subject. It also depends on the availability of adequate time, data and financial sources. The topic to be studied must be specific and not general in order to facilitate a deep study. It must be pragmatic and must be capable of presenting an original contribution. The topic must have central theme and the promise of yielding specific conclusions.
- b) **Objective of the Study:** The researcher has to formulate the objectives of the Study. Unless the objectives are specified with sufficient precision to ensure that the data collected are relevant to the question raised, the study may not provide the desired information.
- c) **Formulation of Hypothesis:** The most important part of the research is the formulation of hypothesis. A Hypothesis is an assertion that the investigator seeks to investigate. In other words a hypothesis is a proposition, condition or principle which is assumed perhaps without belief in order to draw out its logical consequences and by this method to test its accord with facts which are known or may be determined. Formulation of a hypothesis gives definite point to the inquiry, aids in establishing direction in which to proceed and helps to delimit the field of inquiry by signing out the pertinent facts on which to concentrate and by determine which facts should be set aside at least for the time being. The use of hypothesis thus prevents a blind search and indiscriminate gathering of data which may later prove irrelevant to the problem under study.
- d) **Preparations for Collection of Data:** It is always necessary for the researcher to make necessary arrangements for collection of relevant and adequate data. First he has to prepare an exhaustive bibliography on the subject and sketch out a line. He must identify the sources of data collected while making use of the secondary data in historical research. For this purpose he needs a well arranged plan of note taking. The researcher is required to make three different kinds of notes. The first one is a bibliographical note in which the author, title page, place, Date of Publication, name of the publisher and other information about the document are noted. The second type is the subject note which contains the great body of notes. The third kind of note is usually referred to as the method notes which contain the suggestive and interpretative ideas.
- e) **Testing of Hypothesis:** Science does not admit anything as valid until a satisfactory test of its validity has been completed. It is wrong to consider hypothesis as fact, no

matter how cleverly and systematically they have been arrived at. Thus the testing of hypothesis is also necessary in historical method.

- f) **Evaluation of Data:** Evaluation of data, means testing and evaluating the accuracy of data collected. The data is verified validated through the process of criticism. Thus the evaluation of data has fundamental importance in historical research.
- g) **Organization of Data:** After evaluating the data the next step of the researcher would be to organise it into a meaningful form. This process is called synthesis or grouping to fact. An effective synthesis calls for a through understanding of the meaning, implication of every piece of evidence, understanding the work that are related to the theme, critical thinking and ability to interpret and arraigning the data. This arrangement is necessary not only to draw conclusion and to present them logically but to discard the irrelevant facts. This process of course requires sound thinking wide reading greater imagination and good training.
- h) **Interpretation and Writing of Report:** As pointed out by Francisco Cordasco and Elliot Gatner of Long Island University 'Every report must be an attempt to solve some intellectual problem. Interpretation and writing of report is the most important event of the research. After the data has been arranged, Scrutinised and analyzed the next step for the researcher is the interpretation an establishment of cause and effect relationship. Theoretical interpretations serves a double purpose on the one hand ,it gives understanding of the general factors which seem to explain what has been studied on the other hand it provides theoretical generalization which can serve in turn as a guide for further research studies.

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### **3.1.5 Historical Method in LIS Research:**

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An application of historical method to LIS field is usually called "Library History Busha and Harter (1980) defined Library History as " the systematic recounting of past events pertaining to establishment, maintenance, and utilization of systematically arranged collection of records information or knowledge carefully conducted library history relates causes and results of events ; it also often organizes the social economic political intellectual and cultural environment in which these events occurred. The term "Library History" often applied to an account of events that affected any library or group of libraries as well as to the social and economic impacts of libraries on their communities. An understanding of the origin of libraries and library technique help us practice librarianship better nevertheless a number of non- librarians has also conducted significant studies on the library history.

Historical research method can be applied to LIS field to study origin and growth of various libraries. Over a period of time- Public Libraries (Bodlean Library, Boston Public Library, Library of Congress , British Museum and Library, National Library of India) Academic Libraries: ( College and University Libraries) and Special Libraries: (Biography of persons ( C.A.Cutter, John Cotton Dana, Melivel Dewey S.R.Ranganathan, Poole and others) Library association: (LA ALA SLA ILA etc) Library movement in India, in A.P or in other states) or development of a library techniques: ( Catalogue Codes, Classification Schemes , Indexing techniques, POPSI PRECIS) etc



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### **3.1.6 Summation**

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The people consulting a society are the makers of history as well as the products that are the results of history. Historical research method like all other research methods is not merely concerned with collection of data and facts but editing analysis evaluation and interpretation of data are integral part of it.

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### **3.1.7 Questions to be answered**

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1. Define Historical Research Method? Explain the Characteristics of the Historical Method
2. Explain the sources of Historical Research? What are the steps involved in Historical Research

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### **3.1.8 References**

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## **3.2 DESCRIPTIVE RESEARCH**

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### **3.2.0 Aims and objectives of the Study**

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After studying this lesson you should be able to

- Explain Descriptive research method and its application to Library and Information science
- Describe the document analysis
- What are the steps involved in the Descriptive Research

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### **3.2.1 Introduction to Descriptive Research**

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Descriptive Research holds the valuable place within education, because in contrast to laboratory experiments, the human nature of education research is critical to the result. Educational environments and experiences inherently contained many extraneous variables that cannot control in a realistic situation, often call for careful observation of specific life situations, and can require the collections of data from a large number of people spread throughout a wide geographic region. Descriptive Research can be either quantitative or qualitative. It can involve collections of quantitative information that can be tabulated along a continuum in numerical form, such as scored on a test or the number of times a person chooses to use a certain features of a multimedia program me, or it can describe categories of information such a gender or patterns of interaction when using technology in a group situation.

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### **3.2.2 Definition of Descriptive Research:**

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The term descriptive research refers to the type of research questions, design, and data analysis that will be applied to a given topic. Descriptive statistics tell what is while inferential statistics try to determine cause and effect.

**Glass & Hopkins Defines** “Descriptive research involves gathering data that describe events and then organizes, tabulates, depicts and describe the data collection”.

Brog & Gall Defines “Descriptive studies are aimed at finding out “What is” so observational and survey methods are frequently used to collect descriptive data”

Anglin and Towers Defines “Descriptive research might simply report percentage summary on a single variable “

Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individuals, or of a group whereas diagnostic research studies determined the frequency with which something occurs or its association with something else . The studies concerning whether certain variables are associated are examples diagnostic research studies. As against this studies concerned with specific predictions, with narration of facts and characteristics concerning individuals group or situation are all expels of descriptive research studies. Most of the social research concerns under this category. From the point of view of the research design, the descriptive as well as diagnostic studies share common requirements and as such we may group together these two types of research studies. In descriptive as well as in diagnostic studies, the researcher must be able to define clearly, what he wants to measures and must find adequate methods for measuring it along with a clear cut definition of Population he wants to study . Since the aim is to be obtain complete and accurate information In the said studies, the producer to be used must be carefully planned. The research design must take enough provision for protection against bias and must maximums’ reliability, with due concern for the economical completion of the research study.

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### **3.2.3 Steps in Descriptive Research**

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The descriptive Research studies must be rigid not flexible and must focus attention on the following:

1. Formulating the objectives of the study
2. Designing the methods of data collection
3. Selecting the sample
4. Collecting the data
5. Processing and analyzing the data
6. Reporting the findings

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### **3.2.4 DOCUMENTARY ANALYSIS**

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Documentary Analysis is closely related to historical research since in such surveys we study the existing documents. But it is different from historical research in which our emphasis is on the study of the past; and in the descriptive research we emphasis on the study of the present. Descriptive research in the field of education may focus on describing the existing school practices, attendance rate of the students, health records, and so on. The method of documentary analysis enables the researcher to include large amounts of textual information and systematically identify its properties. Documentary analysis today is a widely used research tool aimed at determining the presence of certain words or concepts within texts or sets of texts. Researchers quantify and analyze the presence, meanings and relationships of such words and concepts, then make inferences about the messages within the texts, the writer(s), the audience and even the culture and time of which these are a part. Documentary analysis could be defined as a research technique for the objective, systematic, and quantitative description of manifest content of communications. It is a technique for making inferences by objectively and systematically identifying specified characteristics of messages. The technique of documentary analysis is not restricted to the domain of textual analysis, but may be applied to other areas such as coding student drawings or coding of actions observed in videotaped studies, analyzing past documents such as memos, minutes of the meetings, legal and policy statements and so on. In order to allow for replication, however, the technique can only be applied to data that are durable in nature. Texts in documentary analysis can be defined broadly as books, book chapters, essays, interviews, discussions, newspaper headlines and articles, historical documents, speeches, conversations, advertising, theater, informal conversation, or really any occurrence of communicative language. Texts in a single study may also represent a variety of different types of occurrences. Documentary analysis enables researchers to sift through large amount of data with comparative ease in a systematic fashion. It can be a useful technique for allowing one to discover and describe the focus of individual, group, institutional or social attention. It also allows inferences to be made which can then be corroborated using other methods of data collection. Much documentary analysis research is motivated by the search for techniques to infer from symbolic data what would be too costly, no longer possible, or too obtrusive by the use of other techniques.

These definitions illustrate that documentary analysis emphasizes an integrated view of speech/texts and their specific contexts. Document analysis is the systematic exploration of written documents or other artifacts such as films, videos and photographs. In pedagogic research, it is usually the contents of the artifacts, rather than say, the style or design, that are of interest. Why analyze documents? Documents are an essential element of day-to-day work in education. They include:

1. Student essays
2. Exam papers
3. Minutes of meetings
4. Module outlines
5. Policy documents

In some pedagogic research, analysis of relevant documents will inform the investigation. If used to triangulate, or give another perspective on a research question, results of document analysis may complement or refute other data. For example, policy documents in an institution may be analyzed and interviews with staff or students and observation of classes may suggest whether or not new policies are being implemented. A

set of data from documents, interviews and observations could contribute to a case study of a particular aspect of pedagogy. How can documents be analyzed? The content of documents can be explored in systematic ways which look at patterns and themes related to the research question(s). For example, in making a case study of deep and surface learning in a particular course, the question might be 'How has deep learning been encouraged in this course in the last three years?' Minutes of course meetings could be examined to see whether or how much this issue has been discussed; Student handouts could be analyzed to see whether they are expressed in ways which might encourage deep learning. Together with other data-gathering activities such as student questionnaires or observation of classes, an action research study might then be based on an extended research question so that strategies are implemented to develop deep learning.

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### **3.2.5 Summation**

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The descriptive studies are important most educational studies involve questions about causes such as “What cause under achievement. It is not always possible to isolate the variables that will explain those causes so descriptive research can pay important role in providing information from another perspective. By gathering description of “What is” and comparing them to “What we would like “educators can see the area that needs to be addressed further, descriptive statistics can provided information that can help to isolate the variable that will eventually be used to measure cause and effect and at least can help provide surrounding information that will aid logical interpretation of research questions within the context of a specific situation.

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### **3.2.6 Questions to be answered**

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1. Define a Descriptive Research? Explain its Nature
2. Describe the steps in Document analysis in Descriptive Research

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### **3.2.7 References**

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## **3.3 SURVEY METHOD**

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### **3.0 Aims and Objectives of the Study**

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- Describe the Related survey research in Library and Information Science field
- Explain the importance of the Survey Method
- To Know the characteristics of the Survey Method

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### **3.3.1 Introduction to Survey Method of Research**

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The word survey has been derived from the words ‘sur or ‘sor’ and ‘veir” or ‘veoir’ which mean over and see respectively .The term survey is used for the technique of investigation by a direct observation of a phenomenon of a systematic gathering of data from population by applying personal contact, and interviews.

The survey is important tool it is one of the most widely used methods for social research by which quantitative facts about a social phenomena are collected to contribute to the solution of immediate problems. The survey technique is not the specific method of any one social science discipline but it may be extensively employed in all the social science disciplines.

The term social survey indicates the study of social phenomena through a survey of a small sampled population and also to broad segments of the population. For example a researcher wishing to investigate certain aspects of family life may chose to confine himself to a handful of families studying them intensively. Thus the intensive study rather than superficial examination of a large scale sample will yield better results. Thus the intensive study of a few cases will tend to dig deeper knowledge only about certain aspects of family life.

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### **3.3.2 Definition of the survey**

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Definition of Social Survey: Some of the important definitions of social survey are presented here:

**A.F.Wells:** “social survey is a fact finding study dealing chiefly with working class, poverty and with the nature and problems of community”

**C.A.Moser:** “The Sociologists should look upon surveys a way and supremely useful one of exploring the field of collecting data around as well as directly on the subject of the study so that problems is brought into focus and points worth studying are suggested”

**Mark Abrams:** “A social survey is a process by which quantitative facts are collected about the social aspect of a community’s composition and activities”

**Herman:** “The survey is briefly a method of analysis in scientific and orderly form for defined purpose given social situation of problem or population”

**F.L.Whitney:** “Survey research is an organized attempt to analyze and report the present status of a social institution group or area”

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### **3.3.3 Objective of Survey Method**

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The purpose of social survey is to study social conditions, relationship and behaviors. It also provides information which is useful in the solution of these problems. Social surveys are concerned with the formulation of a constructive programmed of social reform.

According to Whitney the main purpose of a survey is “to get groups of classified generalized and interpreted data for the guidance of practice in the immediate future”

According to Carter V.Good the following are the purposes of a social survey:

1. To secure evidence concerning in existing situation or current condition, to identify standards or norms with which to compare present conditions in order to plan the next step to determine how to make the next step.

In short the objectives of the social survey may be summarized as below:

1. **Direct and close contact:** Survey helps to researcher to come in direct and close contact with the phenomena under study and provides him with all the details that he needs. We cannot describe the phenomena unless we come face to face with it.
2. **To collect General Information:** The purpose of the social survey is to collect general information and they are not meant to prove or disprove anything
3. **A Basis for Hypothesis:** Surveys are started with any hypothesis. But the data collected through these surveys may serve as a basis for a hypothesis.
4. **Cause and Effect Relationship:** Sometimes survey is conducted to explain the cause and effect relationship may help the researcher, through fresh light on some aspect of social theories. Thus it helps in the refinement and expansion of old theories and in the establishment of new ones.
5. **Opinion and Attitudes:** Surveys are also conducted to know the opinion and attitudes of people. They include attitudes of a person towards any social, economic or Political incident, institution or even a personality. These surveys predict public reactions to events which are forthcoming:

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#### 3.3.4. Characteristic of Survey Method:

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There are four characteristics of survey method

1. It is directly concerned with social life as it exists here and now; what is observed described, collected as a body of facts about current situations and problems
2. It focuses upon a given locality or geographical area
3. It leads to measures of reform on the data assembled both for improvement and the means to obtain them
4. It must be conducted in an objective spirit

**Questionnaires** - a series of written questions and the participant answers. This method gathers responses to questions that are essay or agree/neutral/disagree style.

**Interviews** - questions posed to an individual to obtain information about him or her. This type of survey is like a job interview, with one person asking another with a load of questions.

**Surveys** - brief interviews and discussions with individuals about a specific topic. Yes, survey is also a specific type of survey, to make things even more confusing. A survey is a quick interview, with the surveyor asking only a few questions.

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### 3.3.5 Types of Surveys

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The surveys may be classified into FOUR following types:

- 1. General Specific Surveys:** A general survey is conducted for collecting general information of any population, institution or phenomena without any hypothesis while specific surveys are conducted for specific problems or for testing the validity of some theory or hypothesis
- 2. Regular and Ad hoc Surveys:** if the survey is repeated after regular intervals to obtain continuous information it is known as regular survey. It helps in the study trend of the effect of time on the phenomena under the study. For regular surveys permanent machinery for collecting information has to be set up. Adhoc surveys are conducted once for all and are non-repetitive. Such surveys may also be conducted in phase if the area of investigation is large. Adhoc surveys are useful in testing the hypothesis or supplementing some missing information regarding any research problem.
- 3. Preliminary and Final Surveys:** preliminary survey is the pilot study to get the first hand knowledge of the universe under study. It helps the researcher in preparing schedule or questionnaire and organizing the survey on proper lines. Final surveys are made after the pilot study has been completed.
- 4. Census and Sample Survey:** Census survey deals with the investigation of entire population. Under this method the information is collected from each and every unit of the universe. Money, material, time and labour required for carrying out a census survey are bound to be extremely large but its results are more accurate reliable. In case of sample survey only a small part of the universe which representative of the whole population is taken and the information is collected. Thus the sample survey are more economical and less time and labour consuming.

Sampling is the process of studying about the universe on the basis of representative samples drawn from the population and the procedure of obtaining information on the units constituting the sample is to obtain maximum information about the characteristics of population with minimum cost, time and labour.

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### 3.3.6. Library Survey

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A library survey is interpreted as a systematic collection of data concerning libraries, their activities, operations, services, staff, use, and users at a given time or over a given period. Surveys are by nature, over viewing and spread over to a sizeable population/subjects or area. For example, study of a circulation system of a library is not a survey, but if extended to all the libraries of a whole city or region will by definition constitute a survey. A survey of public libraries in Haryana is another such example. In library and information management survey method has been quite popular due to its suitability. It can be easily applied to many library procedures, services and use Surveys are simple, easy to conduct though time taking.

#### **A. DATA COLLECTION**

Survey basically involves data, facts or textual/verbal information or opinion gathering by formal and systematic method. There are many techniques and instruments to do so:

- i. By direct but stand aside observation.
- ii. By observing as one of the participant of the activities.
- iii. By making door to door survey or meeting individual informants for asking specific questions.

This individual survey could be done by:

- a) By a formal and structured printed questionnaire.
- b) By telephone, or through email or website
- c) Sampling

Universe of entities is a set of whole gamut covering the whole field under study, e.g.: University libraries in India; Post-graduate library users; A survey of reading habits of non-working married women in Mumbai, etc. If the population under study is small or manageable then the data should be collected of each item or entity under study. But this is rarely the situation in a survey research. Sampling is required if the universe of population under study is too large. A sample may be defined as a representative subset or cross section of the population in miniature. It should homogeneously represent the entire field. Validity of research results much depends upon the quality of the sample drawn. There are scientific, logical or statistical techniques for formulating a sample. Some of the techniques are common sense methods to ensure that the sample is homogenous and a true and fair miniature of the entire population under study. If the sample is biased or lopsided then the results cannot be trusted or generalized. It can be formulated by the following two methods:

##### **(i) Probability Sampling**

It is a random sampling which defines the chances of every element to be included in the sample. For example, if we decide to include one entity out of every one thousand then the chance of every entity to be included in the sample is 1/1000. For random collection first of all the researchers will divide the whole population into groups of 1000 each as they occur in the natural state. Then from each group the researcher may pick up, say, every 5th member or for that say ever 20th member. This is random sampling, and



sample-formed will be a correct one. But still some error, technically known as “Margin of Error”, cannot be avoided. It can be calculated statistically and accounted for in the results.

### **(ii) Non-Probability Sampling**

It is a non-structured sample and items are included in the study due to some convenience of the researcher, or as the researcher simply stumble upon them. This sampling is convenient, takes less time and is handy.

## **B. HOW TO CONDUCT A SURVEY**

To begin with, the problem must be clearly and strictly formulated by defining its inclusion and exclusion parameters. The geographical area or conceptual constituency of the survey must be focused. Research question should be clearly defined.

- A. Target population should be demarcated and must be accessible in case of human beings, and measurable in other cases.
- B. Types of scales and instruments to be used and mode of survey should be determined depending upon the kind of study and nature of population.
- C. Questionnaire should be carefully prepared and pretested on a small population.
- D. Respondents should be approached with due tact, courtesy, humility, and should be fully explained the aim and purpose of research. No embarrassing questions should be asked. Give them free hand to answer pre-set questions.
- E. In case of verbal answers or interviews the information should be faithfully recorded, howsoever contrary it may be to the researcher’s wishes or expectations. Views of the respondents must be respected. Accept the opinions of others in too. Researcher should be neutral, detached or disinterested in the outcome of the research.
- F. Respondents must be thanked for the cooperation and valuable time they gave.

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### **3.3.7 Summation**

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The survey is important tool to gather evidence relating to certain social problems It is currently being used in those investigations also where published data is used there are some writers who still believe that the term survey can be applicable only when a direct contact made by the researcher

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### **3.3.8 Questions to be answered**

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1. Define a Survey Method? Explain the characteristics of the survey method
2. Describe the Library Surveys

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### **3.3.9 References**

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# UNIT-3

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## LESSON-2 EXPERIMENTAL, AND CASE STUDY METHODS

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### Structure

- 2.0 Aims and objectives
- 2.1 Basic concepts of Experimental Method
- 2.2 Experimental Method-Definition
- 2.3 Characteristics of experimental method
- 2.4 Application of Experiential method in Library and Information Research
- 2.5 Merits of Experimental Method
- 2.6 Introduction to Case Study Method
- 2.7 Definition of the Case Study Method
- 2.8 Characteristics of the Case Study Method:
- 2.9 Basic Assumption of the Case Study Method:
- 2.10 Sources of data in Case Study Method
- 2.11 Steps Involved in Case Study
- 2.12 Usefulness of Case Study Method
- 2.13 Summation
- 2.14 Questions to be answered
- 2.15 References

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### 2.0 Aims and Objectives

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- To know the techniques of experimentation and case study methods in the Library and Information Science Research
- Utility of the experimental method and the new techniques for developing maintaining and utilization of Library collections
- To observe the difference between old and new methods of developments
- How to avoid the difficulties in organization of Library Materials
- Collection Development Techniques based on the past and current events

### EXPERIMENTAL METHOD

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## **2.1 Basic Concepts of Experimental Method:**

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An experiment can be defined as a research situation in which investigators specify exactly, or control, the conditions that will prevail in the investigation. The values of one or more independent variable are then manipulated and the effect of the manipulation on the values of the dependant variable with respect to one or more experimental groups is observed. The effects of other factors that might possibly be relevant to the research problem (i.e. affect the values of the dependent variable) are minimized through careful experimental design.

In Librarianship, experiments can be used to test new techniques for developing, maintaining, and utilizing library collection; a subject of an experiment is the basic unit on which an experiment is performed. In agricultural experimentation, subjects might be plants of certain types or perhaps plots of planted ground. In drug research subjects might be white rats to guinea pigs. In Library science, information science and other social science research, subjects are frequently persons for example patrons, librarians or students.

In addition to subjects, a true experimental design involves a control group on which experiments are not performed. The purpose of the control group is to serve as a comparison. Treatments are applied to the experimental group but not to the control group and the results are observed.

The fact that humans are frequently the subjects of social science experimentation it implies, that a basic difficulty in applying the experimental approach of social science research in general and librarianship in particular. Humans cannot be manipulated as easily as white rates, for excellent moral ethical and legal reason. Hence many research problems in the social sciences are not particularly amenable to the experimental approach.

A treatment is the condition that is applied to an experimental group of subjects. In agricultural research, s treatment may be the application of fertilizer to growing plants to the regulation of the amount of moisture to patient or the use of surgical techniques are examples of treatments.

In Librarianship a treatment that is being tested might be a system of indexing a mode of instruction a type of catalog organization or a method of book selection among others

The use of Experimental method has primarily been used physical science where the subject-matter can be give the laboratory treatment under controlled conditions.. The laboratory treatment of the subject-matter in physical science enables the analysis note through and the deductions more accurate and general. Besides this, they can be tested to the physical sciences, In case of social sciences such a facility is completely lacking.

In this method a hypothesis is proved about cause and effect relationship by manipulation or controlled situation in which different factors are varied. Their consequences noted in several ways tell a definite cause and effect relationship. This

relationship asserts that a particular characteristics or occurrence. The social scientist has to watch them in the wide world and has to wait for the circumstances to occur in their natural course. They cannot be created for his studies as in case of physical sciences. Due to these reasons the experimental method was commonly used in physical sciences only. But with the advancement of knowledge, invention of sophisticated equipments and artificial laboratories the application of this method is gradually finding place in social sciences. Experiments now play slightly different form the physical experiment on account of the limitations placed upon them by the nature of subject-matter with which social sciences has to deal.

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## **2.2 Definition of the Experimental Methods:**

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**Definitions:** According to Festinger, “The essence of an experiment may be described as observing the effect on a dependent variable of the manipulation of an independent variable”.

In the words of Greenwood “An experiment is the proof of a hypothesis which seeks to look up two factors into a causal relationship through the study of contrasting situations which have been controlled on all factors except the one of the interest the latter being either the hypothetical case or the hypothetical effect”.

According to V.H. Bedekar “Experimental method implies a controlled observation of a succession of events. The aim is to search for causal connections.”

The experiments successful to the extent to which certain effects are shown to be the consequences of certain identified causes and vice-versa. The objective of an experiment is to generalize the cause-effect relationship and to apply it to similar situations elsewhere. In the experimental method the key word is control. Thinking and phenomena are deliberately manipulated to identify and isolate certain factors which proved the basis of inter-relationship. Suitable procedures are evolved to vary one factor at a time to find out its concomitant effects. It is only when the rest of the factors remain the same and when a single factor is made to vary that an observer can study its effects. A single cause may give rise to different effects, depending on circumstances. A single identical effect may be produced, depending on circumstances. A single identical effect may be traced to different causes. Also a factor which served as a cause in one circumstance may not lead to that effect, in another situation. For example wherever there is smoke there is fire, but there can be fire without smoke. Similarly rain is not possible without a cloud but presence of cloud may not necessarily result in rain.

In the experiments conducted by an investigator, the main aim is to test a hypothesis about a cause and effect relationship by manipulation or controlled situations in which different factors are varied and their consequences noted in several ways till a definite cause effect relationship is proved. The experimental method is the most effective in physical science or exact sciences. And the experimental method cannot be used in social science because human cannot control space that is too vast or the past that is already over or human behavior that changes under pressure of circumstances. Any problem in science may be solved by undertaking an experiment or a series of experiments, the

experimental studies are the ones concerned with testing the causal hypotheses. A hypothesis of casual relationship asserts that a particular characteristics or occurrence is one of the factors that determine another characteristics or occurrence.

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### **2.3 CHARACTERISTICS OF EXPERIMENTAL METHOD**

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Main Characteristics of Experimental Method e summarized below:

1. Experimental Method in Social Sciences is a method of testing hypothesis.
2. By Experimental Method the researcher tries to isolate complex social phenomena
3. In Experimental Method, we see that the effect of variable keeping other things equal
4. It helps us in scientific study of relationship between cause and effect
5. This approach to social research resembles scientific method so far as model building and formulation of relationship among variable is concerned
6. This method has increased accuracy in prediction of social behavior.

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### **2.4 Application of Experiential method in Library and Information Research**

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Experimental method is very useful in Library science researches following techniques are generally adopted as experimental method in Library and information Science Research:

- Model Building
- Input-output Method
- Cost-benefit analysis Method
- Liner Programming Method

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### **2.5 Merits of Experimental Method**

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Experimental method resembles scientific method in many respects. Therefore efforts are being made to make more and more use of this method. Main merits of experimental method are given below:

1. It is rarely possible to solve scientific problems, ascertain appropriateness of techniques to determine accuracy of the data obtained by reasoning alone. These factors can best be learnt by experimentation.
2. Experimental method helps in the establishment of cause and effect relationship more clearly than other methods. In case of other methods we can at best locate

the degree of association or co-variance but we cannot say with certainty as to which one is the cause and which one the effect.

3. It is more precise and accurate since the variable under study is manipulated leaving other untouched. We can also locate with precision the effect of varying degree of stimulus.
4. It is the best method for testing a hypothesis, casual observations may help in the formulation of a hypothesis can be tested and verified
5. The conclusion drawn from an experimental method are subject to verification at many times
6. Laws framed by experimental method are universal in their application. Though complete universality is only a myth and is rarely achieved in social sciences.
7. Another merit of experimental method is that prediction can be done with sufficient accuracy

Though use of experimental method in social research is limited as our field of inquiry is human beings who pose many problems but use of scientific tools. Laboratories, model building sample techniques measurement of variable has made it possible to use this experimental method in special cases.

## **2.6 CASE STUDY METHOD**

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### **2.6 Introduction to Case study method**

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The statistical method and the case study method are two main methods of scientific social research. A case study is a deep and intensive study in a particular social unit confined to a very small number of cases. Thus the field of study in the case study method is limited but it aims at studying all aspects of a social unit. It also seeks to determine social process it reveals the complexity of factors and indicate their sequences and their relationships. It is also a diagnostic study oriented towards finding out what is happening and why it is happening and what can be done about it."Case study says Charles H. Colley "depends on our perception and gives us a clearer insight into life

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### **2.7 Definition of the case study method**

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P.V. Young defines "Case study is a method of exploring and analyzing the life of a social unit, about a person a family, institution, cultural groups or even an entire community"

Good & Hatt defines "Case study is a way of organizing social data so as to preserve the unitary character of the social object being studied. Expressed somewhat differently, it is an approach which views any social unit as a whole

F.L. Whitney "Case study is a completely analysis and report of the status of an individual subject with respect as a rule to specific phases of his total personality"

J.K. Black & D.J. Champion "case studies are usually characterized as thorough examinations of specific social settings or particular aspects of social setting including in varying details psychological descriptions of person in those settings"

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## 2.8 Characteristics of the Case study Method:

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On the basis of the above definitions the following six characteristics of the case study method has been drawn:

**Study of a single Unit: under** this method only one unit is selected for purpose of investigation among all the units of the universe. The selected unit may be a large small depending upon the nature of the study. According to Giddings: "the unit can be a person, or a single incident of his life or a whole nation, or empire of a historical age. In spite of the varying size of the unit of the study the fundamental point common is that each unit is taken as whole.

**Complete study:** under this method we have to make a study of the unit in its wholeness i.e. it is an approach which views any social unit as a whole. this unit is taken as representative of a group and only such aspects of his life are studied that are relevant to the problem under study.

**Intensive study:** in case study method a penetrating, inclusive and intensive study of an individual unit is conducted. Under this method an investigator has to employ all his skills in systematic gathering of enough information about a unit to permit one to understand how it functions.

**Qualitative Study:** A case study method is mainly qualitative in character because the majority of the material viz. life history, personal documents etc that is used for the research is qualitative in nature. Under this method the researcher has to depend heavily upon his own observation and logic rather than upon the facts.

**Inter Relationship of causal Factors:** like other method an effort is also made to establish cause and affect relationship. Efforts are also made to link all the variable with one another and hypothesis are made so as to arrive at various generalizations.

**Flexible Method:** the case study method is flexible in character therefore a research has complete independent in approaching the problem from any angle that he consider desirable and fruit bearing form his points of view. He has also right to change, omit or distort the variable under study keeping in view that the results are not affected.

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## 2.9 Basic Assumption of the Case Study Method:

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The case study method is based upon the following basic assumptions:

- The case study method is not in itself a scientific method at all. It is merely a first step in scientific procedure.
- It is assumed that in the face of apparent diversity among different units, there is an underlying unity. A particular unit has its uniqueness but it is not different from other units in all respects.
- Under this method it is assumed that a unit selected is the representative of a group. In many respects it is similar to measures of central tendency or averages. It tries to locate the variations in the reactions and activities of the subject.
- It is also assumed that the study of a particular unit is helpful in the prediction and discussion of other units of the same universe.
- A unit is indivisible whole and cannot be studied piecemeal and in fragments. We must study its life history and its background and to explain its behavior at a particular time.
- A social phenomenon is of a very complex nature and the deep study of number of units is a difficult task. Therefore the researcher has to take the shelter of the case study method as a single unit can be studied in wholeness and depth.
- Social phenomena are of dynamic nature and are influenced by time. In search of root causes behind and event a researcher has to study the problem in its historical perspective. It is assumed in the case study that a study of a single unit would be able to explain the influence of time over the variable.

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## **2.10 Sources of Data in Case Study Method**

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Case studies are not limited to any single source of data collection. A number of sources of data collection should be employed by the researchers. Mr.Thomsa made extensive use of personal documents considered them a chief instrument in reaching the actual experiences and attitudes of person and groups as well as in securing a cross section of the entire process of their social becoming. Many others have made exhaustive case studies with preliminary interviews conferences at specified interval conversation observation etc. Sometimes a researcher has to use different techniques and tools to collect data about the different aspects of the cases.

In the case study method the main sources of data are:

- Personal documents
- Life History



## **Personal documents**

Most of the people keep personal record, document, and letters and write their autobiographies or memories. These documents play an important role in the case study as they contain description of the important events of the life of the writer as well as his relations toward them. The documents may also contain the description of even those events in which the narrator has played his part only as a witness. According to P.V.Young “ personal documents represent continuity of experience which helps all to illuminate the writers personality, Social relations and philosophy of life often expressed in objective reality of subjective appreciations

Thus the personal documents are very helpful in studying the personality of the writer and his relations to different circumstance of life as the writer is an identical part of the group; they may represent not only the reaction of the person but of any typical number of the group.

### **Life History:**

Life history is the study of various events of respondent's life together with attempt to find their social significance. Life history data is generally gathered through prolonged interviews with the respondents, use of any written materials about his life conferences at specified interval experimental studies observations post-experimental interviews, various tests and the analysis of facts so collected in order to draw vivid generalization from them.

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### **2.11 Steeps involved in Case Study:**

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Following FOUR steps are involved in any case study method, are as follows

**1. Selection of Cases and Identification of Situations:** before taking up the case study a researcher has to take some decisions such as which unit has to be taken up for studies what aspect or what period of life of unit can be studied what are the situations in which unit exists all these questions should be answered. Keeping in view of these questions a researcher has to choose representative and typical data the selection of such representative unit highly depends on ability and skill of the researcher

### **2. Collection and Recording of Data:**

A careful collection and recording of data depends on the skill and ability of the researcher. The researcher should use different techniques and tools to collect data about different aspects of the unit. Study of personal documents, life histories observations interviews questionnaires schedules etc, are the techniques and tools for collection of data. The data should be recorded uniformly topic wise, accurately and objectively with clarity. The data should be complete and of easy reference. While collecting case data the researcher should be cautious about D.Thomsa Warning “Be suspicious of striking cases. They may be as surprising to the people among whom they occurs they are to you “striking

facts especially those that seem to be abnormal, are frequently far less significant than more common places ones, but it should be remembered that there is no break in continuity between the normal and abnormal in concrete life. Unusual or rare cases should not be overlooked but should be regarded as exceptions.

### **3. Interpretation of Data:**

Analysis and interpretation of data are considered to be highly skilled and technical job. Facts and figures never speak for themselves. The facts collected must be in logical and convenient form, only by means of interpretation the underlying features of the data are revealed and valid generalizations are arrived at

### **4. Report writing:**

Report writing is the end product of a research. Reporting of the research findings is an important part of any type of research. Reporting means the written presentation of the evidence and findings of a research. The report must be in such a manner that the reader can easily understand assess and enable him to verify the validity of the conclusions

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## **2.12 Usefulness of Case Study Method**

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as case study is deep and diagnostic study, it has been praised as a useful research technique “case data are vivid absorbing and tend to reproduce a person social attitudes and values Good and Hatt has also remarked that “As against the analysis of individual traits alone it is a highly fruitful approach as yet sufficiently exploited by those who are currently doing research into research techniques”

No doubt case study has been very useful to social sciences in many ways. The following are some of the specific advantages this method:

- Case study helps to probe the entire life span of a social unit intensively and to analyze the complex factors that are influencing the social unit.
- The relationship between individual and society is well brought out in the case study.
- It is easy to generalize cases with help of case study method.
- Case study is followed for comparison, classification, analysis and for the formulation of hypothesis leading to further research
- The technique of case study method are often used in pure research in Sociology and Economics with a view to develop certain theories and broad principles
- The case study is useful in forming questionnaire, schedule or other forms.
- Case study enlarges the range personal experience of the researcher because of the researcher because under this method the whole range of subject’s life is studied and thus the range of knowledge is naturally enlarged.
- Case Study is essential if the problem under study forms a process rather than one incident.

- Case study provides a detailed information about the growth of the unit group structure, individual life pattern etc.
- Case study vivid, absorbing and tend to reproduce a person's social attitudes and values.

Thus we find that case study method is very useful in social science but for a perfect the use of both the methods i.e. case study and statistical method are essential.

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### **2.13 Summation**

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In the experiments conducted by an investigator the main aim is to set a hypothesis about a cause and effect relationship by manipulation or controlled situations in which different factors are varied and their consequences noted in several ways till a definite cause effect relationship is proved. As can be imagined the experimental method is the most effective in physical science or exact sciences . As is very obvious experimental method cannot be used in social sciences because human cannot control space that is too vast are the past that is already over or human behavior that changes under pressure of circumstances.

As case study is deep and diagnostic study, it has been praised as a useful research technique "case data are vivid absorbing and tend to reproduce a person social attitudes and values Good and Hatt has also remarked that "As against the analysis of individual traits alone it is a highly fruitful approach as yet sufficiently exploited by those who are currently doing research into research techniques"

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### **2.14 Questions to be answered**

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1. Explain the Basic concepts of the Experimental Method
2. Describe the characteristic of the Experimental Method
3. Write a short note on Merits of the Experimental Method
4. Define a Case study Method and Explain the Characteristics of the Case Study Method
5. Describe the Steps in Case study Method

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### **2.15 References**

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# Unit-3

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## Lesson-3 Scientific Method in Library Science Research

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### Structure

- 3.0 Aims and objectives
- 3.1 Meaning Definition and Nature
- 3.2 Science and Scientific Method
- 3.3 Features of Scientific Method:
- 3.4 Spiral of Scientific Method
- 3.5 Phases in Scientific Method
- 3.6 Quadrants and Analysis:
- 3.7 Various Subjects and Scientific Method
- 3.8 Library Classification and Scientific Method
- 3.9 Three Processes in the Scientific Method
- 3.10 Spiral of Scientific Method
- 3.11 Importance of Spiral Scientific Method
- 3.12 Summation
  
- 3.13 Questions to be answered
- 3.14 References

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### 3.0 Aims and Objectives of the Study

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- The aim of this unit is to introduce you Scientific Method and its use in Library and Information Science
- After studying this unit how to apply Scientific Method in Library and Information Science
- Ranganthan's Spiral Research Method how to apply in Library and Information Science Subjects.

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### 3.1 Meaning - Definition and Nature of Scientific Method

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**Scientific Method:** Scientific Method is a method of research and investigation and the term 'science is popularly used to denote a ground of subject fields e.g. Physics, Chemistry, Biology etc., this interpretation of science may lead someone to conclude that 'Scientific Method' is a chiefly used in the study and research in science as a subject and research-group. It does not mean that it cannot be used for study and research in other subject -fields viz Social Sciences and Humanities. It is also not true to conclude that other methods of research viz Historical Method and Descriptive Method cannot be used in

research in the science-subjects. Therefore must it be borne in mind that the term 'Scientific' does not refer to research in the field of science but it is a procedure which is 'Scientific'

The term 'science' has been derived from the Latin word 'Scire' which means, 'to know' Science is therefore concerned with 'Knowledge' and has been defined by Bernard Shaw's as "Science implies as its name and it is primarily, knowledge". It has also been defined (by William Dampier) as "ordered knowledge of natural phenomenon". On the strength of these definitions of 'science', scientific method may be taken to be an organized and systematic procedure of research

The term 'science, may also be taken to synonymous to 'hard or rigorous'. The common belief that 'Science -subjects' require more hard and rigorous study proves it. Scientific method may therefore be taken to be a rigorously organised and systematic procedure of research.

The term 'science implies observation and experimentation; Scientific Method may therefore be taken to be a rigorously organized and systematic method of research based on observation and experimentation. The term scientific method shows that this method helps in reaching 'scientific conclusion' which is different than authority-centered.

Scientific method is an important method of research. It collects facts as historical and descriptive method; it interprets and analytical facts as does descriptive methods; in addition it also tests and verifies data and conclusion either by direct observation or experimentation and does not accept it unless it is proved by all evidences. For this reason it has been referred to by Hilways, though indirectly as "complete research" Gopal has very rightly defined science and scientific method as " the search for truth the basis of facts and for generalization through a process of induction deduction verification non-suppression of evidence and open mind"

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### **3.2. Science and Scientific Method**

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The discoveries of Copernicus, Kepler, Galileo and Newton Archimedes in the 17<sup>th</sup> century not only brought scientific revolution but also established a new method in research. This in many ways was in direct contradiction to the ancient philosophical method. Through this method slowly but surely a body of knowledge has been built- up which we call 'Science' and now to be scientific has become a great desideratum. Every branch of knowledge is tending to become a science just as every thing was philosophy before.

**Bacon:** The great scientific philosopher Francis Bacon (1561-1626) was considered as the first scientist for systematized of the scientific procedure.

**JOHN STUART MILL:** The aim of science is to find the order of nature. As John Sturat Mill(1806-73) put it " the search for the fewest and simplest assumptions, which being granted, the whole existing order would follow' Scientific method leads to the discovery and establishment of such laws.

**KARL PEARSON:** As Karl Pearson the great grammarian of science defined the classification facts, the recognition of their sequence and relative significance is the

function of science the habit of forming a judgment upon these facts unbiased by personal feelings is the scientific method”

Science is ideally a pyramid like system based on observed phenomena or more and more general theories, theories form which less general theories are deduced.

**RANGANATHAN’S SCIENTIFIC METHOD:** Dr. S.R. Ranganathan said that” Science is the name gives to a domain in the universe of knowledge whose development is characterised by a method called scientific method. In other word science is ultimately bound-up which way it is built-up”

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### 3.3 Features of Scientific Method

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1. Scientific method is used with a purpose such as to verify any old theory or to find a new area of knowledge
2. Scientific method is related to a theory in two ways:
  - a) Every scientific method is operational zed on some theoretical base
  - b) Every scientific method through its research activity gives birth to a new theory or modifies the old one. At least it may come out with a new hypotheses rejecting the old one
  - c) Every scientific activity aims at validating or revalidating the establishment truth. However it must be noted that all research activities do not lead to generating new knowledge sometimes a research does not even modify the establishment truth.

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### 3.4 Spiral of Scientific Method

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**Introduction:** S.R. Ranganathan has indicated that scientific method works like a never ending circle and has conceptualised a spiral of Scientific Method in order to explain vividly the steps and phases involved in Scientific Methodology. He writes in this connections:

“Scientific method makes intellectual pursue of any discipline perpetually round and round a never ending succession of cycle. Because the cycle is endless we can begin its description at any of its points..... The terms ‘Nadir’, ‘Zenith’, ‘Quadrants’ .....are self explanatory”. In order to understand the spiral of scientific method it is essential to acquaint oneself with the following terms.

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### 3.5 PHASES IN SCIENTIFIC MEHTOD

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**Empirical Phase:** The first phase of research in which the investigator identities a problem on the basis of his previous experience (empirical means pertaining to experience) and knowledge of the world and the subject. It starts from 'Nadir' and ends at Ascendant. We may club it as the 1<sup>st</sup> quadrant of the spiral. Explaining empirical phase Rnganathan writes: “we start with the fact of individual experience at the Nadir. These

arise out of the apprehension of the phenomenal world through the senses with guidance by the intellect".

**Hypothesizing phase:**

In the second phase of research in the investigator, on the basis of preliminary collection of data, formulates hypotheses through inductive reasoning and intuition. It starts from Ascendant and ends at Zenith. We may dub it as the 2<sup>nd</sup> Quadrant of the spiral..

**Deductive Phase:** the third phase or third quadrant of research in which deduced laws, latent in the normative principles hypothesis are formulated. It starts from Zenith and ends at Descendant. We may dub it as the 3<sup>rd</sup> Quadrant of the spiral

**Verification Phase:** We may dub as the fourth phase of research in which the deduced laws are tested and generalization is made on the basis of all possible collected facts. It starts from Descendant and ends at Nadir

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### 3.6. Quadrants and Analysis

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Ranganathan has conceived Scientific Method as a spiral, or a never ending succession of cycle. This means that the scientific research never ends, It is continuous process. It identifies a problem formulates hypotheses, verifies them makes generalization and thus solves the problem. But it never makes generalization and thus solves the problem. But never accepts the solution as final. It accepts the solution only till it stands proved by evidences or facts. It may happen that later some contradictory evidence or fact come to notice or it may also happen the solution itself gives rise to another problem. The scientific method again precedes on its journey on the cycle or the spiral. This process is unending.

Rangnathan has assumed four cardinal points (N= Nadir, A= Ascendant; Z= Zenith; and D=Descendant) on the spiral which form four quadrants, viz Quadrant 1, Quadrant 2, Quadrant 3 and Quadrant 4. The span of each quadrant  $\frac{1}{4}$ th of the cycle of the spiral ar as follows:

- Q 1 = Nadir to Ascendant
- Q 2 = Ascendant to Zenith
- Q 3 = Zenith to Descendant
- Q 4 = Descendant to Nadir

Schematic representation of the four phases or quadrants on the spiral is given in fig

Research starts form Nadir and ends (temporarily) also at Nadir. The journey from Nadir to Ascendant covers the first one-fourth or quadrant (Q1) of the spiral and is known as empirical phase. The journey from Ascendant to Zenith covers the second one- fourth or quadrant (Q2) of the spiral and known as hypotheses phase. The journey from Zenith to Descendant covers the third one-fourth or quadrant (Q3) of the spiral and is known as deductive phase and the journey from Descendant to Nadir covers the fourth on fourth or Quadrant (Q4) of the spiral and is known as verification phase.

A person without previous knowledge, background or experience of subject cannot formulate a problem clearly. "In the progression through the first Quadrant, these experiences are boiled together as it were with the aid of inductive logic, normal equations and other tools" in this phase i.e. journey is quadrant I is therefore called empirical phase



and in this the researcher derives empirical laws. it requires much imagination and intuition to form hypotheses.

The phase of the journey takes place in Quadrant II, i.e. from Ascendant to Zenith. It is known as hypothesizing phase because in this phase the investigator formulates hypothesis (Known as Normative Principles in social sciences) which are tentative solutions to the problem. Hypotheses are not formed in void or arbitrarily. It requires much imagination and intuition to form hypotheses.

The third phase of journey takes place in Quadrant III i.e. from Zenith to Descendant it is called deductive phase "All the known laws can be derived out of the hypotheses (or Normative principles) by the deductive process. But more laws are usually derivable by deduction. This is because intuition has played a part in the formulation of the hypotheses (or normative principles) therefore hold in latent form many laws on hitherto arrived at the progression through empirical phase. These are "deduced laws" These are not in the third quadrant of the cycle. Their deduction forms the "deductive phase of the cycle. The Work of this phase is solely through intellection"

The fourth and the last phase (for the time being) of the journey takes place in quadrant IV it is known as verification phase because in this: phase one, the deduced laws, which may be considered as developed by hypotheses is verified on the basis of facts. The researcher collects all possible facts pertaining to the problem and tests if all the facts are in agreement with the deduced law in hand. This he does through observation and experimentation with the aid of sense and intellect. It is accepted as the solution and is generalized and the process of research is temporarily terminated. The process however starts again from Nadir any of the facts, later or sooner, is found contradicting the generalization. The work in different quadrant or phase may briefly be shown as under:

Quadrant	Span	Phase	Based on
1	N-A	Empirical	Experience and observation of facts
2	A-Z	Hypothesizing	Intuitions and Imagination
3	Z-D	Deductive	Intellection
4	D-N	Verification	Observation and Intellection

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### 3.7. VARIOUS SUBJECTS AND SCIENTIFIC METHOD:

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Only those subjects can be called 'Sciences that are exposed to the entire circle or entire spiral of scientific method. In other words a subject may be considered to be science if it undertaken a journey in all the four quadrants or phases and touches all four points. If we analyse various disciplines/ subjects we may reach the following conclusions::

'Humanities' is a generic term used to encompass Literature, Fine Arts, Religion, and Philosophy. Literature and Fine Arts are based directly on imagination and intuition. These subjects therefore emanate directly in Quadrant II from Ascendant, do not touch Nadir and do not undertake journey in Quadrant I. Religion is based on sacred books, which are considered to be contained and 'revealed thought' it does not start from Nadir, or even from Ascendant because there is no scope for experience and guess in it. Philosophy starts from Zenith and goes up to Nadir via Descendant. It uses intuition and also intellection, and tends to verify its theories. In the words of Ranganathan, "It oscillates between the Zenith and the Nadir" It has nothing to do with Nadir and Ascendant. These subjects (Humanities)

are therefore not exposed to all the Quadrants of the circle on the spiral of scientific method. Hence these cannot be called as 'Science'

As far as sciences are concerned, the Natural Sciences are fully exposed to all the quadrants. The Social Sciences though not fully but are fairly exposed to all quadrants. Thus it may be dubbed as "deemed science"

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### **3.8. Library Classification and Scientific Method:**

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Library classification has entered in the spiral of Scientific Method and therefore it may also be recognized as a "Deemed Science". The parent subject, or most appropriately the host subject of library classification is one of the Social Sciences. Since Library Science lies in the region of social science, it should formulate normative principles instead of hypothesis for claiming a position in the spiral of scientific method. Let us now see that how library classification is exposed to all phases and how it underakes the journey in all the quadrants on the spiral of scientific method.

Due to changed circumstances and the advent of printing press, spread of literacy, emergence of democracy, spread of education normative principles changed. For example, the Five Laws of Library Science have changed the normative principles to " Book are for use" " Books are for all" ,"Every reader his/her Book" "Every Book its reader" "Save the time of the reader" and "Library is growing organism".

But the normative principles of today emphasizes on open access to books arrangement of entries in catalogue in systematic way and arrangement of books on shelves by their subject and thus according to class number. The classification of books minutely on the basis of subject expounded" and " Give each book a class number, a book number and a collection number, the three together constituting its call number, by which its location is known".

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### **3.10. SPIRAL OF SCIENTIFIC METHOD& SECTORS**

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Dr. S.R.Ranganathan had characterized the working of scientific method by a never ending spiral movement for convenience the four cardinal points of the cycle have been denoted by the terms Nadir, Ascendant, Zenith and Descendant and Nadir were called as the four sectors of the cycle.

#### **3.10.1 First sector (use of preliminary senses to accumulation of data)**

1. Use of primary sense either in their native state with the aid of instrument
2. Observing the knowees either with or without experimental inferences and conditioning
3. Progress towards particularization and regression from generalization
4. Progress towards concreteness and regression from abstractness
5. Facts found and recorded

#### **3.10.2 Second Sector: with the aid of intellectual to the formulation of and recording of inducted or empirical laws)**

1. Use of internet
2. Reasoning with the aid of inductive logic to boil down the numerous facts ( collected at step-I) to small number of inducted and empirical Laws
3. Progression towards generalization form particularization

4. Progression towards generalization form concreteness
5. Formation of empirical laws and their recording

**3.10.3 Third Sector:** (with the aid of intuition to the formulation of and recording of fundamental laws)

1. use of intuition unmediated by the primary senses or the intellect
2. Boiling down of the inducted or empirical laws to the very small number of fundamental laws
3. Progression towards ultimate generalization
4. Progression towards ultimate abstractness
5. Seizing of fundamental laws and their recording

**3.10.4 Fourth Sector** (with the use of intellect to the formulation and recording of deduced laws)

1. Use of intellect aided by itself or aided by machinery
2. Reasoning with the aid of deducting logic including mathematical and other calculus's
3. Progress towards particularization
4. Progress towards concreteness
5. Deduced laws must include one and all the induced empirical laws
6. Derivation of deduced laws and their recording
7. The number of deduced laws exceed the number that of empirical laws if fundamental laws have been seized with intuition of adequate intensity

Thus we find that the process of observation correspond to sector 1 and 2 in the spiral the process of formulation of hypothesis to sector 3 and testing of hypothesis to sector 4 in the cycle.

**3.10.5 Re-entrance into the Spiral:** Two things happen in the re-entrance

1. Observation and experimentation are made to verify empirically the validity of new deduced laws
2. Further continuous observation and experimentation leads to accumulation of new empirical facts.

So long as the deduced laws are verified empirically to be true and the new empirical laws are found to be in conformity with the implications of the fundamental laws, there is no movement in the spiral. But as and when the new empirical facts appear to contradict the fundamental Laws every effort is made to ensure absence of any kind of fallacy in the process of deduction even then if the contradiction persists, a crisis is declared in the application of the scientific method. A new cycle gets into full swing and carries and spiral of scientific method further. Thus the cycle is liable to be repeated without end.

Thus any domain in the universe of knowledge which admits of the above described spiral of scientific method in the course of its development is a 'Science'

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### **3.11 Importance of the Spiral of Scientific Method:**

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1. It helps in knowing the intrinsic attributes of subjects
2. It helps in knowing the stage of development of a subject
3. Completed one or more cycles in the spiral e.g. Physics Chemistry , Biology
4. Completed 1,2&4 Quadrants and the cycle likely to be completed in due course e.g Applied Science like Engineering Chemical Technology
5. Completed Quadrants 3& 4 above ( Pure Mathematics)
6. Completed Quadrants 4 & 1 above ( Religion and Metaphysics)
7. Quadrant 3 above (Mysticism Fine arts and Literature
8. It helps in understating the kind of work involved and the kind of ideas produced in the different stages if development of subjects
9. It helps in ascertaining the different patterns of development in the universe of subjects [ some start at stage1 some stat at stage2 and so on]
10. It helps in studying he modes of development of subjects and groups of subjects
11. It helps in predicting the likely development in a subject in the near future
12. It helps in learning the affinity among long regions of knowledge which helps the classifications, in replacing these subjects in helpful position in the universe of subjects in helpful position in the universe of subjects and thereby in the scheme for classification
13. Gives a proper historical perspective of the development of subjects and thereby of the universe of subjects as a whole; and
14. It characterizes a discipline on the basis of its method of development rather than on the basis of its subject of study or the method used in studying  
Modern science is based on certain assumptions certain and when we make use of those assumptions and concepts in searching the unknown is a systematic manner this course of action is known as the scientific method. This means searching truth after accepting certain norms which have been given by the modern science the rules, and our enquiry may be called as the scientific work or activity.

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### **3.12 Summation**

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The scientific method is intricately associated with science, the process of human inquiry that pervades the modern era on many levels. While the method appears simple and logical in description, there is perhaps no more complex question than that of knowing how we come to know things. In this introduction, we have emphasized that the scientific method distinguishes science from other forms of explanation because of its requirement

of systematic experimentation. We have also tried to point out some of the criteria and practices developed by scientists to reduce the influence of individual or social bias on scientific findings.

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**3.13 Questions to be answered:**

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1. Define the Scientific Research? Characteristics of the Scientific Research
2. Describe the Spiral Scientific Research Method in Library and Information Science
3. Explain the how do Re-entry of the Spiral Scientific Research Method

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**3.14 References**

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# UNIT-III

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## LESSON-4 DATA COLLECTION TOLLS AND TECHNIQUES

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### Structure

4.0 Aim & Objectives

4.1 Introduction to Data Collection

4.1.1 Primary and Secondary Data:

4.1.2 Sources of Secondary Data

4.2 Method of Primary Data Collection:

4.2.1 Merits and Demerits

4.3 Indirect Oral Investigation:

4.3.1 Merits and demerits

4.4 Information Received through local agents and correspondents:

4.4.1 Merits and Demerits:

4.5 Mailed questionnaire method:

4.5.1 Merits and Demerits

4.6 Questionnaire method and Enumerators

4.6.1 Merits and Demerits

4.7 Drafting a Schedule or Questionnaire for Collection of Data

4.7.1 Prepare of Schedule/Questionnaire

4.7.2 Characteristics of a Good Questionnaire

4.8 Precautions for use of the data

4.9 Summation

4.10 Questions to be answered

4.11 References

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### 4.0 Aim and Objectives of the study

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- To know the Difference between primary and secondary
- How to collect the primary and how to add the secondary data
- Techniques of the collection of the primary and secondary data

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#### **4.1 Introduction to Data Collection:**

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The collection of data refers to gathering of information relevant to the subject matter of the research study from the units under investigation. The method of data collection depend mainly upon the nature, purpose and the scope of inquiry on one hand and the availability of resources and time on the other. The collected statistical data may be classified into primary and secondary data depending upon the nature of the collected data and mode of collection of data.

##### **4.1.1 Primary and Secondary Data:**

Primary data has been obtained or collected through the original observations by the researcher or through his agents for the first time for any investigation and used by them in the statistical analysis; whereas secondary data are collected by some other researcher and used by others. The difference between primary and secondary data is determined only with the degree of variation relating to present Research and the study. Detachment with the original source. The data which are primary at one time may be treated as secondary at another. Once the primary data have been used, it loses its original character and becomes secondary. Such Secondary data are mostly published in newspapers, periodicals and journals. The distinctive character between primary and secondary data mainly depends upon the nature, objectives and scope of the inquiry availability of time and money degree of accuracy desired and the status of the investigator. The primary data are more reliable on the face, but the secondary data can be relied only by examining the source from which they have been obtained, their true significance, completeness and method of collection. Often in a certain investigations, both primary and secondary data are used as supplement to one another. It may be pointed out that, in a good number of statistical inquires, secondary data are generally used because fairly reliable published data on large number of diverse field are now available. In fact the primary data are collected on the current topic of research, sometimes even if there do not exist any secondary data suited to the present investigation under study.

**4.1.2 Sources of secondary data:** various sources of secondary data may be classified into two following broad groups:

**(a) Published statistics:** there are a number of national Government semi-Government and private organizations and also international agencies which collect statistical data relating to business, trade, labour prices consumption production industries, agriculture, national income, currency exchange population and a number of socio-economic phenomena and published their findings in statistical reports on a regular basis. These publications of the various organizations serve as a very powerful source of secondary data.

**(b) Unpublished statistics:** Secondary data may also be available in unpublished form. For example information contained in the official records and files of the government and private officer's studies made by research institutions and scholars can be important sources of secondary data.

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## 4.2 Primary Data Methods of Data Collection

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The various commonly used methods for collection of primary data are given below:

- a) **Direct Personal Investigation (DPI)** : This method can be applied in two ways: under this DPI method the investigator has to go to the field personally for the collection of data from the selected sample population or the respondents. This technique or the method of investigation is suited only if the inquiry is intensive, and mostly the investigation is generally local confined to a single locality. The information gathered from such investigation is original in nature.
- b) **Interview Method:** Under this method the investigator only observe and records the behavior rather than putting questions to the respondents. Observation is very helpful in studying the behavior of children, tribal and literate since direct oral inquiry in such cases will not receive proper responses.

### 4.2.1 Merits and Demerits:

#### **Merits:**

1. Investigator can clear up his doubts and misunderstanding on the spot especially when his informants are illiterate people. He may also check wrong information on certain items by intelligent cross questioning.
2. The results obtained by this method are generally more accurate and reliable than any other methods.
3. Due to direct contact of the investigator people tend to cooperate in a better way and the promptness in the collection of data is also assured.
4. Supplementary information can also be collected which often proves to be of great help in interpreting results.

#### **Demerits:**

1. This method may not be suitable if the number of persons to be interviewed is very large or persons are spread over a large geographical area.
2. This method is costly and time consuming since the respondents can be approached only at their convenience. This delay in collection of data and analysis of results will cause delay in reaching final results.
3. If the investigator is not trained, intelligent and tactful enough to understand the psychology of the informants; the result obtained may not be reliable and accurate.
4. Personal biases, prejudices and whims of the investigator may in certain cases adversely affect the findings of the inquiry. In words of W.I King "the prejudices and desires of the investigators become too often unconsciously woven into the fabrics of conclusions."

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## 4.3 Indirect Oral Investigation:

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This method is used in cases where direct social investigation is not possible either because of the unwillingness of the informants to furnish the requisite information or complexity of data or due to the extensive nature of the inquiry or due to the fact that



direct sources of information do not exist or are unreliable. Under this method instead of directly approaching the information, the investigator interviews several third parties informants who are directly or indirectly concerned with the subject-matter of the inquiry and who are in possession of the requisite information. After preparing a small list of question pertaining to the inquiry the questions are put to the persons known as witness of informants and their replies are recorded. All inquiry committees and commissions appointed by the Government adopt this method.

The success of this method heavily depends upon representative character of the witness and their personal knowledge about the problem under study, the prejudices and desires of witness about supplying information, the personal quality and ability of the interviewer and the experiences, sincerely and honestly of the investigator.

#### **4.3.1 Merits and demerits**

1. Under this method a wide geographical area can be covered.
2. This method is less expensive and less time and labor consuming and the results can be obtained with limited means.
3. While directly approaching the people their biases of prejudices can be avoided to a great extent by interrogating the third party informants. Thus the results obtained under this method may be more accurate and reliable
4. Under this method to make a more effective and efficient inquiry the suggestions of the experts and specialists can be obtained.
5. The information obtained under this method is not sometimes very reliable because the investigator has to rely entirely on the information supplied by the enumerators. Witness influence by certain considerations may also deliberately twist the result and bias the study.
6. Sometimes a wrong and improper choice of the witness may bias results and adversely affects the findings of the inquiry

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#### **4.4 Information Received through local agents and correspondents:**

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Under this method local agents or correspondents are appointed by the investigator indifferent parts of the field inquiry. The agents collect the required information in their areas mostly in the form of current estimates and transmit the same to higher agency where the data is processed for final analysis. This method is particularly used by the newspapers and Government agencies where the information desired at regular interval of time form a wide area

##### **4.4.1 Merits and Demerits:**

1. This method is quite ideal and useful where information local estimates are needed periodically

2. This method is most economical, reliable and expenditure for extensive investigation
3. This method is suitable only in those cases where a rough and approximate estimate re enquired and higher degree of accuracy is not desired
4. Since the information is collected by different local agents in their own styles, the results are bound to be biased due to the personal prejudice and whims of the local correspondents.

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#### **4.5 Mailed Questionnaire Method:**

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Under this method the questionnaire will be sent to the respondents with a request for quick response within the specified time. This method of collections primary data involves following steps:

1. Preparing a questionnaire or schedule relation to the field of inquiry and providing space for the answer to be filled of inquiry and providing space for the answer to be filled in by the respondents.
2. Devising a scheme for selecting individuals who should be approached for collecting the desired information
3. The questionnaires are mailed to the selected respondent along with instructions, if any and a covering letter explaining the purpose of the inquiry and requesting the respondents to return them within a specified time. Respondents are also taken into confidence by assuring them that the information supplied by them in the questionnaire will be kept strictly confidential.

The success of this method depends mainly upon the ability of the researcher with which the questionnaires are prepared the degree of response from the respondents and the ability and know lodge of the informants.

The merits and demerits of mailed questionnaire method be summarized as below:

##### **4.5.1 Merits and Demerits:**

1. This method of collecting primary data is most economic in terms of money, time and labour
2. This method is very useful for extensive inquires cover a very wide area where information are spread over.
3. The information gathered under this method is free from bias of the investigation as the information is supplied directly by the informants. Thus the information collected under this method is original and more authentic.
4. This method is useless if the informants are illiterate.
5. Due to indifferent attitude of the respondents they may not return the questionnaire at all or may not return in time and even if they return some returns may be inaccurately and improperly filled because some of the question contained in the questionnaire may have not been properly understood.
6. This method is not flexible as the questionnaires are filled by the respondents themselves and there is no scope for asking supplementary questions for cross checking of the information supplied by them.

7. At times informants are not willing to give written information in their own handwriting on certain personal questions like income property personal habits etc, which makes the investigation difficult.

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#### **4.6 Questionnaire Method Enumerators:**

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Under this method a team of enumerators is appointed who are provided with standard questionnaire to filled up by putting questions to the respondents. These enumerators are also given special training and instructions regarding the way of information to be collected and scheduled to be filled. This is most widely used method of collection of primary data.

##### **3.6.1 Merits demerits:**

1. This method can be employed even in the case of illiterate informants.
2. The data collected under this method are more reliable and accurate because the information given by the informants can be checked on the spot by cross examination
3. This problem of non-response on the part of the informant is minimized as the enumerators obtain the information personally
4. It is most expensive method since the enumerators are paid remunerations for their services.
5. As compared with the mailed questionnaire method, this method is more time consuming.
6. Inefficiency on the part of the enumerator's couple with personal biases due to their prejudices and whims may lead to false conclusions.
7. If the schedule is prepared haphazardly and incompletely the enumerators will find it very difficult to get the complete and correct desired information from the respondents.
8. The success of this method mainly depends upon the personal qualities of the enumerators like unbiased attitude courtesy, fact honesty sincerely experience etc. the availability of the enumerators possessing all these qualities is a very difficult task.

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#### **4.7 Drafting a Schedule or Questionnaire for Collection of data:**

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Schedule or questionnaires are similar in nature and there is a very slight difference between the two so far as the construction is concerned. A Schedule has to be used in direct interview or direct observation and is filled by the enumerators while the

questionnaires are generally mailed to the respondents who fill it up and return it to the researchers.

The drafting of a schedule or a questionnaire is a very technique job and the requires general care skill wisdom efficient and experience no hard and fast rule can be laid down for framing a questionnaire but it should be drafted with utmost care so that all the relevant and essential information for the inquiry may be collected easily. The success of the survey largely depends on the quality of the questionnaire.

According to prof. Arthur kormhauseer framing of a questionnaire concerns with four decisions:

1. Decision regarding the set of questions to be asked
2. Decision regarding question wording it concerns how the question are framed and posed
3. Decision regarding form of response to the questions
4. Decision about the placing of questions in sequence. It concerns with the order of questions. for example the questions which should follow such that there is a suitable sequence in all the questions posed.

#### **4.7.1 Purpose of a Schedule or a questionnaire**

The purpose of a schedule is to provide a standardized tool for interview in order to attain objectivity in order to attain objectivity. Schedules also act as memory tickler in the absence of which the field worker may put different questions to the different respondents. He may forget to inquiry about some important aspect of the survey. In such a case he would be required to follow the whole process again to collect that missing information. A schedule keeps the memory of the enumerators refreshed and reminded of the different aspects that are to be particularly observed.

A Schedule also facilitates the work of classification tabulation and analysis of data it puts the whole information in a structured form which makes the tabulation and analysis very easy.

#### **4.7.2 Characteristics of a good questionnaire**

The following are some essential characteristics of a good questionnaire

1. It should clearly indicate the objectives of the inquiry so that the respondents may be aware of the research problem and may be in a better to give suitable answers.
2. The questions should be simple ,clear brief unambiguous and corroborative in nature to avoid guessing on the part of the respondents
3. The size of the questionnaire should be as small as possible if the questionnaire is too lengthy the response is likely to be poor. Respondent's time should not be wasted by asking irrelevant useless and unimportant questions.
4. A greater attention is required regarding the appearance of the questionnaire. The questions should be made attractive by proper lay out and appearing getup. These qualities of questionnaire create a good impression upon the informant.

5. The sequences of questions are also of a great importance. The questions should be arranged in a logical order. It will enable the respondents to understand its purpose and as a result the quality of answer may be improved.
6. The questions should not be such as would require the respondents to disclose any private confidential or personal information which he may be unwilling or reluctant to disclose.
7. The questionnaire should be framed that the respondents may give very brief answers in yes or no or tick or X
8. The questions should not be emotionally worded or irritating otherwise there would be a biased response.
9. As far as possible corroboratory questions should be asked so that the information given by the informants might easily be checked
10. It is also desirable to try out the questionnaire on a small scale before using it for the given inquiry. This testing on a small scale called the pre-test has been found to be extremely useful in practice. The questionnaire can be improved or modified in the light of drawbacks, shortcomings and problems faced by the investigator in the pretest
11. A covering letter explaining the objectives and scope of the survey should be enclosed along with the questionnaire.
12. The respondents should also be given assurance that the information supplied by them would be kept strictly confidential
13. Mode of tabulation and analysis should also be kept in mind while designing a questionnaire

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#### **4.8 Precautions in the use of secondary data**

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Owing to these limitations of secondary data, a proper scrutiny of secondary data must be made before they are used by a researcher. It is therefore suggested that before using secondary data the investigator is required to consider the following aspects: (1) Suitability of data; (2) Reliability of Secondary Data; (3) Adequacy of Data; (4) Processing of data. (5) Editing (6) Coding:

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#### **4.9 Summation:**

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A primary source is a publication in which the data are published by some authority which has gathered and analyzed them. A Secondary source is a publication reporting data which has been gathered by other authorities and for which others are responsible "in simple words secondary data is one which is collected by some earlier agency but is used and analyzed by any other for its own use. Data which are primary have been used; it loses its significance, original character and becomes secondary. Secondary data are more popular in modern surveys since they are easily available, time saving and economical.

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#### **4.10 Questions to be answered**

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1. Define a Primary and Secondary data and how its collected the data
  2. Method of collection of data
  3. Describe the Drafting the Schedules

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#### **4.11 References**

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# UNIT-III

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## LESSON-5 DATA REPRESENTATION- TABLES, CHARTS, GRAPHS

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### Structure

5.1 Aim and Objectives of the Study

5.2 Definition on Tabulations

5.3 objectives of the Tabulation

5.4 Preparation of Statistical Table

5.5 Types of Tables

5.6 Limitations of the Table

5.7 Classification of the Tables

5.8 Requisite of a good table

5.9 Summation

5.10 Questions to be answered

5.11 References

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### 5.0 Aims and Objectives of the Study

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- To know about the organization of the tables
- How to draw the tables
- To know the tabulation of and calculations the data
- How to analyze the data application of statistics
- How to sketch and draw the tables through the data

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### 5.1 Introduction

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Data representation in form of Tables, Graphs and Charts in the dissertations, Ph.D, theses and in reports enables the users to have a clear cut view about the data. The represented further represented in the form of graphs and tables, study as the self explanatory. It gives completes and comprehensive view of the data, and the analysis gives the basic outcome of that particular Table.

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### 5.2 Definition:

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Harry Jerome has defined the requisites of a good table in the following words: "A good statistical table is not a mere careless grouping of columns and rows of figures it is a triumph of integrity and technique a master piece of economy of space combined with a maximum of clearly presented information. To prepare a first class table one must have a clear idea of the facts to be presented in contrasts to be stressed, the points upon which emphasis is to be placed and lastly a familiarity with the techniques of preparation. L.R. Connor has said "tabulation involves the orderly and systematic presentation of numerical data in a form designed to elucidate the problem under consideration" According to A.M. Tuttle "A statistical table is the logical listing of related quantitative data in vertical columns and horizontal rows of numbers with sufficient explanatory and qualifying words phrases and statements in the form of titles, heading and notes to make clear the full meaning of data and their origins".

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### **5.3 Objective of tabulation:**

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The main objectives of the tabulations are:

1. The function of tabulation in the general scheme of statistical investigation is to arrange in easily accessible form the answer with which the investigator is concerned "—Bpwely
2. The main objective of the statistical table is to summaries large and complex information and to present it in the simplest possible form consistent with the purpose for which it has been designed.
3. A table permits the observation of the whole data at a glance. Thus the table makes the significance of the data very clearly
4. The economy of space is achieved by tabulation without sacrificing the quality and usefulness of the data.
5. Table makes the data readily comprehensible and facilitates comparisons by classifying data into suitable groups.
6. Tabulation also facilitates the detection of the errors and the omissions in the data
7. Tabulation depicts the trend and tendencies of the problem under study
8. Tabulation information is convenient to refer and identify at any future date.
9. Tabulated data have an attractive get up and leave a lasting impression on the mind as compared to the data in textual form.

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### **5.4 Preparation of a statistical table:**

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The preparation of a good statistical table is specialized job and requires great skill experience and common sense, on the part of the tabular. Its preparation depends upon the size and nature of data, number of classes and nature of comparison desired. A good statistical table is neither too long nor too short. It should be of reasonable size without any loss of clarity adjusted to the space at our disposal and should posses an attractive get up. The purpose of tabulation must be kept in mind before its preparation. Following are the main parts of a good statistical table:



1. **Table Number:** if a research contains more than one table all the tables should be numbered in a logical sequence for easy identification and reference in future. The table number is usually placed at the top of the table either in the centre, above the title or in the side of the title.
2. **Title of the Table:** The second part of the good table is its suitable heading which usually appears at the top of the table. A title is meant to describe the contents of the table in brief and concise form and should be self explanatory. It should also clearly describe the nature of the data, the place time and the sources of data.
3. **Head Notes or Prefatory Notes:** If needed, head note should also be given just below the title in a prominent type and enclosed in brackets for future description of the content of the table. For instance the unites of measurement are usually expressed as head note such as in hectare in millions, in lakhs in kilograms in rupees etc.
4. **Captions:** captions are the heading of vertical columns. It should be brief concise and self explanatory and provides the basis for classification. A Caption has usually a main heading and its sub-headings called sub-captions. For example caption male and female can be sub-divided into educated uneducated and total.
5. **Stubs:** Stubs are the heading of the horizontal rows Normally a relatively important classification with long description is give in horizontal rows or stubs for example the rows may indicate the different period class intervals income groups etc.

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## 5.5 Types of Tables

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Various types of tables commonly used in practice are presented in the following chart:

**1. General purpose and Special purpose Tables:** A general purpose table or reference table provides the raw data in detail and covers the variety of information on the same subject without any intention of any analytical purpose such as comparative studies. Relationship in the appendix of a report for reference, they are also sometimes called reference tables most of the tables prepared by the various Government agencies like CSO census reports RBI etc are of this kind of tables the primary and usually the sole purpose of a reference table is to represent the data in such a manner that individual items may be found readily by a reader. Also a reference table contains ungrouped date, basic for a particular report usually containing a large amount of data and frequency related to a tabular appendix.

A specific purpose table also known as text table summary table or also sometimes called interpretative table is prepared with the ideas of making comparative studies and studying the relationship and the significance of the figures provided by the data relating to a specific problem. In such tables interpretative figures like ratios. Such tables are usually smaller than reference tables and are generally found in the body of the report

**2. Original and derived tables:** in an original table, initially collected data from the original source are expressed in original form such table contains absolute and actual

figures and not rounded numbers of percentages. On the other hand the table which present results derived from the original data like average, dispersion skewers etc is known as derived table. In practice the mixture of the original data and the derived results are presented in the same table.

**3. Simple and complex table:** A simple table deals with the information about only one single characteristic of the data and accordingly it is also known as one way table. It deals with sub classes of a given phenomenon related with some other variables. On the other hand if the data are grouped into different classes with a table then it is called complex or manifold table. Complex tables are more popular because they enable full information to be incorporated and facilitate proper consideration of all related facts

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### 5.5 Limitations of the Statistical Tables

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Them” L.R.Connor is also of the opinion that “Statistics especially other people statistics are full from of the following L imitations:

1. The facts on which information was collected may not be relevant for the present enquiry. They might have been collected in abnormal circumstances and the time at which they were collected may not be relevant now.
2. Secondary data might have been influenced by the personal prejudices and bias of the investigation.
3. Secondary data might not contain the degree of accuracy desired therefore they may not be acceptable for the purpose in hand.

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### 5.6 Precautions in the use and Tabulation of the data

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Owing to these limitations of secondary data, a proper scrutiny of secondary data must be made before they are used by a researcher. It is therefore suggested that before using secondary data the investigator is required to consider the following aspects:

1. **Suitability of data:** The investigator must satisfy him that the data available are suitable for the present study. For this purpose the investigator should compare the nature and scope of the present study with that of the original enquiry to confirm that the various items and units were clearly defined throughout the earlier investigation and these definitions are suitable for the present enquiry also.
2. **Reliability of Secondary Data:** In order to know about the reliability of the secondary data investigator should satisfy about the reliability integrity and of the source of information and the methods used for the collection and analysis of data. It should also be ascertained that the collecting agency was thoroughly scrutinized and edited so as to make it free from errors free as far as possible. Moreover it should also be verified that the data relates to normal times and is still relevant for the present study. If the data was collected on the basis of a sample an investigator should satisfy himself that the sample was adequate representation and was selected by proper sampling techniques. The researcher should also ascertain that

the data were collected by trained, experienced and unbiased investigators under the proper supervisory check and proper estimation techniques with desired degree of accuracy were used for estimating the parameters of the universe.

3. **Adequacy of Data:** Adequacy of data should also be tested before use. The testing of adequacy is very essential if the coverage given in the inquiry was too narrow or too wide than what it desired in the present inquiry. Another important factor to decide about the adequacy of the available data for the given investigation is the time period for which the data available as very old data might not be relevant to the present investigation.

In short the secondary data must be subjected to through scrutiny and before it is accepted for use in order to arrive at conclusions free from limitations and inaccuracies.

**Processing of Data:** Editing, coding, classification and tabulation are crucial stages in a scientific research. Data collected during the research is processed with a view to reducing them to manageable proportions. A careful and systematic processing will highlight the important characteristics of the data facilitates comparisons and render it suitable for further statistical analysis and interpretations. In other words data processing which includes editing, coding classification and tabulation is an intermediate stage between the collection of data and their analysis and interpretation. A brief discussion of some broad areas of work for statistical processing is given below.

**Editing:** To render haphazard, complex incomplete, inconsistent and large data into some significant and understandable form, editing is the first and foremost stage in data processing. According to PARTEN "The process of examining the data collected in a survey; to detect errors and omissions and to set them as they are correct and the schedules prepared for tabulation is known as editing" In other words schedules or questionnaires received from the respondents have to be scrutinized carefully to detect errors caused by careless recording of information by the field workers or by inconsistent or wrong information supplied by the informants. An attempt should be made with available information and if necessary this may be done by reinter the views or fresh filling of questionnaires. According to MOSER before the questionnaires can be regarded as ready for coding tabulation and analysis they should be checked it's for completeness accuracy and uniformity.

**Coding:** After editing, the collected data, the next steps to be followed is coding. Coding refers to assigning of number of digits or letters ingested both to various responses so as to enable tabulation of information become very easy. The purpose of coding is to classify the answers to a question into meaningful categories which is essential for tabulation.

According to M.Parton "coding consists in assigning a number or symbols to each answer which falls in a predetermined class" Good and Hatt defines coding as "An operation by which data are organized into classes and number or symbol is given to each item according to the class in which it falls.

The need of coding arises more in the ease of quantitative data which is pre-requisite for any meaningful interpretation of social data. Coding in the modern age of computers is done after translating the information collected in the usual manner into language of machine.

**Classification:** once the data is collected and edited, the first task of the satisfaction is the organization of the figures in such a way that their significance for the purpose in hand may be appreciated that comparison with masses of similar data may be facilitated and that further analysis may be possible. This is done through classification and tabulation. But before tabulation the data into different homogenous classes. It is necessary to sort out the relevant and significant features from the irrelevant and insignificant ones. The process of arranging the data into groups or classes according to resemblances and similarities is technically called as classification.

Classification has been defined by Prof. Connor in the following words "Classification is the process of arranging things in groups or classes according to their resemblance or affinities and give expression to the unity of attributes that may substitute amongst a diversity of individuals."

**Objectives of the classification:**

The main objectives of the classification of data are:

1. The first object of the classification is to express the complex, scattered and haphazard data into concise, logical, simple and intelligible form, which is readily understandable and attempts to highlight the significant features contained in the data.
2. Classification brings out clearly the points of similarity and dissimilarity. The huge numerical data can be easily arranged in some classes or groups or categories which make condensation, analysis and interpretation will be very easy.
3. Classification, facilitates comparison between variables.
4. Relationship between variables can be established through classification and tabulation.
5. Classification makes the complex data so simple that its significance can be easily followed by the researcher without much strain on the mind.
6. Classified data are presented in a tabular form which provides a basis for tabulation and further statistical processing i.e. analysis and interpretation of the data.

**Rules for classification:** No hard and fast rules can be laid down for the classification of data however consistent with the nature and objectives of the inquiry, the following guiding principles may be observed for a good classification:

1. Classification must be exhaustive and there should not be any room for doubt or confusion regarding the placement of the observations in the given classes. A Good classification should be free from the residual class like all the others the rest miscellaneous etc., because it only shows the weakness of a classification.
2. The classes must not overlap every unit of the group must find a place in some class of the other and no unit is placed in more than one classes.
3. In order to draw meaningful results, the classification must be stable i.e. once a particular mode of classification has been decided it should be retained throughout the analysis and also for further inquiry on the same subject.
4. Classification should be in accordance with the objectives of the inquiry.

Classification must have the capacity of adjustments to new situations and circumstance no classification is good enough to be used for ever; change here and there become necessary with the changes in time and circumstances.

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### 5.7 Kinds of classification:

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The data can be classified into the following four types:

1. Geographical or area-wise or region wise
2. Chronological or historical or temporal
3. Qualitative or by character or by attributes
4. Quantitative or numerical or magnitudes

**1. Geographical Classification:** such classification is based on geographical regions like states districts regions zones etc. The listing of individual entries in this type of classification may be done in an alphabetical order.

**2. Chronological classification:** when statistical data is classified accordingly to the time of its occurrence, the type of classification is known as chronological classification

**3. Qualitative classification:** in this method the basis of classification is either quality or attribute which cannot be measured quantitatively such as beauty poverty honesty etc. In qualitative classification the data are classification according to the presence of absence of the attributed in the given units and the number in each category has to be counted qualitative classification is of the two types:

(a) Simple Classification and (b) Manifold or Multiple Classifications

**(a) Simple Classification:** In simple classification data are classified into two classes with respect to an attribute like its presence or absence among the various units. In this way the of such classification are in of a given population of individuals as educated or uneducated, male or female Hindus or non-Hindus etc.

**(b) Multiple Classifications:** Multiple classifications is one where a number of groups are formed on the basis of some quality. Thus in the field of education the classification into illiterate matriculate , Inter, Degree is an example of this type of classification.

Moreover if the given population is divided into classes on the basis of simultaneous study of more than on attributed at a time this classification is again terms as multiple or manifold classification for example: suppose we divided the population into educated and uneducated and each of these two classes in future divided into two classes with respect to another attributes say employed and unemployed. Thus giving four classes in all. Each of these four classes can further be subdivided into two classes with respect to a third attribute say male and female thus giving eight classes in all

**4. Quantitative or Numbered or Marginal Classification:** in a quantitative classification, the data are classified on the basis of phenomena which are capable of quantitative measurements. Such classification is based on the magnitudes of the variables are present

rather than its presence or absence for example age: income, height, production etc are in all variable.

**Statistical Series:** the table in which such classification is given is known as statistical series. According to H. SECRIST "A series as used statistically may be defined as things or attributes of things arranged according to some logical order" CONNOR has also defined series in the following words "if two variables quantities can be arranged side by side so that measurable differences in one corresponds with measurable differences in the other the result is said to form a statistical series".

Thus a series refers to some logical arrangements of data by size magnitudes or characteristics as the case may be Types of series following are the main type of statistical series relating to a quantitative phenomenon

(a) **Individual Series:** when the measurement of individual items are arranged in ascending Order or descending order or according to some other scientific order it is known as individual series.

Discrete series when we count the number of times each value of the variable occurs it is known as discrete series. The discrete series consists of two columns i.e. (1) the size or measurement of variable and (II) frequency: the frequency are counted through the technique of tally marks or tally bars.

**Main body of the table:** The main bodies of the table contain the numerical information according to the description given in captions and stubs. Undesirable and irrelevant information should be avoided to increase the usefulness of the table. Totals must be given for separate class Category immediately below the columns or against the rows in addition the grand totals for the all classes for rows and columns should also be given the arrangement in the body is generally form left to right in the rows and form top to bottom in the columns

**Foot notes:** if there is anything special about the figures or the whole table to which the attention has to be specially draws the same is done by giving the foot notes. As the name suggests foot notes are places at the bottom of the table directly identified by the symbols etc.

**Source notes** the source note is required is the secondary data are used in the table A source note refers to the source for which information has been taken a source note should include the name of the author, title, volume, page publisher's name, and the year of publication. A source not is generally given on the left hand side or the right hand side of the base line at the end of the table.

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### **5.8 Requisites of a good table:**

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According to BOWELY "in collection and tabulation commonsense is the chief requisite and experience the chief teacher" there are no hard and fast rules for tabulating data. However a statistical table should possess the following essential qualities:

1. **Simple and attractive:** The table should be simple and compact so that it is readily comprehensible and must look pleasing to the eyes. Thus the foremost quality of a table is its simplicity and attractiveness.
2. **Manageable:** The table should not cover large space than what the common eye can grasp in one look. As far as possible it should not be kept bigger than the size of the other papers. If the information is too large, it is better to prepare number of tables and then the different tables should be consolidated in one table
3. **Suit the purpose:** the table should suit the object of the present statistical investigation
4. **Scientifically prepared:** the table should be prepared in a scientific way. In other words the table should be prepared in systematic and logically organized manner.
5. **Clarity:** The table should be so arranged that it should be clear and easily understandable even to a lay man
6. **Comparable:** comparison of data is the main object of the tabulation. To make it comparable the data should be placed in a comparable form. For the sake of comparison of data, percentages, totals or ratios etc may be calculated.
7. **Columns and Rows should be numbered:** if the table possess a number of rows and columns, they must be numbered for reference
8. **Ruling and spacing:** the rows and columns should be prepared by single, double or thick lines depending on the broad classes and sub-classes used. Related percentage should also be given very close to corresponding columns and rows.
9. **Suitable Approximation:** If the figures are too large, they should be suitably approximated to the nearest whole numbers.
10. **Units:** the unit designation should also be given at the top of the table but below the title such as price in rupees, weights in kilograms etc.
11. **Logical arrangement of Items:** for the logical arrangement of items in a table the items may be arranged alphabetically, geographically chronologically conventionally, progressively in ascending or descending order.
12. **Proper lettering:** Large capital letters should be used for heading, stubs, captions and small letters should be used for prefatory notes and source notes to make the table easily understandable and pleasing to eyes.

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### 5.9 Summation:

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After the data has been classified the next step is to arrange them in form of tables. It is an intermediate process between the collection of the data on one hand and statistical analysis on this other hand. Tabulation is regarded as the last stage in processing of data and forms the gateway for future statistical treatments.

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### 5.10 Questions to be answered

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1. Describe the Requisites of the good Statistical Tables
2. Write a short essay on classification of the statistical tables
3. Describe the Limitation of the statistical table

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### 5.11 References

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# UNIT- IV

Research in simple terms refers to a search for knowledge. It is also known as a scientific and systematic search for information on particular topic or issue. It is also known as the art of scientific investigation. Research process comprises a series of steps required for effectively conducting research. Collection, analysis and interpretation of data are crucial steps in the research process. Statistics plays an important role in conducting research.

The first lesson dealt with different techniques of data analysis and interpretation. Role of statistics in research is explained in the second lesson, while parametric and non-parametric statistics relating to research methodology is discussed in the third lesson. At present computer is being used in almost all fields of knowledge. Various computer based statistical programs are available for use by researcher. SPSS Statistics is a software package used for statistical analysis of data in conducting research. Detailed information about this package and how to work with the SPSS is given in the fourth lesson of this unit.

# UNIT IV

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## Lesson 1. Data Analysis and Interpretation

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### Structure

- 2.0 Objectives
- 2.1 Introduction
- 2.2 Data Processing Operations
- 2.3 Types of Data Analysis
- 2.4 Meaning of Data Interpretation
- 2.5 Technique of Data Interpretation
- 2.6 Precautions in Data Interpretation
- 2.7 Sum Up
- 2.8 Self-Assessment Questions
- 2.9 References

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### 2.0 Objectives:

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After reading this lesson, you will be able

- ✓ to know the purpose of data analysis
- ✓ to understand the data processing operations
- ✓ to know the various types of data analysis
- ✓ to know the meaning of data interpretation
- ✓ to examine the techniques of data interpretation
- ✓ to know the precautions in data interpretation

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### 2.1 Introduction

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After collecting the data, it has to be processed and analysed in accordance with the outline laid down for the purpose at the time of developing the research plan. This is essential for a scientific study and for ensuring that the relevant data making contemplated for comparisons and analysis. Technically speaking, processing implies editing, coding, classification and tabulation of collected data so that they are amenable to analysis. The term analysis refers to the computation of certain measures along with searching for patterns of relationship that exist among data-groups. Thus, in the process of analysis, relationships or differences supporting or conflicting with original or new hypotheses should be subjected to statistical tests of significance to determine with what validity data can be said to indicate any conclusions. But some researchers do not like to make

difference between processing and analysing. They opine that analysis of data in a general way involves a number of closely related operations which are performed with the purpose of summarising the collected data and organising these in such a manner that they answer the research questions. Hence it is a need to know the difference between the two terms in order to understand their implications more obviously. Here, an attempt has been made to assess the purpose of analysis of data and describe the processing operations and types of data analysis. Further, it is examined that the techniques and precautions in data interpretations.

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## **2.2 Data Processing Operations:**

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The following are the some of the data processing operations which are very significant to arrange the data in a technical way.

- 1. Editing:** Editing of data is a process of examining the collected raw data to detect errors and omissions and to correct these when possible. As a matter of fact, editing involves a careful scrutiny of the completed questionnaires or schedules. Editing is done to assure that the data are accurate, consistent with other facts gathered, uniformly entered, as completed as possible and have been well arranged to facilitate coding and tabulation. With regard to points or stages at which editing should be done, one can talk of field editing and central editing.
  - Field editing consists in the review of the reporting forms by the investigator for completing what the latter has written in abbreviated or in illegible form at the time of recording the respondents' responses. This type of editing is necessary in view of the fact that individual writing styles often can be difficult for others to decipher. This sort of editing should be done as soon as possible after the interview, preferably on the very day or on the next day.
  - Central editing should take place when all forms or schedules have been completed and returned to the office. This type of editing implies that all forms should get a thorough editing by a single editor in a small study and by a team of editors in case of a large inquiry. Editor may correct the obvious errors such as an entry in the wrong place, entry recorded in months when it should have been recorded in weeks, and the like.
- 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. Such classes should be appropriate to the research problem under consideration. They must also possess the characteristic of exhaustiveness and also that of mutual exclusivity which means that a specific answer can be placed in one and only one cell in a given category set. Coding is necessary for efficient analysis and through it the several replies may be reduced to a small number of classes which contain the critical information required for analysis. Coding decisions should usually be taken at the designing stage of the questionnaire. This makes it possible to pre code the

questionnaire choices and which in turn is helpful for computer tabulation as one can straight forward key punch from the original questionnaires. But in case of hand coding some standard method may be used.

- One standard method is to code in the margin with a coloured pencil.
- The other method can be to transcribe the data from the questionnaire to a coding sheet.

Whatever method is adopted, one should see that coding errors are altogether eliminated or reduced to the minimum level.

**3 Classification:** Most research studies result in a large volume of raw data which must be reduced into homogeneous groups if we are to get meaningful relationships. This fact necessitates classification of data which happens to be the process of arranging data in groups or classes on the basis of common characteristics. Data having common characteristics are placed in one class and in this way the entire data get divided into a number of groups or classes. Classification can be one of the following two types, depending upon the nature of the phenomenon involved

- Classification according to attributes:
- Classification according to class-intervals:

**4 Tabulation:** When a mass of data has been assembled, it becomes necessary for the researcher to arrange the same in some kind of concise and logical order. This procedure is referred to as tabulation. Thus, tabulation is the process of summarising raw data and displaying the same in compact form for further analysis. In a broader sense, tabulation is an orderly arrangement of data in columns and rows. Tabulation is essential because of the following reasons.

- It conserves space and reduces explanatory and descriptive statement to a minimum.
- It facilitates the process of comparison.
- It facilitates the summation of items and the detection of errors and omissions.
- It provides a basis for various statistical computations.

Tabulation can be done by hand or by mechanical or electronic devices. The choice depends on the size and type of study, cost considerations, time pressures and the availability of tabulating machines or computers. In relatively large inquiries, researchers may use computer tabulation if other factors are favourable and necessary facilities are available. Hand tabulation is usually preferred in case of small inquiries where the number of questionnaires is small and they are of relatively short length.

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### **2.3 Types of Data Analysis:**

As stated earlier, by analysis we mean the computation of certain indices or measures along with searching for patterns of relationship that exist among the data groups. Analysis, particularly in case of survey or experimental data, involves estimating

the values of unknown parameters of the population and testing of hypotheses for drawing inferences. Analysis may, therefore, be categorised as descriptive analysis and inferential analysis. Descriptive analysis is largely the study of distributions of one variable. This study provides us with profiles of companies, work groups, persons and other subjects on any of a multiple of characteristics such as size. Composition, efficiency, preferences, etc. This sort of analysis may be in respect of one variable or in respect of two variables or in respect of more than two variables. In this context we work out various measures that show the size and shape of distributions along with the study of measuring relationships between two or more variables. We may as well talk of correlation analysis and causal analysis.

- **Correlation analysis** studies the joint variation of two or more variables for determining the amount of correlation between two or more variables.
- **Causal analysis** is concerned with the study of how one or more variables affect changes in another variable. It is thus a study of functional relationships existing between two or more variables. This analysis can be termed as regression analysis.
- **Multiple regression analysis** is adopted when the researcher has one dependent variable which is presumed to be a function of two or more independent variables. The objective of this analysis is to make a prediction about the dependent variable based on its covariance with all the concerned independent variables.
- **Multiple discriminant analysis** is appropriate when the researcher has a single dependent variable that cannot be measured, but can be classified into two or more groups on the basis of some attribute. The object of this analysis happens to be to predict an entity's possibility of belonging to a particular group based on several predictor variables.
- **Multi-ANOVA** is an extension of two ways ANOVA, wherein the ratio of among group variance to within group variance is worked out on a set of variables.
- **Canonical analysis** can be used in case of both measurable and non-measurable variables for the purpose of simultaneously predicting a set of dependent variables from their joint covariance with a set of independent variables.
- **Inferential analysis** is concerned with the various tests of significance for testing hypotheses in order to determine with what validity data can be said to indicate some conclusions. It is also concerned with the estimation of population values. It is mainly on the basis of inferential analysis that the task of interpretation is performed.

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## 2.4 Meaning of Data Interpretation

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Interpretation refers to the task of drawing inferences from the collected facts after an analytical and experimental study. In fact, it is a search for broader meaning of research findings. The task of interpretation has two major aspects viz., the effort to establish continuity in research through linking the results of a given study with those of another, and the establishment of some explanatory concepts. In one sense, interpretation is

concerned with relationships within the collected data, partially overlapping analysis. Interpretation also extends beyond the data of the study to include the results of other research, theory and hypotheses. Thus, interpretation is the device through which the factors that seem to explain what has been observed by researcher in the course of the study can be better understood and it also provides a theoretical conception which can serve as a guide for further researches.

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## **2.5 Technique of Data Interpretation**

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The task of interpretation is not an easy job, rather it requires a great skill and dexterity on the part of researcher. Interpretation is an art that one learns through practice and experience. The researcher may, at times, seek the guidance from experts for accomplishing the task of interpretation. The technique of interpretation often involves the following steps:

- (i) Researcher must give reasonable explanations of the relations which he has found and he must interpret the lines of relationship in terms of the underlying processes and must try to find out the thread of uniformity that lies under the surface layer of his diversified research findings. In fact, this is the technique of how generalization should be done and concepts be formulated.
- (ii) Extraneous information, if collected during the study, must be considered while interpreting the final results of research study, for it may prove to be a key factor in understanding the problem under consideration.
- (iii) It is advisable, before embarking upon final interpretation, to consult someone having insight into the study and who is frank and honest and will not hesitate to point out omissions and errors in logical argumentation. Such a consultation will result in correct interpretation and, thus, will enhance the utility of research results.
- (iv) Researcher must accomplish the task of interpretation only after considering all relevant factors affecting the problem to avoid false generalization. He must be in no hurry while interpreting results, for quite often the conclusions, which appear to be all right at the beginning, may not at all be accurate.

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## **2.6 Precautions in Data Interpretation**

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One should always remember that even if the data are properly collected and analysed, wrong interpretation would lead to inaccurate conclusions. It is, therefore, absolutely essential that the task of interpretation be accomplished with patience in an

impartial manner and also in correct perspective. Researcher must pay attention to the following points for correct interpretation:

- (i) At the outset, researcher must invariably satisfy himself that the data are appropriate, trustworthy and adequate for drawing inferences; the data reflect good homogeneity; and that proper analysis has been done through statistical methods.
- (ii) The researcher must remain cautious about the errors that can possibly arise in the process of interpreting results. Errors can arise due to false generalization and due to wrong interpretation of statistical measures, such as the application of findings beyond the range of observations, identification of correlation with causation and the like.
- (iii) Researcher must always keep in view that the task of interpretation is very much intertwined with analysis and cannot be distinctly separated. As such he must take the task of interpretation as a special aspect of analysis and accordingly must take all those precautions that one usually observes while going through the process of analysis viz., precautions concerning the reliability of data, computational checks, validation and comparison of results.
- (iv) Researcher must never lose sight of the fact that his task is not only to make sensitive observations of relevant occurrences, but also to identify and disengage the factors that are initially hidden to the eye. This will enable him to do his job of interpretation on proper lines. Broad generalization should be avoided as most research is not amenable to it because the coverage may be restricted to a particular time, a particular area and particular conditions. Such restrictions, if any, must invariably be specified and the results must be framed within their limits.
- (v) The researcher must remember that ideally in the course of a research study, there should be constant interaction between initial hypothesis, empirical observation and theoretical conceptions. It is exactly in this area of interaction between theoretical orientation and empirical observation that opportunities for originality and creativity lie.

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### **2.7 Sum Up:**

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Thus, in the process of analysis, relationships or differences supporting or conflicting with original or new hypotheses should be subjected to statistical tests of significance to determine with what validity data can be said to indicate any conclusions. But some researchers do not like to make difference between processing and analysing. They opine that analysis of data in a general way involves a number of closely related operations which are performed with the purpose of summarising the collected data and organising these in such a manner that they answer the research questions. Further, interpretation is the device through which the factors that seem to explain what has been observed by researcher in the course of the study can be better understood and it also provides a theoretical conception which can serve as a guide for further researches.

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### **2.8 Self-Assessment Questions:**

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1. State and explain the data processing operations
2. Describe various types of data analysis
3. What are the techniques of data interpretations
4. Write a short note on the following
  - a. Data analysis
  - b. Data interpretation
  - c. Editing
  - d. Classification
  - e. Tabulation

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## 2.9 References

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# UNIT IV

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## Lesson 2. Statistics in Research

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### Structure

- 1.0 Objectives
- 1.1 Introduction
- 1.2 The important statistical measures
  - 1.2.1 Measures of central tendency or statistical averages
  - 1.2.2 Measures of dispersion
  - 1.2.3 Measures of asymmetry
  - 1.2.4 Measures of relationship
- 1.3 Statistical methods
- 1.4 Free software for data analysis
- 1.5 Sum up
- 1.6 Self Assessment Questions
- 1.7 References

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### 1.0 Objectives

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After reading this lesson, you will be able

- ✓ to know important statistical measures for research,
- ✓ to find out various statistical methods, and
- ✓ to know free software for data analysis

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### 1.1 Introduction:

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Statistics plays an important role in research where designing research, analysing its data and drawing conclusions. Most research studies result in a large volume of information which must be suitably reduced so that the same can be read easily and can be used for further analysis. Clearly the subject of statistics cannot be ignored by any research worker, even though he may not have occasion to use statistical techniques in all their details and ramifications. Collection of data and tabulation as stated earlier, achieve this objective to some extent, but researcher have to go a step further and develop certain measures to summarise the collected and classified data. In this lesson an attempt has been made to describe the importance of statistical measures and find out various statistical methods and free software for data analysis.

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### 1.2 The important statistical measures

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The following are the some of the important statistical measures that are used to summarise the survey or research data.

### 1.2.1 Measures of central tendency or statistical averages

Measures of central tendency tell us the point about which items have a tendency to cluster. Such a measure is considered as the most representative figure for the entire mass of data. Measure of central tendency is also known as statistical average. Mean, median and mode are the most popular averages.

- i. **Mean:** It is the most common measure of central tendency and may be defined as the value which we get by dividing the total of the values of various given items in a series by the total number of items.
- ii. **Median:** It is a positional average and is used only in the context of qualitative phenomena, for example, in estimating intelligence, etc., which are often encountered in sociological fields. Median is not useful where items need to be assigned relative importance and weights. It is not frequently used in sampling statistics.
- iii. **Mode:** It is the most commonly or frequently occurring value in a series. The mode in a distribution is that item around which there is maximum concentration. In general, mode is the size of the item which has the maximum frequency, but at items such an item may not be mode on account of the effect of the frequencies of the neighbouring items.
- iv. **Geometric mean:** It is also useful under certain conditions. It is defined as the  $n$ th root of the product of the values of  $n$  times in a given series.
- v. **Harmonic mean:** It is defined as the reciprocal of the average of reciprocals of the values of items of a series.

### 1.2.2 Measures of dispersion

- i. **Range:** It is the simplest possible measure of dispersion and is defined as the difference between the values of the extreme items of a series.
- ii. **Mean deviation:** It is the average of difference of the values of items from some average of the series. Such a difference is technically described as deviation. In calculating mean deviation we ignore the minus sign of deviations while taking their total for obtaining the mean deviation.
- iii. **Standard deviation:** It is most widely used measure of dispersion of a series. It is defined as the square-root of the average of squares of deviations, when such deviations for the values of individual items in a series are obtained from the arithmetic average.

### 1.2.3 Measures of asymmetry

- i. **Skewness:** It is a measure of asymmetry and shows the manner in which the items are clustered around the average. In a symmetrical distribution, the items

show a perfect balance on either side of the mode, but in a skewed distribution the balance is thrown to one side. The amount by which the balance exceeds on one side measures the skewness of the series. The difference between the mean, median or the mode provides an easy way of expressing skewness in a series.

- ii. **Kurtosis:** It is the measure of flat-toppedness of a curve. A bell shaped curve or the normal curve is Mesokurtic because it is kurtic in the centre but if the curve is relatively more peaked than the normal curve, it is called Leptokurtic whereas a curve is more flat than the normal curve, it is called Platykurtic.

#### 1.2.4 Measures of relationship

- i. **Karl Pearson's coefficient of correlation:** It is also known as the product moment correlation coefficient. The value of 'r' lies between  $\pm 1$ . Positive values of r indicate positive correlation between the two variables. When  $r = (+) 1$ , it indicates perfect positive correlation and when it is  $(-)1$ , it indicates perfect negative correlation, meaning thereby that variations in independent variable explain 100 per cent of the variations in the dependent variable.
- ii. **Charles Spearman's coefficient of correlation:** It is the technique of determining the degree of correlation between two variables in case of ordinal data where ranks are given to the different values of the variables. The main objective of this coefficient is to determine the extent to which the two sets of ranking are similar or dissimilar.
- iii. **Regression:** It is the determination of a statistical relationship between two or more variables. In simple regression, we have only two variables, one variable is the cause of the behaviour of another one. Regression can only interpret what exists physically i.e., there must be a physical way in which independent variable X can affect dependent variable Y.

$$X = f(Y)$$

- iv. **Attributes:** When data is collected on the basis of some attribute or attributes, we have statistics commonly termed as statistics of attributes. It is not necessary that the objects may possess only one attribute; rather it would be found that the objects possess more than one attribute. In such a situation our interest may remain in knowing whether the attributes are associated with each other or not.

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### 1.3 Statistical methods

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Many statistical methods have been used for statistical analyses. A very brief list of four of the more popular methods is:

- General linear model: A widely used model on which various methods are based (e.g. t test, ANOVA, ANCOVA, MANOVA). Usable for assessing the effect of several predictors on one or more continuous dependent variables.

- Generalized linear model: An extension of the general linear model for discrete dependent variables.
- Structural equation modeling: Usable for assessing latent structures from measured manifest variables.
- Item response theory: Models for (mostly) assessing one latent variable from several binary measured variables (e.g. an exam).

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#### **1.4 Free software for data analysis**

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- Data Applied - an online data mining and data visualization solution.
- Dev Info - a database system endorsed by the United Nations Development Group for monitoring and analyzing human development.
- ELKI - data mining framework in Java with data mining oriented visualization functions.
- KNIME - the Konstanz Information Miner, a user friendly and comprehensive data analytics framework.
- PAW - FORTRAN/C data analysis framework developed at CERN
- SCAViS - a multiplatform (Java-based) data analysis framework from the jWork.ORG community of developers led by Dr. S.Chekanov
- R - a programming language and software environment for statistical computing and graphics.
- ROOT - C++ data analysis framework developed at CERN

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#### **1.5. SumUp:**

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Thus Statistics plays an important role in research where designing research, analysing its data and drawing conclusions. Most research studies result in a large volume of information which must be suitably reduced so that the same can be read easily and can be used for further analysis. Clearly the subject of statistics cannot be ignored by any research worker, even though he may not have occasion to use statistical techniques in all their details and ramifications.

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#### **1.6. Self Assessment Questions:**

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1. Describe important Statistical Measures for analysis of data
2. Describe and present some of the statistical methods and software for data analysis
3. Write a short note on the following
  - a) Regression
  - b) Statistical Methods
  - c) Kurtosis
  - d) Attributes

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#### **1.7. References**

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# UNIT IV

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## Lesson 3. USE OF SPSS

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### Structure

- 3.0 Objectives
- 3.1 Introduction
- 3.2 Versions of SPSS Packages
- 3.3 SPSS Statistics for Students: The Basics
- 3.4 Starting SPSS Statistics
  - 3.4.1. Data Editor
  - 3.4.2. Output Viewer
  - 3.4.3. Syntax Editor
- 3.5 Sum Up:
- 3.6 Self-Assessment Questions
- 3.7 References

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### 3.0 Objectives

After reading this lesson, you will be able

- To know various versions of SPSS Packages released
- To understand the importance of SPSS Statistics for Students
- To know how working with SPSS Package

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### 3.1 Introduction

SPSS Statistics is a software package used for statistical analysis. Long produced by SPSS Inc., it was acquired by IBM in 2009. The current versions (2014) are officially named IBM SPSS Statistics. Companion products in the same family are used for survey authoring and deployment (IBM SPSS Data Collection), data mining (IBM SPSS Modeler), text analytics, and collaboration and deployment (batch and automated scoring services). The software name stands for Statistical Package for the Social Sciences (SPSS), reflecting the original market, although the software is now popular in other fields as well, including the health sciences and marketing.

SPSS is a widely used program for statistical analysis in social science. It is also used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners,<sup>[3]</sup> and others. The original SPSS manual (Nie, Bent & Hull, 1970) has been described as one of "sociology's most influential books" for allowing ordinary researchers to do their own statistical analysis.<sup>[4]</sup> In addition to statistical analysis, data management (case selection, file reshaping, creating derived data) and data documentation (a metadata dictionary was stored in the datafile) are features of the base software.

Statistics included in the base software:

- Descriptive statistics: Cross tabulation, Frequencies, Descriptives, Explore, Descriptive Ratio Statistics
- Bivariate statistics: Means, t-test, ANOVA, Correlation (bivariate, partial, distances), Nonparametric tests
- Prediction for numerical outcomes: Linear regression
- Prediction for identifying groups: Factor analysis, cluster analysis (two-step, K-means, hierarchical), Discriminant

The many features of SPSS Statistics are accessible via pull-down menus or can be programmed with a proprietary *4GLcommand syntax language*. Command syntax programming has the benefits of reproducibility, simplifying repetitive tasks, and handling complex data manipulations and analyses. Additionally, some complex applications can only be programmed in syntax and are not accessible through the menu structure. The pull-down menu interface also generates command syntax: this can be displayed in the output, although the default settings have to be changed to make the syntax visible to the user. They can also be pasted into a syntax file using the "paste" button present in each menu. Programs can be run interactively or unattended, using the supplied Production Job Facility.

Additionally a "macro" language can be used to write command language subroutines. A Python programmability extension can access the information in the data dictionary and data and dynamically build command syntax programs. The Python programmability extension, introduced in SPSS 14, replaced the less functional SAX Basic "scripts" for most purposes, although SaxBasic remains available. In addition, the Python extension allows SPSS to run any of the statistics in the free software package R. From version 14 onwards, SPSS can be driven externally by a Python or a VB.NET program using supplied "plug-ins". (From Version 20 onwards, these two scripting facilities, as well as many scripts, are included on the installation media and are normally installed by default.)

SPSS Statistics places constraints on internal file structure, data types, data processing, and matching files, which together considerably simplify programming. SPSS datasets have a two-dimensional table structure, where the rows typically represent cases (such as individuals or households) and the columns represent measurements (such as age, sex, or household income). Only two data types are defined: numeric and text (or "string"). All data processing occurs sequentially case-by-case through the file. Files can be matched one-to-one and one-to-many, but not many-to-many.

The graphical user interface has two views which can be toggled by clicking on one of the two tabs in the bottom left of the SPSS Statistics window. The 'Data View' shows a spreadsheet view of the cases (rows) and variables (columns). Unlike spreadsheets, the data cells can only contain numbers or text, and formulas cannot be stored in these cells. The 'Variable View' displays the metadata dictionary where each row represents a variable and shows the variable name, variable label, value label(s), print width, measurement type, and a variety of other characteristics. Cells in both views can be manually edited, defining the file structure and allowing data entry without using command syntax. This may be sufficient for small datasets. Larger datasets such as statistical surveys are more often



created in data entry software, or entered during computer-assisted personal interviewing, by scanning and using optical character recognition and optical mark recognition software, or by direct capture from online questionnaires. These datasets are then read into SPSS. SPSS Statistics can read and write data from ASCII text files (including hierarchical files), other statistics packages, spreadsheets and databases. SPSS Statistics can read and write to external relational database tables via ODBC and SQL. Statistical output is to a proprietary file format (\*.spv file, supporting pivot tables) for which, in addition to the in-package viewer, a stand-alone reader can be downloaded. The proprietary output can be exported to text or Microsoft Word, PDF, Excel, and other formats. Alternatively, output can be captured as data (using the OMS command), as text, tab-delimited text, PDF, XLS, HTML, XML, SPSS dataset or a variety of graphic image formats (JPEG, PNG, BMP and EMF).

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### 3.2 Versions of SPSS Packages:

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The following are the various versions of SPSS Packages

<ul style="list-style-type: none"> <li>• SPSS 1 - 1968</li> <li>• SPSS release 2 - 1983</li> <li>• SPSS 5.0 - December 1993</li> <li>• SPSS 6.1 - February 1995</li> <li>• SPSS 7.5 - January 1997</li> <li>• SPSS 8.0 - 1998</li> <li>• SPSS 9.0 - March 1999</li> <li>• SPSS 10.0.5 - December 1999</li> <li>• SPSS 10.0.7 - July 2000</li> <li>• SPSS 10.1.4 - January 2002</li> <li>• SPSS 11.0.1 - April 2002</li> <li>• SPSS 11.5.1 - April 2003</li> <li>• SPSS 12.0.1 - July 2004</li> <li>• SPSS 13.0.1 - March 2005</li> <li>• SPSS 14.0.1 - January 2006</li> </ul>	<ul style="list-style-type: none"> <li>• SPSS 15.0.1 - November 2006</li> <li>• SPSS 16.0.1 - November 2007</li> <li>• SPSS 16.0.2 - April 2008</li> <li>• SPSS Statistics 17.0.1 - December 2008</li> <li>• SPSS Statistics 17.0.2 - March 2009</li> <li>• PASW Statistics 17.0.3 - September 2009</li> <li>• PASW Statistics 18.0 - August 2009</li> <li>• PASW Statistics 18.0.1 - December 2009</li> <li>• PASW Statistics 18.0.2 - April 2010</li> <li>• PASW Statistics 18.0.3 - September 2010</li> <li>• IBM SPSS Statistics 19.0 - August 2010</li> <li>• IBM SPSS Statistics 19.0.1 - December 2010</li> <li>• IBM SPSS Statistics 20.0 - August 2011</li> <li>• IBM SPSS Statistics 20.0.1 - March 2012</li> </ul>
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### 3.3 SPSS Statistics for Students: The Basics

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IBM SPSS Statistics is software for managing data and calculating a wide variety of statistics. This document is intended for students taking classes that use SPSS Statistics or anyone else who is totally new to the SPSS software. Those who plan on doing more involved research projects using SPSS should attend our workshop series. The SPSS software is built around the SPSS programming language. The good news for beginners is that you can accomplish most basic data analysis through menus and dialog boxes without having to actually learn the SPSS language. Menus and dialog boxes are useful because they give you reminders of your options with each step of your analysis. However, some tasks cannot be accomplished from the menus, and others are more quickly carried out by typing

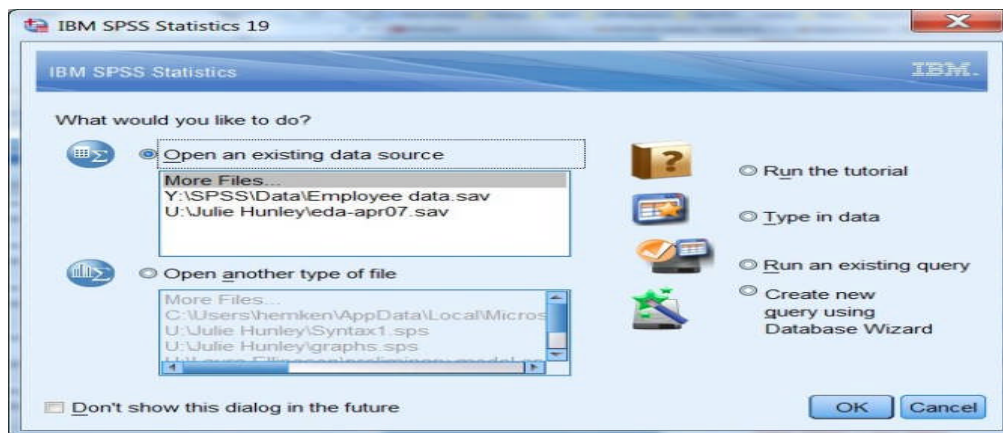
a few key words than by working through a long series of menus and dialogs. As a beginner, it will be strategic to learn a bit of both SPSS programming and the menus.

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### 3.4 Starting SPSS Statistics

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The SSCC has SPSS installed in our computer labs and on the Winstats. For information about SSCC lab accounts, the labs, Winstat and more see Information for SSCC Instructional Lab Users. To run SPSS, log in and click Start, Programs, IBM SPSS Statistics, and then IBM SPSS Statistics. When SPSS is first started you are presented with a dialog box asking you to open a file:



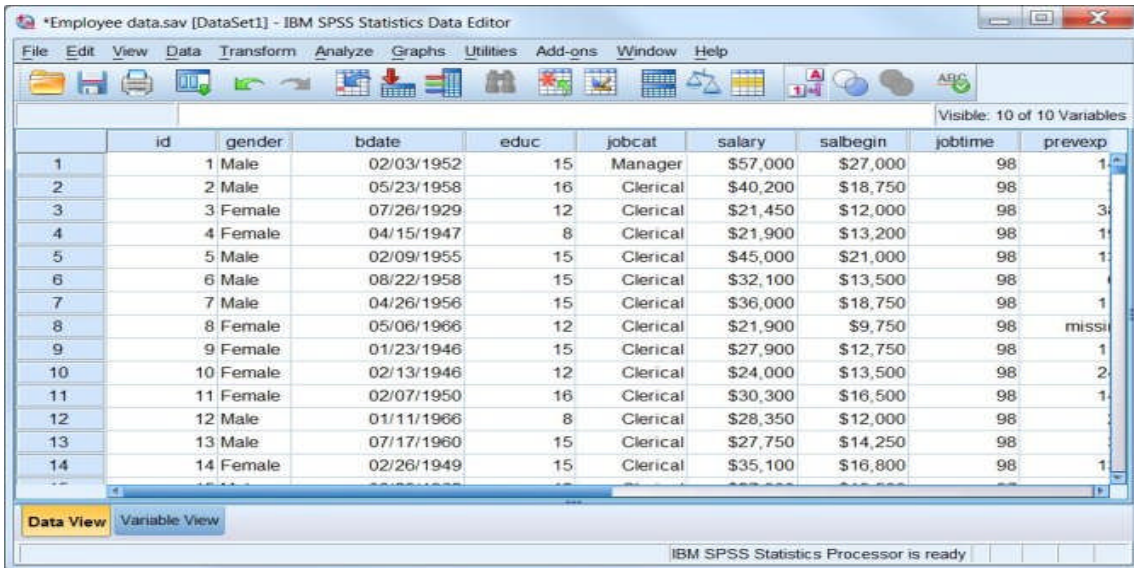
Typically you start your SPSS session by opening the data file that you need to work with. SPSS Statistics has three main windows, plus a menu bar at the top. These allow you to

- see your data,
- see your statistical output, and
- see any programming commands you have written.

Each window corresponds to a separate type of SPSS file.

#### 3.4.1 Data Editor

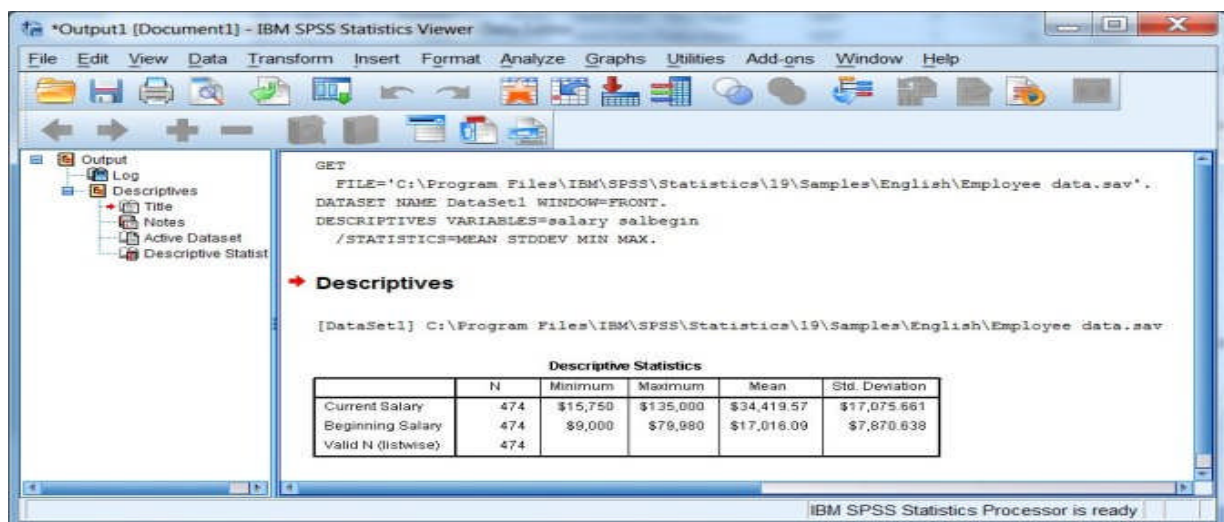
The Data Editor lets you see and manipulate your data. You will always have at least one Data Editor open. When you open an SPSS data file, what you see is a working copy of your data. Changes you make to your data are not permanent until you save them. Data files are saved with a file type of .sav, a file type that most other software cannot work with. When you close your last Data Editor you are shutting down SPSS and you will be prompted to save all unsaved files.



To open a different data set, click File, Open, and Data. SPSS lets you have many data sets open simultaneously, and the data set that you are currently working with, the “active” data set, is always marked with a tiny red “plus” sign on the title bar. In order to avoid confusion it is usually a good strategy to close out any Data Editors you're done using.

### 3.4.2 Output Viewer

As you ask SPSS to carry out various computations and other tasks, the results can show up in a variety of places. New data values will show up in the Data Editor. Statistical results will show up in the Output Viewer.

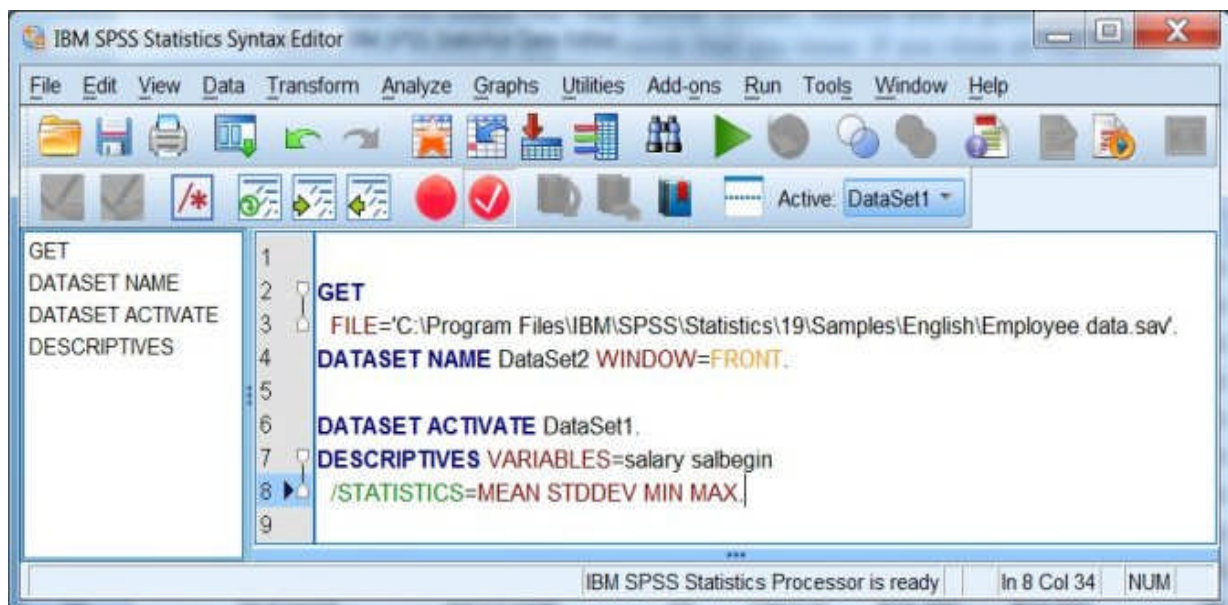


The Output Viewer shows you tables of statistical output and any graphs you create. By default it also show you the programming language for the commands that you issued (called “syntax” in SPSS jargon), and most error messages will also appear here. The Output

Viewer also allows you to edit and print your results. The tables of the Output Viewer are saved (click File, Save or Save As) with a file type of .spv, which can only be opened with SPSS software. As with Data Editors, it is possible to open more than one Output Viewer to look at more than one output file. The “active” Viewer, marked with a tiny blue plus sign, will receive the results of any commands that you issue. If you close all the Output Viewers and then issue a new command, a fresh Output Viewer is started.

### 3.4.3. Syntax Editor

If you are working with the SPSS programming language directly, you will also open a Syntax Editor. The Syntax Editor allows you to write, edit, and run commands in the SPSS programming language. If you are also using the menus and dialog boxes, the Paste button automatically writes the syntax for the command you have specified into the active Syntax Editor. These files are saved as plain text and almost any text editor can open them, but with a file extension of .sps. As with the other types of windows, you can have more than one Syntax Editor Open and the “active” window is marked with a tiny orange plus sign. When you paste syntax from dialog boxes, it goes to the active Syntax Editor. If you close out all your Syntax Editors and then paste a command, a fresh Syntax Editor is opened.

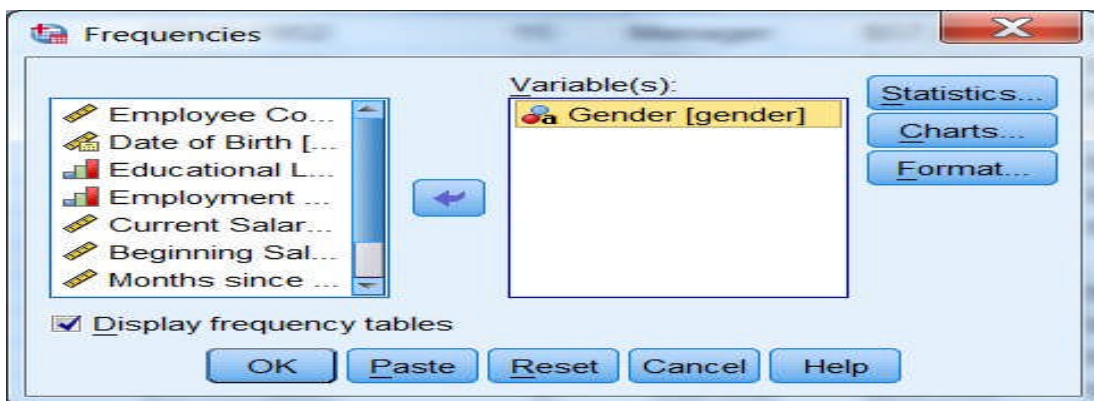


### Issuing Commands

Unless you command SPSS to do something, it just sits there looking at you. In general commands may be issued either through menus and dialog boxes that invoke the programming language behind the scenes, or by typing the programming language in a Syntax Editor and “running” the commands.

## Dialog Boxes

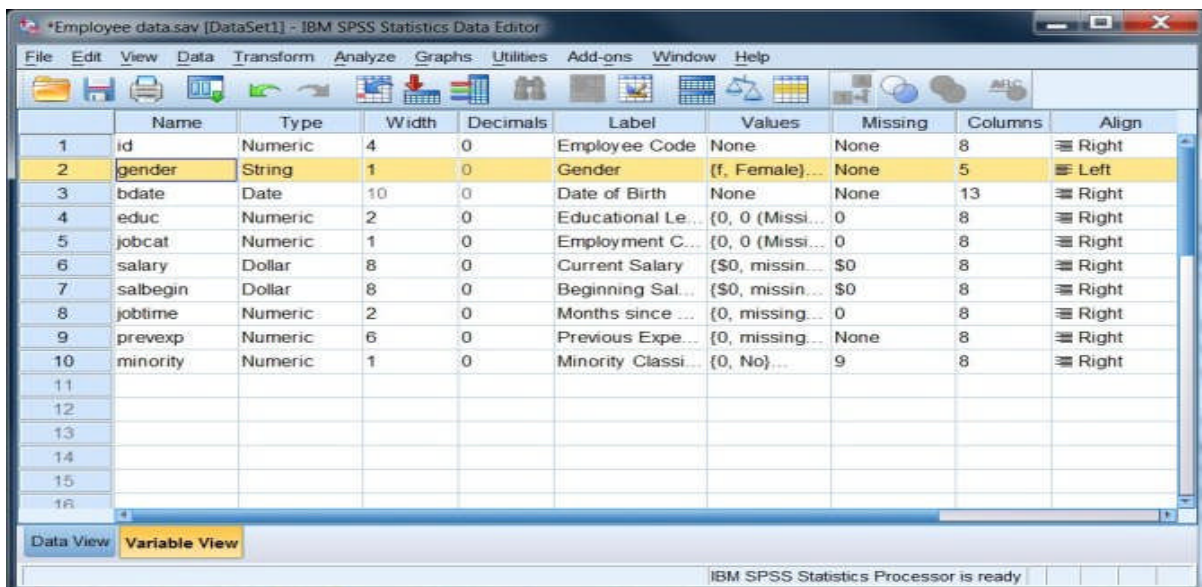
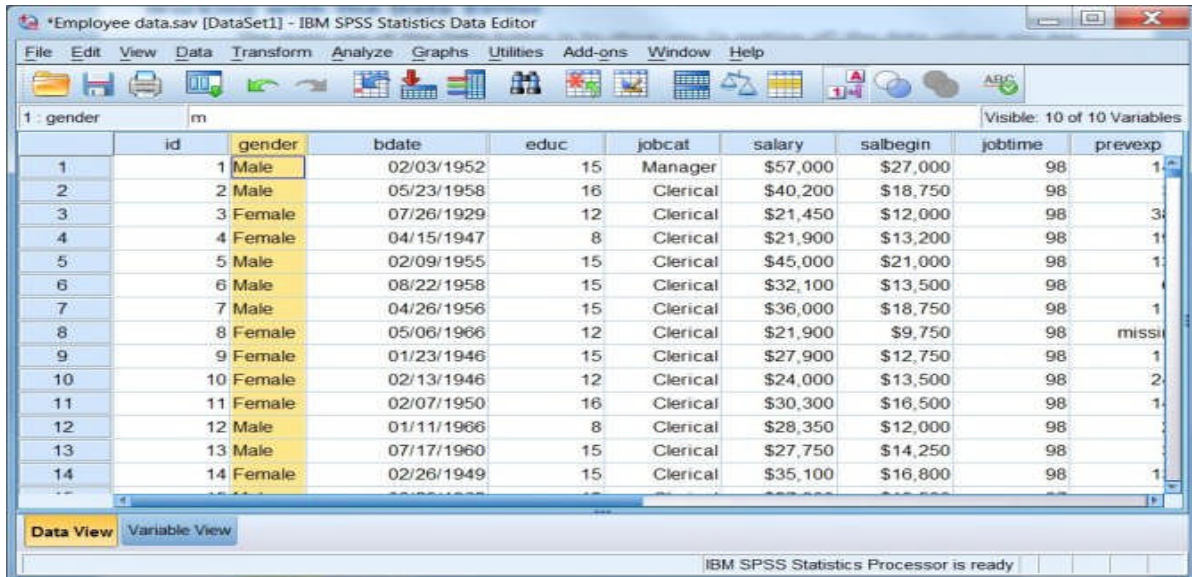
Although each dialog box is unique, they have many common features. A fairly typical example is the dialog box for producing frequency tables (tables with counts and percents). To bring up this dialog box from the menus, click on Analyze, Descriptive Statistics, and Frequencies. On the left is a variable selection list with all of the variables in your data set. If your variables have variable labels, what you see is the beginning of the variable label. To see the full label as well as the variable name [in square brackets], hold your cursor over the label beginning. Select the variables you want to analyze by clicking on them (you may have to scroll through the list). Then click the arrow button to the right of the selection list, and the variables are moved to the analysis list on the right. If you change your mind about a variable, you can select it in the list on the right and then click the arrow button to move it back out of the analysis list. On the far right of the dialog are several buttons that lead to further dialog boxes with options for the frequencies command. At the bottom of the dialog box, click OK to issue your command to SPSS, or Paste to have the command written to a Syntax Editor.



On the left is a variable selection list with all of the variables in your data set. If your variables have variable labels, what you see is the beginning of the variable label. To see the full label as well as the variable name [in square brackets], hold your cursor over the label beginning. Select the variables you want to analyze by clicking on them (you may have to scroll through the list). Then click the arrow button to the right of the selection list, and the variables are moved to the analysis list on the right. If you change your mind about a variable, you can select it in the list on the right and then click the arrow button to move it back out of the analysis list. On the far right of the dialog are several buttons that lead to further dialog boxes with options for the frequencies command. At the bottom of the dialog box, click OK to issue your command to SPSS, or Paste to have the command written to a Syntax Editor. If you return to a dialog box you will find it opens with all the specifications you last used. This can be handy if you are trying a number of variations on your analysis, or if you are debugging something. If you'd prefer to start fresh you can click the Reset button.

## Working with the Data Editor

The main use of the Data Editor is to show you (a portion of) the data values you are working with. It can also be used to redefine the characteristics of variables (change the type, add labels, define missing values, etc.), create new variables, and enter data by hand. The Data Editor gives you two views of your data set: a Data View and a Variable View, selected by clicking on the appropriate tab in the lower left corner of the window.



## Data View

In the Data View, the data are laid out in the standard rectangular format for statistical software. Each row represents a unit of observation, sometimes also referred to as a “record” or in SPSS as a “case.” The case (observation) number in the leftmost column is assigned automatically and is not saved as data. Each column represents a variable. All of

the data in a column must be of the same “type,” either numeric or string (also called “character”). Each data cell holds a data value. If data are missing, they are displayed as a period (“.”) or as a blank (“ ”). Data values may be displayed as either the actual value or as a “formatted” value. For example, a data value about a person’s income might be 15000, while its formatted value might be shown as “\$15,000.” Formats can also take the form of value labels, for instance, data recorded as 1’s and 2’s might be labeled as “Male” and “Female.” While formatting makes it easier to interpret results, it is important to remember that the data values are what SPSS actually processes. In particular, when you set up a command that requires you to specify one or more data values, you use values and not formatted values.

You can switch the Data View between formatted and unformatted data by clicking on the Value Labels button on the Toolbar, the fourth button from the right. You can also see the actual values for a given variable by clicking on it and then looking at the bar just above the data. The box to the left indicates the observation number and variable selected, e.g. 1:sex, while the center box shows you the actual value, e.g. 2.

Data values can be edited or added by typing them directly into the Data View. To enter data type in the actual data value. However, aside from very small data sets for class exercises, you should almost never need to do this.

## **Variable View**

In the Variable View you can see and edit the information that defines each variable (sometimes called “meta-data”) in your data set: each column of the Data View is described by a row of the Variable View. The first attribute of each variable is its Name. The variable name is how the data column is identified in the programming language and in order for the programming language to work gracefully variable names has to abide by certain restrictions: names must begin with a letter, and may be made up of characters, numerals, non-punctuation characters, and the period. Capitalization is ignored. Variable names may be up to 64 characters long. Other restrictions may apply – no coupons please. Variable names may be added or changed simply by typing them in.

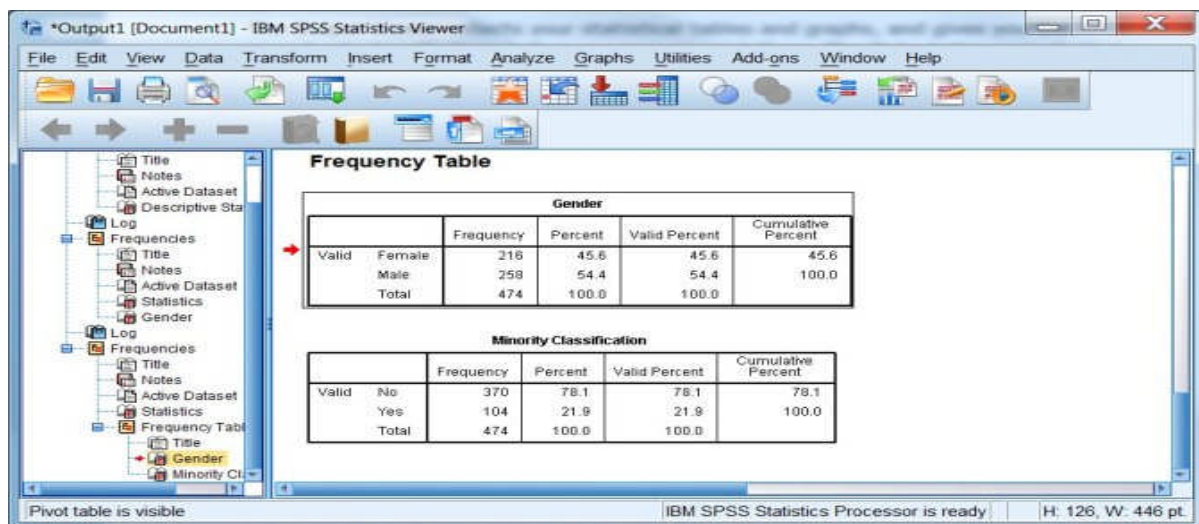
The basic variable types are either numeric or string. However, just to make things confusing, SPSS allows you to select among several different standard formats for displaying numeric data (e.g. scientific notation, comma formatting, currencies) and calls it Type. You set the variable type by clicking in the column, then clicking on the gray button that appears and working in a dialog box. The Label attribute allows you to give each variable a longer description that is displayed in place of the variable name, analogous to value labels for data values. The Values attribute allows you to create a list of value labels. Often several variables will share a common set of value labels, and in this window you can copy and paste value label sets. Variable labels are set by typing them in, value labels work through a dialog box.

The Missing attribute is a place for you to designate certain data values that you want SPSS to ignore when it calculates statistics. For instance, in survey data it is common

practice to record a data value of “8” when a respondent says “I don’t know” in response to a question, and you can have SPSS treat the 8’s in a variable as if they were missing data. The other attributes, Width, Decimals, Columns, Align, Measure, and Role, are minor settings related to data display. Although Measure (level of measurement) is statistically a very important concept, it has little meaning within the SPSS software.

## Working with the Output Viewer

The Output Viewer collects your statistical tables and graphs, and gives you the opportunity to edit them before you save or print them. The Output Viewer is divided into two main sections, an outline pane on the left, and a tables pane on the right. When you print your output, it is the table’s pane that is printed. When SPSS creates output (tables, syntax, error messages, etc.) it adds them to the table’s pane as “objects,” and each object is noted in the outline pane. Individual objects may be opened and edited, deleted, hidden, rearranged, or printed. To select an object to work with, you can either click on it in the table’s pane, or click on the corresponding entry in the outline pane. A red arrow appears next to the object in both panes.



When SPSS creates output (tables, syntax, error messages, etc.) it adds them to the tables pane as “objects,” and each object is noted in the outline pane. Individual objects may be opened and edited, deleted, hidden, rearranged, or printed. To select an object to work with, you can either click on it in the table’s pane, or click on the corresponding entry in the outline pane. A red arrow appears next to the object in both panes.

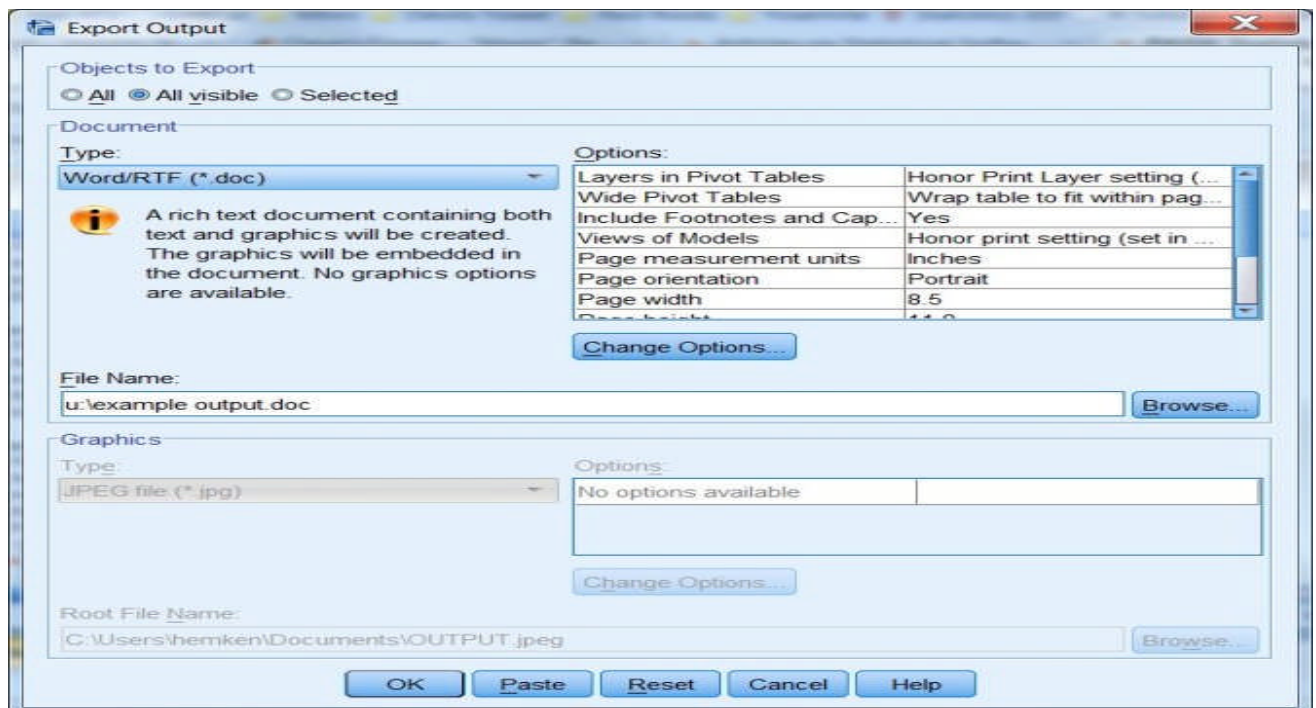
To edit objects, double-click on them in the tables pane. Depending on whether you are trying to edit a simple object like a title (which is just a box with some text in it), or something more complicated like a table or a graph, you may be able to simply change the object in the Output Viewer, or another window may open. Except for editing the look of graphs, it will often be easier to edit your output by exporting it to Microsoft Word first, but in principle you can change anything you can see in your output, down to deleting columns



and changing numbers. (But if your intent is to fake your results, you should attend our Simulations workshop for better methods of doing this.)

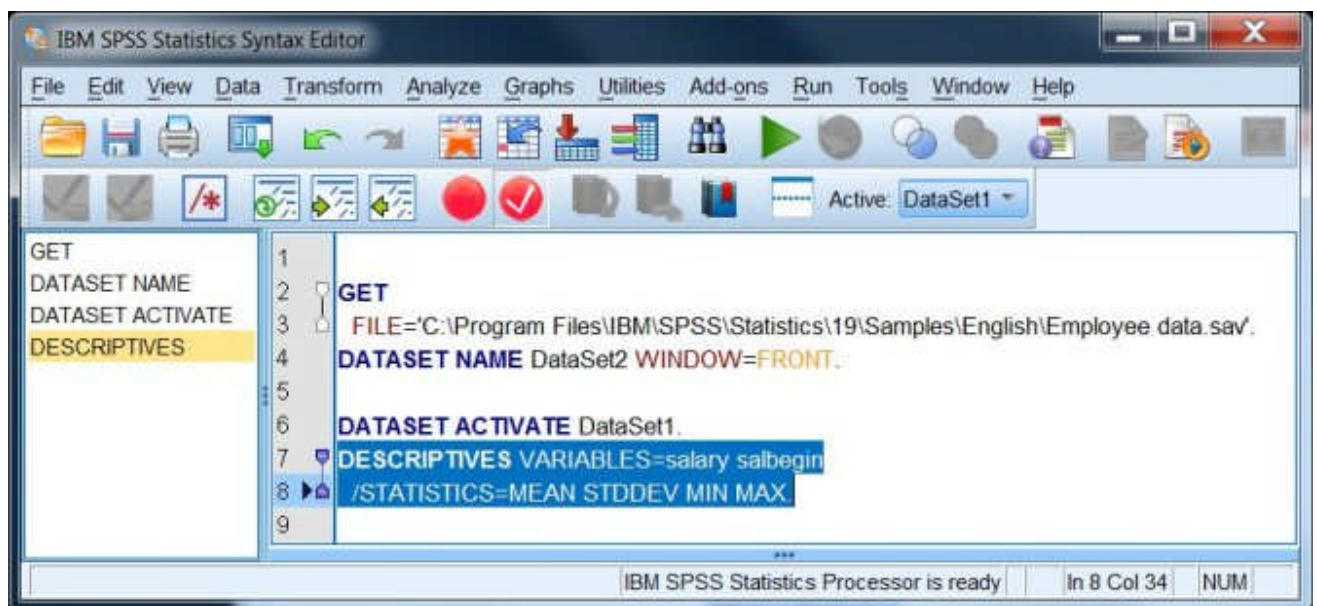
To delete objects, select them in either pane or use the Delete key. To hide objects, double-click on the icon for each object in the outline pane. To make them visible, just double-click again. You can hide a whole section of the outline by clicking on the minus sign to the left of the group in the outline pane. Hidden objects are not printed, but are saved with the output file.

To rearrange objects, select the object (or group of objects) in either pane, and drag them until the red arrow points to the object below which you want them to appear. To export your output, you go through a special procedure. In the Output Viewer click File, Export to invoke the Export dialog box. There are three main settings to look at. First, pick the type of file to which you want to export: useful file types include Excel, PDF, PowerPoint, or Word. Next, check that you are exporting as much of your output as you want, the Objects to Export at the top of the dialog. If you have a part of your output selected, this option will default to exporting just your selection, otherwise you typically will export all your visible output. Finally, change the default file name to something meaningful, and save your file to a location where you will be able to keep it, like your U:\ drive. Once your options are set, click OK.



## Working with the Syntax Editor

Learning SPSS programming syntax is a separate topic; the fundamentals are addressed in our SSCC training workshops. But you don't have to memorize a whole new language in order to paste and run SPSS syntax. The fundamental unit of work in the SPSS language is the command: think of commands as analogous to well-formed sentences. In this language, commands begin with a keyword and end with a period. Commands should begin in the leftmost column in the editor. If they are wrapped onto more than one line, the continuing lines should begin with a blank space. Capitalization does not matter. The Syntax Editor displays syntax that SPSS cannot interpret in red type. Like the Output Editor, the Syntax Editor has two panes. The tables pane on the right is what is actually saved in the .sps file.



### Running syntax.

To have SPSS actually carry out your command(s), you must “run” them. Click Run, and then one of the menu options. There is also an icon on the Toolbar to run your program, a right-facing triangle. You can run all the commands in the editor, or select a group of commands and run just that (be careful that you highlight full commands, from the first keyword through the final period). You can also run the “current” command, which is whatever command the cursor is located within.

### Pasting and running.

From most dialog boxes you have the option of “pasting” commands instead of simply running them. SPSS then writes the command into a Syntax Editor. The syntax tends to be verbose, specifying many options that are the defaults--syntax you write yourself

tends to be much shorter and simpler. After you have pasted a command, you still need to run it to get any output.

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### 3.5 Sum Up:

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Thus, SPSS is the most widely used programs for statistical analysis in social science. It is also used by market researchers, health researchers, survey companies, government, education researchers, marketing organisations and others. SPSS Statistics places constraints on internal file structure, data types, data processing, and matching files, which together considerably simplify programming. SPSS datasets have a two-dimensional table structure, where the rows typically represent cases individuals or households and the columns represent measurements of age, sex, or household income.

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### 3.6 Self-Assessment Questions:

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1. State various versions of SPSS Package
2. Examine the importance of SPSS Package for research students
3. Describe how a researcher work with SPSS Package
4. Write a short note on the following
  - a. Data Editor
  - b. Output Viewer
  - c. Syntax Editor

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### 3.7 References

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# UNIT IV

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## Lesson 4. PARAMETRIC & NON-PARAMETRIC STATISTICS

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### Structure

- 4.0 Objectives
- 4.1 Introduction
- 4.2 Parametric statistics
- 4.3 Some parametric tests
  - 4.3.1 Z-test
  - 4.3.2 t-test
  - 4.3.3  $\chi^2$  -test
  - 4.3.4 F-test
- 4.4 Non-parametric statistics
- 4.5 Sum up
- 4.6 Self-Assessment Questions
- 4.7 References

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### 4.0 Objectives:

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After reading this lesson, you will be able

- ✓ to know the importance of parametric and non-parametric statistics,
- ✓ to distinguish between parametric and non-parametric tests,
- ✓ to know various parametric statistics and,
- ✓ to understand non-parametric statistics

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### 4.1 Introduction:

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The purpose of parametric and non-parametric statistics determines the validity of the assumption or null hypothesis with a view to choose between two conflicting hypotheses about the value of a population parameter. Hypothesis testing helps us to decide on the basis of a sample data, whether a hypothesis about the population is likely to be true or false. Statisticians have developed several tests of hypotheses or tests of significance for the purpose of testing of hypotheses which can be classified as:

- (a) Parametric tests or standard tests of hypotheses
- (b) Non-parametric tests or distribution-free test of hypotheses.

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### 4.2 Parametric statistics:

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It is a branch of statistics which assumes that the data has come from a type of probability distribution and makes inferences about the parameters of the distribution. Most well-known elementary statistical methods are parametric. Generally speaking parametric methods make more assumptions than non-parametric methods. If those extra assumptions are correct, parametric methods can produce more accurate and precise estimates. They are said to have more statistical power. However, if assumptions are incorrect, parametric methods can be very misleading. For that reason they are often not considered robust. On the other hand, parametric formulae are often simpler to write down and faster to compute. In some, but definitely not all cases, their simplicity makes up for their non-robustness, especially if care is taken to examine diagnostic statistics.

Suppose we have a sample of 99 test scores with a mean of 100 and a standard deviation of 1. If we assume all 99 test scores are random samples from a normal distribution we predict there is a 1 per cent chance that the 100<sup>th</sup> test score will be higher than 103.265 (that is the mean plus 3.265 standard deviations) assuming that the 100<sup>th</sup> test score comes from the same distribution as the others. The normal family of distributions all have the same shape and are parameterised by mean and standard deviation. This means if one can know the mean and standard deviation, and that the distribution is normal and the probability of any future observation. Parametric statistical methods are used to compute the 2.365 value above given 99 independent observations from the same normal distribution. A non-parametric estimate of the same thing is the maximum of the first 99 scores. We don't need to assume anything about the distribution of test scores to reason that before we gave the test it was equally likely that the highest score would be any of the first 100. Thus there is a 1 per cent chance that the 100<sup>th</sup> is higher than any of the 99 that preceded it.

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### 4.3 Some Parametric Tests:

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The most important parametric tests are explained here under. All these tests are based on the assumption of normality i.e., the source of data is considered to be normally distributed. In some cases the population may not be normally distributed, yet the tests will be applicable on account of the fact that we mostly deal with samples and the sampling distributions closely approach normal distributions.

**4.3.1 Z-test:** It is based on the normal probability distribution and is used for judging the significance of several statistical measures, particularly the mean. The relevant test statistic 'z' is worked out and compared with its probable value (to be read from table showing area under normal curve) at a specified level of significance for judging the significance of the measure concerned. This is a most frequently used test in research studies.

- This test is used even when binomial distribution or t-distribution is applicable on the presumption that such a distribution tends to approximate normal distribution as 'n' becomes larger.
- It is generally used for comparing the mean of a sample to some hypothesised mean for the population in case of large sample, or when population variance is known.
- It is also used for judging the significance of difference between means of two independent samples in case of large samples, or when population variance is known.

- It is also used for comparing the sample proportion to a theoretical value of population proportion or for judging the difference in proportions of two independent samples when  $n$  happens to be large.
- Besides, this test may be used for judging the significance of median, mode, coefficient of correlation and several other measures.

**4.3.2 t-test:** It is based on  $t$ -distribution and is considered an appropriate test for judging the significance of a sample mean or for judging the significance of difference between the means of two samples in case of small samples when population variance is not known. In case two samples are related, we use paired  $t$ -test for judging the significance of the mean of difference between the two related samples. It can also be used for judging the significance of the coefficients of simple and partial correlations. The relevant test statistic,  $t$ , is calculated from the sample data and then compared with its probable value based on  $t$ -distribution at a specified level of significance for concerning degrees of freedom for accepting or rejecting the null hypothesis. It may be noted that  $t$ -test applies only in case of small samples when population variance is unknown.

**4.3.3  $\chi^2$  -test:** It is based on chi-square distribution and as a parametric test is used for comparing a sample variance to a theoretical population variance.

**4.3.4 F-test:** It is based on  $F$ -distribution and is used to compare the variance of the two-independent samples. This test is also used in the context of analysis of variance (ANOVA) for judging the significance of more than two sample means at one and the same time. It is also used for judging the significance of multiple correlation coefficients. Test statistic,  $F$ , is calculated and compared with its probable value for accepting or rejecting the null hypothesis.

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#### 4.4 Non-parametric statistics

In statistics, the term non-parametric statistics refers to statistics that do not assume the data or population have any characteristic structure or parameters. In statistics, the term non-parametric statistics has at least two different meanings. The first meaning of non-parametric covers techniques that do not rely on data belonging to any particular distribution. These include, among others: Distribution free methods, which do not rely on assumptions that the data are drawn from a given probability distribution. As such it is the opposite of parametric statistics. It includes non-parametric descriptive statistics, statistical models, inference and statistical tests. Non-parametric statistics, whose interpretation does not depend on the population fitting any parameterised distributions. Order statistics, which are based on the ranks of observations, are one example of such statistics and these play a central role in many non-parametric approaches. The following discussion is taken from Kendall's. Statistical hypotheses concern the behaviour of observable random variables.... For example, the hypothesis

- (a) that a normal distribution has a specified mean and variance is statistical also is the hypothesis
- (b) that it has a given mean but unspecified variance; so is the hypothesis
- (c) that a distribution is of normal form with both mean and variance unspecified; finally, so is the hypothesis
- (d) that two unspecified continuous distributions are identical.

It will have been noticed that in the examples (a) and (b) the distribution underlying the observations was taken to be of a certain form and the hypothesis was concerned entirely with the value of one or both of its parameters. Such a hypothesis, for obvious reasons, is called parametric. Hypothesis (c) was of a different nature, as no parameter values are specified in the statement of the hypothesis; we might reasonably call such a hypothesis non-parametric. Hypothesis (d) is also non-parametric but, in addition, it does not even specify the underlying form of the distribution and may now be reasonably termed distribution-free. Notwithstanding these distinctions, the statistical literature now commonly applies the label "non-parametric" to test procedures that we have just termed "distribution-free", thereby losing a useful classification. The second meaning of non-parametric covers techniques that do not assume that the structure of a model is fixed. Typically, the model grows in size to accommodate the complexity of the data. In these techniques, individual variables are typically assumed to belong to parametric distributions, and assumptions about the types of connections among variables are also made. These techniques include, among others: non-parametric regression, which refers to demonstrating where the structure of the relationship between variables is treated non-parametrically, but where nevertheless there may be parametric assumptions about the distribution of model residuals. Non-parametric hierarchical Bayesian models, such as models based on the Dirichlet process, which allow the number of latent variables to grow as necessary to fit the data, but where individual variables still follow parametric distributions and even the process controlling the rate of growth of latent variables follows a parametric distribution.

Non-parametric methods are widely used for studying populations that take on a ranked order. The use of non-parametric methods may be necessary when data have a ranking but no clear numerical interpretation, such as when assessing preferences. In terms of levels of measurement, non-parametric methods result in "ordinal" data. As non-parametric methods make fewer assumptions, their applicability is much wider than the corresponding parametric methods. In particular, they may be applied in situations where less is known about the application in question. Also, due to the reliance on fewer assumptions, non-parametric methods are more robust.

Another justification for the use of non-parametric methods is simplicity. In certain cases, even when the use of parametric methods is justified, non-parametric methods may be easier to use. Due both to this simplicity and to their greater robustness, non-parametric methods are seen by some statisticians as leaving less room for improper use and misinterpretation. The wider applicability and increased robustness of non-parametric tests comes at a cost: in cases where a parametric test would be appropriate, non-parametric tests have less power. In other words, a larger sample size can be required to draw conclusions with the same degree of confidence.

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#### **4.5 SumUp:**

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Thus, parametric tests usually assume certain properties of the population from which we draw samples. Assumptions like observations come from a normal population, sample size is large, assumptions about the population parameters like mean, variance, etc., must hold good before parametric tests can be used. But there are

situations when the researcher cannot or does not want to make such assumptions. In such situations we use statistical methods for testing hypotheses which are called non-parametric tests because such tests do not depend on any assumption about the parameters of the parent population. Besides, most non-parametric tests assume only nominal or ordinal data, whereas parametric tests require measurement equivalent to at least an interval scale.

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#### 4.6 Self-Assessment Questions:

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1. Describe the importance of parametric statistics and present some of the parametric tests in research.
2. Distinguish between parametric and non parametric statistics for research methodology.
3. Write a short note on the following
  - a) Z-Test
  - b) T-test
  - c) chi-square distribution
  - d) ANOVA

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# UNIT- V

The last step of research is writing a research report or research paper or thesis. The first lesson of this unit outlines the typical structure of a report and provides a step by step guide to produce clear and well structured report. When writing a research paper, it is important to cite the sources you used in a way such that a reader could find them. There are literally hundreds of different referencing styles from which to choose when you are citing the sources of your research material. A style guide or style manual is a set of standards for the writing and design of documents, either for general use or for a specific publication, organization or field. Style guides are available for general and specialized use, for the general reading and writing audience, and for students and scholars of various academic disciplines. There are some most common formats for citing sources viz. APA (American Psychological Association), MLA (Modern Language Association), ACS (American Chemical Society), IEEE style and Chicago Manual of Style etc. The second lesson of this unit explains different styles to cite the references.

Statistics is the study of the collection, analysis, interpretation, presentation, and organization of data. In applying statistics to, e.g., a scientific, industrial, or societal problem, it is conventional to begin with a statistical population to be studied. Statistics is applicable to a wide variety of academic disciplines including natural and social sciences. Statistics form a key basis tool in Library and Information Science as is the case with every branch of knowledge. The third lesson of this unit discusses various applications of statistics to Library and Information Science subject. Fourth lesson discussed the recent trends in Library and Information Science Research.

# UNIT-V

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## LESSON 1. RESEARCH REPORT WRITING

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### Structure

- 1.0 Aims and Objectives of the study
- 1.1 Introduction
- 1.2. Importance of research reports:
- 1.3 Purpose of a Report
- 1.4 Factors influence Research Report:
- 1.5 Planning and Organization of the Report
- 1.6 Steps in Planning and Organization of the Report Witting
- 1.7 Outline of the Research Report
- 1.8 Problems in Preparing Research Report
- 1.9 Summation
- 1.10 Questions to be answered
- 1.11 References

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### 1.0 Aim and Objectives

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In this unit your will be introduced to the concept of research in Library and information Science it recent trends and development in the present scenario and the further developments

- ✓ To understand the how to write the Research Report
- ✓ How to write the research Report
- ✓ To know the Research Reports composition
- ✓ To enumerate the sources of LIS Research concepts
- ✓ To know the problems of Research Problems involved
- ✓ To discuss the further perspectives of Library and Information Research

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### 1.1 Introduction

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The researcher thus reporting is an important facet of the research process, and scholars have a scientific obligation to effectively communicated news about completed investigations,. The most insightful systematic, and rigorous inquires within librarianship will have minimal impact if research activities are not reported of reported poorly. Research Reports are detailed and accurate accounts of the conduct of disciplined studies accomplished to solve problems to reveal new knowledge. Most reports about inquiries within Library and Information Science are prepared for the benefit of persons within the field; however some accounts about research are directed to people in related fields-or even to the general public. The principal investigators of sponsored researcher studies are often required to prepare detailed, written reports of research activities and conclusions. Whereas some findings of original investigations are reported verbally at conferences in

professional meetings, and many research reports are published in one form or another. These written reports are very useful, stands as guiding tools provided that they are well-prepared and disseminated through an appropriate publication vehicle.

Research reports must be complete, well- organized, and carefully written if their contents are contributed to-librarianship and store of knowledge. The production of an effective report depends upon a combination of factors, i.e. some of which are related to the abilities of research workers and to the editorial capabilities and discretionary powers of editors and publishers. These factors include the following components i.e. the ability of investigators; their knowledge skills followed by exercise analysis, synthesis their expository powers and their perceptiveness and evaluative techniques of journal editors and the referees presented. In turn all of these factors contribute to the degree of success that the audience might achieve in comprehending the reports. Thus in this lesson we will explore some of the important fundamentals areas for effective report writing the concept of Research Reporting writing must give emphasis the following topics

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## **1.2. Importance of Research Reports:**

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Communicating the findings of research project is an extremely important part of the research process, but one which tends to receive less attention than it deserves both in the literature and by individuals conducting research. It is difficult to do it well. Many people understand the time and effort necessary to produce a clear and simple account of research project. The writing up part of the research process tends to be the part of which elicits the least enthusiasm, perhaps because it is tempting to think that once he has been collected and analyzed the job is done; perhaps because writing Research report brings any of the laws into research focus.

Research findings lose their value if they cannot be communicated to those who could benefit from them or whose decisions you wish to inform. They also lose their impact if the gap between producing and reporting them becomes too protracted. The following guidelines are intended to make the process easier for those who are inexperienced in writing research reports, and to help them to avoid some of the pitfalls.

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## **1.3 Purpose of a Report**

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According to American Marketing Society the purpose of a report is “to convey to the interested persons the whole result of the study in sufficient detail and so arranged to enable each reader to comprehend the data and so determine for himself the validity of conclusions”. Thus the general purpose of the report is to invite the attention of others to study the generalizations and of their own comments regarding the investigation so as to

answer its widest use. Report also offers ground for hypothesis and leads to further research on the same or allied problems, various small segments of research can be coordinated and consolidated into one single theory, and such coordination is made on the basis of different researchers which enable us to propound a theory.

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#### **1.4 Factors influence Research Report:**

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Before considering what should go into a research report and which form it should take, it may be useful to consider some of the factors which are likely to influence the nature of a research report. The basic areas:-

- ❖ The audiences for whom the report is intended
- ❖ Time and other resources
- ❖ The nature of the research, particularly the kind of data collected

There is of possible audience for a report of library or information research, depending on the kind of report the audiences might include local councilors either individuals or on committees, Library managers the genera; public the

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#### **1.5 PLANNING AND ORGANIZATION OF THE REPORT**

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Before starting the report writing a good deal of planning is necessary. Researcher's mind at this stage is crowded with ideas and jumble of thoughts. A good planning is always helpful in report writing Planning and organizing the report means systematic arrangement of ideas and thoughts in a logical and coherent manner within the frame work of the overall structure laid down. It facilitate the report writing by with proper emphasis on different aspects of the study; to being clarity and comprehensive thought.

The advantage of planning and organization of the report are summarized below:

1. Planning and origination of the report helps the researcher in screening the ideas and facts which are relevant to the study and excluding the irrelevant material.
2. A well planned report furnishes greater clarity and unity of thoughts.
3. Planning also ensures unity and sequence in presentation of facts one after another
4. Planning results in an integrated and comprehensive research report.
5. A well planned report facilitates in communicating the findings and results of the survey to the readers
6. A well conceived planning and organization of the report writing by following proper emphasis in various aspect of the study

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#### **1.6 Steps in Planning and Organization of the Report Witting**

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Planning and organization of the research report involve following three steps:

1. Organization the research notes
2. Reflective thinking,
3. Formulation of an outline

**1. Organizing the Research Notes:** Notes taking is very important activity in social science research because such notes are very helpful in every stage of research. From the selection of the topic, till the completion of the final report, the notes stands as an aid to the researchers. Notes taken from various literary forms and the outlined as also form field observation are very useful for writing the report. Methodical and systematic presentation of the facts and figures makes the report more effective.

Separate cards or sheets of paper should be used while taking down the notes and arranged them topically. After organizing the notes under different topics, the researcher should critically evaluate them. If the notes are found inadequate the researcher has to collect additional information on the concerned subject.

**2. Reflective Thinking:** Researcher is not a mechanical process of gathering information and presenting them but it required deep knowledge and intensive thinking. Thinking process starts even before selecting of the topic for research. According to M.H. Gopal, 'Research is not merely the accumulation evaluation and assimilation of facts; F.L.Whitney is also of the opinion "there is a high positive correlation between good thinking and effective writing". Besides defining and delimiting different concepts, choosing the appropriate methodological and statistical relevent and techniques are all the result of deep continuous and intensive thinking. Result, in clear writing.

**3. Formulation of an Outline:-** Drafting the outline give a natural sequence and it is an outcome of thinking. The outlining of a research study may be prepared in two stages i.e. first at the time of beginning the study; and second before writing the research report. The outline prepared or report writing should be in detail so as to include all important aspects of the research. Such a detailed outline makes the drafting becomes easy and provides right direction to the report writing. According to Parten " Generally the report secures greater clarity and unity if the outline is more and more detailed outline". A detailed outlining also provides a skeleton for report writing. M.H. Gopal suggests the following points to be observed while planning an outline:

- a) It should be as detailed as possible and should enable continuous writing.
- b) It should not ne vague and should not include such vague phrase as introduction body conclusion etc. which gives no direction to the report writing
- c) it should fulfill the considerations of chronology, topic unity coherence and transition each transition
- d) Each paragraph should contain one major idea

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## **1.7 OUTLINE OF THE RESEARCH REPORT**

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### **I. Pre-factory material**

- a. Title page
- b. Preface and acknowledgements
- c. List of tables, graphs etc

d. Chapter scheme

II. Text or Body of report

A. Introduction

- a) Concise and clear cut statement as to the nature of the study
- b) Objectives of the study
- c) Sources of information
- d) Time, place and materials of the survey
- e) Scope, assumptions and limitations

B. brief statement of working hypothesis which guided the study

C. definition and concepts of units of study

D. brief discussion of techniques followed in the study

- a. Types of observation used and conditions under which observation were made
- b. Types of schedules formulated and conditions under which information was secured
- c. Types of case history data secured their sources manner of presentation and preliminary analysis made
- d. Sampling procedures and conditions of selection and testing for appropriateness, representativeness and errors.
- e. Statistical procedures, source of statistical data, conditions under which they were obtained
- f. Types of scaling techniques used.

E. Brief description of experimental treatment of data and techniques used in experiments.

F. Major findings of the study

G. Major conclusions research about findings and suggestions

H. Special Remarks

- a. Problems encountered in gathering data, classifying them, analyzing them
- b. Possible discrepancies in the data collected
- c. Suggestions to subsequent investigators on same topic in same context.

I. Bibliographical references found useful in the study

J. Appendix as might include sample questionnaires, transcription sheets, sample interviews and the likes

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## 1.8 Problems in Preparing Research Report

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It seems that a research report could be simple to write since it is merely an exposition of the question asked, the techniques used to answer it and the answer which were finally developed. Actually it is rarely so. Instead the entire research grows in many directions. Some parts of the research design must be changed, while others will be dropped, many more facts seem to be needed than was originally supposed and many questions turn out not to have any simple answers. Neither positive nor negative many of our answers must be placed in the doubtful category.

The principles of report writing are easier to draw than to follow. If the researcher is a careful reader, he will already have found many errors in the work he has studied. Many sentences are unclear and sometimes there is no apparent development of any main line of thought. Crucial data are omitted and at times the tables of data do not demonstrate the conclusions offered. Carelessness and accident are other factors which pose problems in report writing. Lack of commonly accepted conceptual system and the lack of a clear system of abstraction are important problems in communication and we cannot indicate quickly and easily how much knowledge is to be assumed and how much is to be presented. Though every report is a technical matter and is not being followed by every layman unless he has some prior basis, yet the researcher should be cautioned not to draft report too much technical.

The most important step in drafting a report is clear thinking research report writing is a reasoning process and without clarity thought there won't establish a report clarity in writing. Only by thinking researcher develops originality and reflects it in his report.

Utmost attention should be paid in writing the research report. the report should be clear, accurate in information and easy to understand as it is a communication process between the researcher and the reader, Vagueness will make the report incomplete and uninteresting.

The language of the report should be simple and easy to understand and not too much technical. The researcher should have full command over the language. Poor command over language results reflects in poor writing. According to Cater.V.Good " too frequently faulty sentence structure illogical paragraphing poor punctuation, incorrect spelling and other variations of English usage render an otherwise promising manuscripts virtually worthless" the researcher should not use difficult language and should always remember that he is writing a scientific report and not an article for magazine.

The researcher should keep in mind that the brevity is an important point of a good report. It is people's tendency to exaggerate fact to catch the attention of others. Repetition and superfluousness should be avoided while writing a report. The economy of the words is necessary for a concise report but it should convince the readers about the truth of the ideas presented. Of course not all the information may be presented in the report for the sake of brevity but important information should not be omitted. Efforts should be made to avoid tendency towards exaggerating facts.



Before giving final touch to the research report it is better to carefully re-examine and re-edit it to make it more effective. Report should not be mere a collection of facts, but ot ascertain some concrete results, the facts and inferences should be mere collection of fact, but to ascertain some concrete results, the facts and inference should be interwoven into a theory.

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### **1.9 Summation**

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A good research Report is understandably the latter since it makes the most sense in relation to the findings a given study has thrown up. It needs to be appreciated that a study is not irreversibly destined at the time the problem of research is formulated. Quite a few times, during the progress of the study, a more adequate statement of the problems itself may come to be developed, new hypotheses may emerge of unforeseen relationship may meet the eye. Hence the original manner of problem formulation whild providing the basic points of reference for the report can always afford some room and margin to accommodate subsequent developments.

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### **1.10 Questions to be answered**

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1. Define a Research Report? Discuss the outlines of the Research Report
  2. Describe the Steps in Research Report
  3. What are the Problems arise in the preparing the Research Report
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### **1.11 References**

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1. Good, C.V. on effective Report writing , phil delta Kappa,1941
2. C.L.S. Wrights man and S.W. Cook: Research Methods in Social Relations, Rinehart and Winston,1976

# UNIT-V

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## Lesson-2 Style Manuals

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### Structure

3.0 Aim and Objectives of the Study

3.1 Introduction

3.2 Different Citation Styles

3.3 MLA Style:

3.4 APA Style Manual

3.4.1 Specific Parts of sources

3.4.2 Reference Lists

3.4.3 Books

3.4.4 Research Reports & Papers

3.5 Summation

3.6 Questions to be answered

3.7 References

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### 3.0 Aim and Objective of the Study

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- The Researcher Know the Importance of style Manuals in the Research activity
- Every Researcher give a complement to the authors in prescribed Manner and standard style
- The Standard Manual will help in understand about the propaganda of authors names, subject, title of the document, and pagination of the documents, etc.
- The student able to give good acknowledgement to the referred books Journals and also E-documents/source
- The student will understand, after completion of the research how to honor the supported people in their research activity

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### 3.1 Introduction

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Style Manuals or the Style Guides stands as the guiding tools for in presenting the official citation rules; which are accepted by the internationally renowned associations, organizations, societies and institutions. There are about nine such style guides and style manuals, which deal with different subject areas, viz. Medical Sciences, Sciences, and Social sciences etc. There is separate style guide used for the legal studies generally known as

Bluebook. These style manuals may be available in print form as well, available in online version also. The style manuals describe the citation styles of references, and the established conventions are listed, and guide us how to document a used sources in a research paper. The reference citation styles are required for both in-text citations and in reference citations at research articles. In these two cases, the reference citations should be a full citation in the reference list. In the style manuals the official accepted citations formats of all fields of research agreed; on the need of document scholarly borrowings, but the documentation conventions vary because of the different needs of scholarly disciplines.

In the context of meeting the varied needs of scholarly disciplines these are different stranded style manuals or style guides to satisfy the needs of scholarly works in various disciplines. The institutions, associations, societies and organizations etc produced citation styles, covering different subject areas with accepted conventions, rules and formats are cited in the following reputed style manuals with standard citation styles are as follows:

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### 3.2 Different Citation Styles:

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1. American Anthropological Association (AAA)
2. American Chemical Society (ACS)
3. American Institute of Physics (AIP)
4. American Medical Association (AMA)
5. American Political Science Association (APSA)
6. American Psychological Association (APA)
7. American Sociological Association (ASA)
8. Associated Press (AP)
9. Association Legal writing Directors (ALWD)
10. Blue Book
11. Chicago Style Manuals

**3.2.1 AAA Style Guide:** Official rules on reference cited lists and citing references in text. Where no rule is present on this list, follow the Chicago Manual of Style. From American Anthropological Association.

**3.2.2 ACS (American Chemical Society):** used in Chemistry The ACS Style Guide has the official citation rules from the American Chemical Society. At this time there is no online version of the book ACS Style Guide available to the general public. Use either the print copy or an online guide based on the 3rd edition like those listed below.

**3.2.3 AIP (American Institute of Physics)** - used in Physics, particularly for American Institute of Physics journals AIP Style Manual - Official rules from the AIP Style Manual, 4th ed. (1990) with a 1997 addendum. Available for download. From American Institute of Physics.

**3.2.4. AMA (American Medical Association)** - used in Medical Sciences AMA Reference Citation Format - From New York Medical College.AMA Style Guide - From University of Evansville Libraries.AMA Manual of Style: A Guide for Authors and Editors (10th ed., 2007). (Call number: Ready Reference R 119.A533 2007.) AU Library has print copy, but does not subscribe to the online version. Contact the library if you would like the library to subscribe to the online version. AMS (American Mathematical Society) - used in Mathematics

**3.2.5 APSA (American Political Science Association)** - used in Political Science, International Studies Based on the Chicago Manual of Style. Style Manual for Political Science (2006) (pdf) - Official APSA version. Style Manual for Political Science (2006). (Call number: Ready Reference JA86 .A52 2006.) AU Library has print copy.

**3.2.6 APA (American Psychological Association)** - used in Psychology, Business, Criminology, Economics, Education, Sociology . At this time there is no online version of the APA's Publication Manual, 6th edition. Use either the print copy or an online guide like those listed below. APA Style - Includes explanations and detailed discussion. From Purdue University.

**3.2.7 ASA (American Sociological Association)** - used in Sociology Based on the Chicago Manual of Style. The ASA Style Guide has the official citation rules from the American Sociological Association. At this time there is no online version of the 4th ed. of the ASA Style Guide. Use either the print copy or an online guide like those listed below. ASA Format (pdf). From California State University, Los Angeles.ASA Style - From Purdue University. American Sociological Association Style Guide (4th edition, 2010). Call number: Ready Reference HM586 .A54 2010.) AU Library has print copy.

**3.2.8 AP (Associated Press)** - used in Journalism, Public Relations AP Stylebook (AU Community Only) Official version. Associated Press 2010

**3.2.9 ALWD (Association of Legal Writing Directors)** - used in Legal Studies. Also see the Bluebook. ALWD Citation Manual - Companion website to the book. The appendices are available in full in PDF. ALWD Citation Manual Resources - From ALWD. Introduction to Basic Legal Citation by Peter W. Martin - A well organized guide to citing legal sources. Refers to both The Bluebook and the ALWD Citation Manual. ALWD Citation Manual: A Professional System of Citation (4th ed., 2010). (on order)

**3.2.10 Bluebook** - used in Legal Studies: There is no online version of the Bluebook available to the whole campus. Use either the print copy or an online guide like those listed below. Bluebook Guide for Law Students - From Suffolk University Law School Library. Bluebook Guide - Introduction - From Georgetown University Law Library. Introduction to Basic Legal Citation by Peter W. Martin - A well organized guide to citing legal sources. Refers to both The Bluebook and the ALWD Citation Manual.

The Bluebook: A Uniform System of Citation (19th ed., 2010). (Call number: Ready Reference KF245 .B58.) AU Library has print copy.

**3.2.11 Chicago Manual of Style** - widely used in the humanites and social sciences Chicago Manual of Style 16th ed. (2010) and 15th ed. (2003) (AU Community Only) Official version. Bibme - Creates bibliographies, and one can then download the bibliography as an RTF file. Registration is free.Son of Citation Machine - Fill in online form and site will generate standard bibliographic and in-text citations.Chicago Manual of Style (16th ed., 2010) (Call number: Ready Reference Z253 .U69 2010.) Print copies of the latest edition are located in the dictionary stand on every floor of Bender Library Which should you use? Ask each of your teachers which style they want you to use. If they have no preference, you can use any or follow these guidelines:

- APA: psychology, education, and other social sciences.
- MLA: literature, arts, and humanities.
- AMA: medicine, health, and biological sciences.
- Turabian: designed for college students to use with all subjects.
- Chicago: used with all subjects in the "real world" by books, magazines, newspapers, and other non-scholarly publications.

The complete hardcopy style manuals are kept on reserve in the Reference Department. These contain examples about citing a wider variety of sources than these web pages do, as well as other things you may need to know, such as margins, font size, etc

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### **3.3 MLA Style:**

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All fields of research agree on the need to document scholarly borrowings, but documentation conventions vary because of the different needs of scholarly disciplines. MLA style for documentation is widely used in the humanities, especially in writing on language and literature. Generally simpler and more concise than other styles, MLA style features brief parenthetical citations in the text keyed to an alphabetical list of works cited that appears at the end of the work. MLA style has been widely adopted by schools, academic departments, and instructors for over half a century. The association's guidelines are also used by over 1,100 scholarly and literary journals, newsletters, and magazines and by many university and commercial presses. The MLA's guidelines are followed throughout North America and in Brazil, China, India, Japan, Taiwan, and other countries around the world. The MLA publishes two authoritative explanations of MLA style:

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### **3.4 APA STYLE MANUAL:**

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APA citation style refers to the rules and conventions established by the American Psychological Association for documenting sources used in a research paper. APA style requires both in-text citations and a reference list. For every in-text citation there should be a full citation in the reference list and vice versa. The examples of APA styles and formats listed on this page include many of the most common types of sources used in academic research. For additional examples and more detailed information about APA citation style,

refer to the Publication Manual of the American Psychological Association and the APA Style Guide to Electronic References. Also, for automatic generation of citations in appropriate citation style, use a bibliographic citation management program such as Reference works or Endnote. You can find more information on this in our Citation Management page.

In APA style, in-text citations are placed within sentences and paragraphs so that it is clear what information is being quoted or paraphrased and whose information is being cited.

Examples:

- 1. Works by a single author:** The last name of the author and the year of publication are inserted in the text at the appropriate point. from theory on bounded rationality (Simon, 1945)

If the name of the author or the date appear as part of the narrative, cite only missing information in parentheses. Simon (1945) posited that

- 2. Works by multiple authors**

When a work has two authors, always cite both names every time the reference occurs in the text. In parenthetical material join the names with an ampersand (&). as has been shown (Leiter&Maslach, 1998) In the narrative text, join the names with the word "and." asLeiter and Maslach (1998) demonstrated

- 3. When a work has three, four, or five authors,** cite all authors the first time the reference occurs. Kahneman, Knetsch, and Thaler (1991) found In all subsequent citations per paragraph, include only the surname of the first author followed by "et al." (Latin for "and others") and the year of publication. Kahneman et al. (1991) found

- 4. Works by associations, corporations, government agencies, etc.:** The names of groups that serve as authors (corporate authors) are usually written out each time they appear in a text reference. (National Institute of Mental Health [NIMH], 2007) When appropriate, the names of some corporate authors are spelled out in the first reference and abbreviated in all subsequent citations. The general rule for abbreviating in this manner is to supply enough information in the text citation for a reader to locate its source in the Reference List without difficulty. (NIMH, 2007)

- 5. Works with no author:** When a work has no author, use the first two or three words of the work's title (omitting any initial articles) as your text reference, capitalizing each word. Place the title in quotation marks if it refers to an article, chapter of a book, or Web page. Italicize the title if it refers to a book, periodical, brochure, or report. on climate change ("Climate and Weather," 1997) *Guide to Agricultural Meteorological Practices* (1981)

Anonymous authors should be listed as such followed by a comma and the date. on climate change (Anonymous, 2008)

### 3.4.1 Specific parts of a source

To cite a specific part of a source (always necessary for quotations), include the page, chapter, etc. (with appropriate abbreviations) in the in-text citation. (Stigter & Das, 1981, p. 96)

De Waal (1996) overstated the case when he asserted that "we seem to be reaching ... from the hands of philosophers" (p. 218).

If page numbers are not included in electronic sources (such as Web-based journals), provide the paragraph number preceded by the abbreviation "para." or the heading and following paragraph. (Mönnich & Spiering, 2008, para. 9)

### 3.4.2 Reference List

References cited in the text of a research paper must appear in a Reference List or bibliography. This list provides the information necessary to identify and retrieve each source.

1. Order: Entries should be arranged in alphabetical order by authors' last names. Sources without authors are arranged alphabetically by title within the same list.
2. Authors: Write out the last name and initials for all authors of a particular work. Use an ampersand (&) instead of the word "and" when listing multiple authors of a single work. e.g. Smith, J. D., & Jones, M.
3. Titles: Capitalize only the first word of a title or subtitle, and any proper names that are part of a title.
4. Pagination: Use the abbreviation p. or pp. to designate page numbers of articles from periodicals that do not use volume numbers, especially newspapers. These abbreviations are also used to designate pages in encyclopedia articles and chapters from edited books.
5. Indentation\*: The first line of the entry is flush with the left margin, and all subsequent lines are indented (5 to 7 spaces) to form a "hanging indent".
6. Underlining vs. Italics\*: It is appropriate to use italics instead of underlining for titles of books and journals.

Two additional pieces of information should be included for works accessed online.

- Internet Address\*\*: A stable Internet address should be included and should direct the reader as close as possible to the actual work. If the work has a digital object identifier (DOI), use this. If there is no DOI or similar handle, use a stable URL. If the URL is not stable, as is often the case with online newspapers and some subscription-based databases, use the home page of the site you retrieved the work from.

- Date: If the work is a finalized version published and dated, as in the case of a journal article, the date within the main body of the citation is enough. However, if the work is not dated and/or is subject to change, as in the case of an online encyclopedia article, include the date that you retrieved the information.

\* The APA has special formatting standards for the use of indentation and italics in manuscripts or papers that will be typeset or submitted for official publication. For more detailed information on these publication standards, refer to the Publication Manual of the American Psychological Association, or consult with your instructors or editors to determine their style preferences.

\*\* See the APA Style Guide to Electronic References for information on how to format URLs that take up more than one line.

Examples:

3. Articles in journals, magazines, and newspapers: References to periodical articles must include the following elements: author(s), date of publication, article title, journal title, volume number, issue number (if applicable), and page numbers.
4. Journal article, one author, accessed online : Ku, G. (2008). Learning to de-escalate: The effects of regret in escalation of commitment.*Organizational Behavior and Human Decision Processes*, 105(2), 221-232. doi:10.1016/j.obhdp.2007.08.002
5. Journal article, two authors, accessed online: Sanchez, D., & King-Toler, E. (2007).Addressing disparities consultation and outreach strategies for university settings.*Consulting Psychology Journal: Practice and Research*, 59(4), 286-295.doi:10.1037/1065- 9293.59.4.286
6. Journal article, more than two authors, accessed online: Van Vugt, M., Hogan, R., & Kaiser, R. B. (2008). Leadership, followership, and evolution: Some lessons from the past. *American Psychologist*, 63(3), 182-196. doi:10.1037/0003-066X.63.3.182
7. Article from an Internet-only journal: Hirtle, P. B. (2008, July-August). Copyright renewal, copyright restoration, and the difficulty of determining copyright status.*D-Lib Magazine*, 14(7/8). doi:10.1045/july2008-hirtle
8. Journal article from a subscription database (no DOI): Colvin, G. (2008, July 21). Information worth billions.*Fortune*, 158(2), 73-79. Retrieved from Business Source Complete, EBSCO.
9. Magazine article, in print: Kluger, J. (2008, January 28). Why we love. *Time*, 171(4), 54-60.
10. Newspaper article, no author, in print : As prices surge, Thailand pitches OPEC-style rice cartel. (2008, May 5). *The Wall Street Journal*, p. A9.
11. Newspaper article, multiple authors, discontinuous pages, in print : Delaney, K. J., Karnitschnig, M., &Guth, R. A. (2008, May 5). Microsoft ends pursuit of Yahoo, reassesses its online options. *The Wall Street Journal*, pp. A1, A12.

### 3.4.3 Books



References to an entire book must include the following elements: author(s) or editor(s), date of publication, title, place of publication, and the name of the publisher.

12. No Author or editor, in print: Merriam-Webster's collegiate dictionary (11th ed.). (2003). Springfield, MA: Merriam- Webster.
13. One author, in print: Kidder, T. (1981). *The soul of a new machine*. Boston, MA: Little, Brown & Company.
14. Two authors, in print : Frank, R. H., & Bernanke, B. (2007). *Principles of macroeconomics* (3rd ed.). Boston, MA: McGraw-Hill/Irwin.
15. Corporate author, author as publisher, accessed online Gibbs, J. T., & Huang, L. N. (Eds.). (2001). *Children of color: Psychological interventions with culturally diverse youth*. San Francisco, CA: Jossey-Bass.

Dissertations: References for dissertations should include the following elements: author, date of publication, title, and institution (if you accessed the manuscript copy from the university collections). If there is a UMI number or a database accession number, include it at the end of the citation.

16. Dissertation, accessed online: Young, R. F. (2007). *Crossing boundaries in urban ecology: Pathways to sustainable cities* (Doctoral dissertation). Available from ProQuest Dissertations & Theses database. (UMI No. 327681)
17. Essays or chapters in edited books: References to an essay or chapter in an edited book must include the following elements: essay or chapter authors, date of publication, essay or chapter title, book editor(s), book title, essay or chapter page numbers, place of publication, and the name of the publisher.
18. One author: Labajo, J. (2003). Body and voice: The construction of gender in flamenco. In T. Magrini (Ed.), *Music and gender: perspectives from the Mediterranean* (pp. 67-86). Chicago, IL: University of Chicago Press.
19. Two editors: Hammond, K. R., & Adelman, L. (1986). Science, values, and human judgment. In H. R. Arkes & K. R. Hammond (Eds.), *Judgement and decision making: An interdisciplinary reader* (pp. 127-143). Cambridge, England: Cambridge University Press.
20. Encyclopedias or dictionaries and entries in an encyclopedia: References for encyclopedias must include the following elements: author(s) or editor(s), date of publication, title, place of publication, and the name of the publisher. For sources accessed online, include the retrieval date as the entry may be edited over time.
- 21 (A) Encyclopaedia set or dictionary: Sadie, S., & Tyrrell, J. (Eds.). (2002). *The new Grove dictionary of music and musicians* (2nd ed., Vols. 1-29). New York, NY: Grove.
- 22 Article from an online encyclopedia: Containerization. (2008). In *Encyclopedia Britannica*. Retrieved May 6, 2008, from <http://search.eb.com>

23 Encyclopaedia article : Kinni, T. B. (2004). Disney, Walt (1901-1966): Founder of the Walt Disney Company. In *Encyclopedia of Leadership* (Vol. 1, pp. 345-349). Thousand Oaks, CA: Sage Publications.

#### 3.4.4 Research reports and papers:

References to a report must include the following elements: author(s), date of publication, title, place of publication, and name of publisher. If the issuing organization assigned a number (e.g., report number, contract number, or monograph number) to the report, give that number in parentheses immediately after the title. If it was accessed online, include the URL.

Government report, accessed online: U.S. Department of Health and Human Services. (2005). *Medicaid drug price comparisons: Average manufacturer price to published prices*

Government reports, GPO publisher, accessed online: Congressional Budget Office. (2008). *Effects of gasoline prices on driving behavior and vehicle markets: A CBO study* (CBO Publication No. 2883). Washington, DC: U.S. Government Printing Office.

Technical and/or research reports, accessed online: Deming, D., & Dynarski, S. (2008). *The lengthening of childhood* (NBER Working Paper 14124). Cambridge, MA: National Bureau of Economic Research. Retrieved July 21, 2008, from

Document available on university program or department site: Victor, N. M. (2008). *Gazprom: Gas giant under strain*. Retrieved from Stanford University, Program on Energy and Sustainable Development Web site: [http://pesd.stanford.edu/publications/gazprom\\_gas\\_giant\\_under\\_strain/](http://pesd.stanford.edu/publications/gazprom_gas_giant_under_strain/)

Audio-visual media: References to audio-visual media must include the following elements: name and function of the primary contributors (e.g., producer, director), date, title, the medium in brackets, location or place of production, and name of the distributor. If the medium is indicated as part of the retrieval ID, brackets are not needed.

Videocassette/DVD : Achbar, M. (Director/Producer), Abbott, J. (Director), Bakan, J. (Writer), & Simpson, B. (Producer) (2004). *The corporation* [DVD]. Canada: Big Picture Media Corporation.

Audio recording : NhatHanh, T. (Speaker). (1998). *Mindful living: a collection of teachings on love, mindfulness, and meditation* [Cassette Recording]. Boulder, CO: Sounds True Audio.

Motion picture : Gilbert, B. (Producer), & Higgins, C. (Screenwriter/Director). (1980). *Nine to five* [Motion Picture]. United States: Twentieth Century Fox.

Television broadcast :Anderson, R., & Morgan, C. (Producers). (2008, June 20). *60 Minutes* [Television broadcast]. Washington, DC: CBS News.

Television show from a series : Whedon, J. (Director/Writer). (1999, December 14). Hush [Television series episode]. In Whedon, J., Berman, G., Gallin, S., Kuzui, F., &Kuzui, K. (Executive Producers), *Buffy the Vampire Slayer*. Burbank, CA: Warner Bros..

Music recording: Jackson, M. (1982). Beat it. On *Thriller* [CD]. New York, NY: Sony Music.

Undated Web site content, blogs, and data: For content that does not easily fit into categories such as journal papers, books, and reports, keep in mind the goal of a citation is to give the reader a clear path to the source material. For electronic and online materials, include stable URL or database name. Include the author, title, and date published when available. For undated materials, include the date the resource was accessed.

Blog entry:

Arrington, M. (2008, August 5). The viral video guy gets \$1 million in funding. Message posted to <http://www.techcrunch.com>

Professional Web site: National Renewable Energy Laboratory.(2008). *Biofuels*. Retrieved May 6, 2008, from [http://www.nrel.gov/learning/re\\_biofuels.html](http://www.nrel.gov/learning/re_biofuels.html)

Data set from a database: Bloomberg L.P. (2008). *Return on capital for Hewitt Packard 12/31/90 to 09/30/08*. Retrieved Dec. 3, 2008, from Bloomberg database.  
Central Statistics Office of the Republic of Botswana.(2008). *Gross domestic product per capita 06/01/1994 to 06/01/2008* [statistics].Available from CEIC Data database.

Entire Web site: When citing an entire Web site (and not a specific document on that site), no Reference List entry is required if the address for the site is cited in the text of your paper. Witchcraft In Europe and America is a site that presents the full text of many essential works in the literature of witchcraft and demonology (<http://www.witchcraft.psmmedia.com/>).

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### 3.5 Summation

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A citation is a short code (within the body of the document) that identifies an idea or fact that the writer has borrowed from elsewhere. The list of references, or bibliography, provides a complete and detailed list (at the end of the document) of all the sources the writer used<sup>1</sup>. Do not underline any part of a reference; use *italics* as indicated in the examples below. Consider citations as equations or formulas in words – be precise.

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### 3.6 Questions to be answered

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1. Define style Manuals? Explain the Different Style Manuals
2. Describe the different Style Manuals
3. Explain the APA and MLA style Manuals

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### **3.7 References**

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1. Busha, Charles and Stephen P Harter. Research Methods in Librarian ship :  
Techniques and Interpretation New York Academic Press ,1980
2. Wilkinson and Bandrakar Methodology and Techniques of Social Science Research,  
Bombay Himalaya Publishing House, 1998

# Unit-V

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## Lesson-3 Statistical Applications in Library & Information Science

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### Structure

- 2.0 Aim and Objectives of the study
- 2.1 Introduction to Bibliometrics
- 2.2 Librametry
- 2.3 Bibliometrics- Meaning –Definition and Scope
  - 2.3.1 Definitions of Bibilometrics
  - 2.3.2 Bibilometrics-scope
  - 2.3.3 Applications of Bibiliometircs
  - 2.3.4 Bibliometric laws
    - 2.3.4.1 Bradford’s law: scattering of articles over different journals
    - 2.3.4.2 Lotka’s law: productivity of authors in terms of scientific papers
    - 2.3.4.3 Zipf’s law:
- 2.4 Citations Analysis
  - 2.4.1 Citation deals with two types of data
  - 2.4.2 Histories of citation analysis:
  - 2.4.3 Importance of citation
  - 2.4.4 Citation Counting
  - 2.4.5 Applications
  - 2.4.6 Utility of citation analysis
  - 2.4.7 Limitations of citation studies
- 2.5 Scientometrics
  - 2.5.1 Scope of Scientometrics:
  - 2.5.2 Application of Scientometrics
- 2.6 Informetrics
- 2.7 Webometrics- Definition -concept
- 2.8 Summation
- 2.9 Questions to be answered
- 2.10 References

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### 2.0 Aim and Objectives of the Study

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- This unit aim at introducing you to Bibliometrics as a tool and Technique of method of research in Library and Information Science
- To Know the origin and Development of the Bibliometrics
- To help the Judicious Selection of the Library Documents
- To know the Collection Development in different Libraries

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### 2.1 Introduction to Bibliometrics

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The main aim of any library is to satisfy the information needs of users within a limited budget, but in this world of information explosion it is a challenging job to any librarian to select the right kind of reading materials. For a judicious selection librarian usually depends upon various acceptable tools or techniques. Bibliometric study is one of the universally acceptable tool and technique. It helps in determining the major forms of reading materials like Periodicals, textbooks, manuals, handbooks, etc. Bibliometric studies are used to identify the pattern or patterns of authorship citation and or secondary journal coverage with the hope that such regularities can give an insight into the dynamics of the area under consideration. This consequently leads to better organization of information resource which is essential for effective and efficient use. Bibliometric studies are undertaken now-a-days enormously at national and international level. In most cases Bibliometric studies have been carried out on well established subject areas. The present study is also being done on the area of Bibliometrics itself.

Bibliometrics is an emerging thrust area of research in the field of Library and Information Science. It is first appeared in 1969 and it became popular during 1980's. Bibliometrics It is a qualitative and quantitative analyses of publication for the purpose of ascertaining specific kinds of phenomena. There are two types of Bibliometric studies: (i) Descriptive studies and (ii) Behavioral studies. The descriptive studies are those studies, which describes various features of literature. These studies cover the medium of communication, the subject matter, and the volume of information covered. Other type of Bibliometric studies is behavioral studies, which explore the bibliographic relationship between different documents. These studies also show the relationship between different authors, disciplines, etc. With the Bibliometric studies one can shed light on the process of written communications analyzing its various facets.

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## **2.2 LIBRAMETRY**

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The term Librametrics has two roots. 'Libra' and 'metrics'. The word Librametrics means measurement. Ranaganthan conceived the idea of Librametry in 1948 at the Aslib,s Conference held in Lamington Spa when he was asked to comment on the lecture of Prof. J.D.Bernal by the then president of Aslib . Later in 1969 at the annual seminar of the Document Research and Training Centre (DRTC), Bangalore, in his paper he elaborately explained application of libremetrics techniques in organizing various library activities and services of Madras University as its librarian. Neelameghan also presented a paper reporting about the investigation conducted in 1969 by Research Unit of the DRTC on applicability of Librametic techniques. The common definition introduced in 15<sup>th</sup> All India IASLIC conference on Bibilometrics and Librametrics.

“Information process and information handling in libraries and information centers by quantitatively analyzing the characteristics and behaviors of documents, library staff and library users”. Sengupta defined Librametrics as “quantitative analysis of various facets of library activities and library documents by application of mathematical and statistical calculus to seek solution to library problems”.

In the Madras University Library, S.R.Ranganthan maintained the statistics systematically relating to various library operations. This provided the base for calculating man hours needed in a year for each item of work in the library. This, in turn helped to reduce staff, and the staff formula can be used for the determination of the strength of staff in an objective and impersonal way. Thus, when the volume of new accession, the hours of working, number of readers, etc can be estimated, then the size of the staff required may also be estimated with the help of the staff formula. This has helped many librarians to justify demand for additional staff and also intelligently plan new services for new system.

Librametric studies can also help in the most judicious distribution of staff. The pressure of work in the circulation and reference sections usually, vary during different periods of the day. If the exact pattern of this varying work-load is known, provision of staff in these sections can be accordingly planned. Dr S.R.Ranganathan suggested the use of Librametry for determining the optimum use of library service, design of library building, size of reading rooms and so on. Even in classification and cataloguing there was wide scope for Librametry, such as determining the most helpful facet sequence through statistical analysis of readers needs. Applications of quantitative techniques to libraries were until recently known as “Statistical bibliography”. In 1948 this subject was termed as Librametry by the late Dr..S.R.Ranganathan and the scope of this subject was however until recently, only to the application of quantitative methods in library management. In 1969 the term, Librametry was coined to describe all studies which seek to quantify process of written communication.

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## **2.3 BIBLIOMETRICS-MEANING DEFINITION ANDSCOPE**

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The word Bibliometricis is derived from Latin and Greek words i.e.Bilio and Metrics. 'Bybl' meaning book, paper, the word “metric” on the other hand, indicates the science of

the meter. So etymologically it is a measurement, and is derived either from Latin or Greek word 'metricus' or merticos respectively means measurement.

Bibilometrics as a sub discipline in Information Science is first known to have been applied by F.J.Cole and N.B.Eales in 1917. They analyzed comparative anatomy papers by counting the number of publication by country. A subsequent study was conducted by counting by Hulme in 1923 both of these studies have designed it as 'Statistical bibliography' and defined it as the application of quantitative techniques to library and bibliographical work. Gross and Gross is considered to be the third study in the field based on citations. After Hlume, the term statistical bibliography was used by Henkle in 1938 in his article the periodical literature of Biochemistry' and Gosnel in his dissertation in 1943 and later in his article of 1948. Later Fussler in 1988 and 1949 Raising in 1962, Barker in 1966 and Prichard in 1968 and 1969 have used the term 'Statistical Bibliography' in their work. As the term was considered very clumsy, not very descriptive, and can be confused with statistics itself or bibliographies on statistics Pritchard suggested the word "Bibliometrics". 'Librametrics', Scientometrics and Informetrics are also in use in the literature. Bibilometrics is analogous to 'Ranganthans', Librametrics'; Russian concept, Scientomeris; FID's, Informatics and also to some other well established sub disciplines like 'Econometrics' Psychometrics,' Sociometrics and Biometrics, where the mathematical and statistical Calculus has been applied to study and solve the problems in the field of library science, history of science, information sciences, Economics, Psychology, Sociology and Biology respectively. Kopelock (1978) points out, during the period 1967-1977, 52 different terms have been used to describe Bibilometircs.

Library Science is one of the oldest professional subject disciplines that started merely as a craft and remained so till 20<sup>th</sup> century, which started developing like other sciences viz. Biometrics, Psychometrics, Econometrics and Scientometrics etc. One can notice the similar development in Library and Information Science namely, Bibilometrics, Informetrics and Scientometrics

### **2.3.1 DEFINITIONS OF BIBILOMETRICS**

Bibliometrics means application of statistical studies in library and information centers. Over the years the subject has been growing and gaining ground in libraries and information centers all over the world.

A famous definition in this regard is by Alan Prichard (1969)" Bibilometrics as the application of mathematics and statistical method to books and other media of communication"

British Standard Institution defines Bibliometrics as "The study of the used of documents and patterns of publication in which mathematical and statistical method have been applied"

According to Sengupta<sup>1</sup>"Bibiliometric as organizations classification and quantitative evaluation of publication pattern of all macro and micro communication along with their authorship by mathematical and statistical calculus"



Dr.S.R.Ranganathan explains that “Application of quantitative techniques to libraries were until recently known as “statistical bibliography” this subject was termed as”Librametry”. The scope of the subject was, however until recently limited only to the application of quantitative methods to library management”

According to Faithrone “Bibilometrics as the quantitative treatment of the properties of recorded discourse and behavior pattern”

While describing the importance of statistical Bibliography Hulme states that “The purpose of statistical bibliography is to shed light on the process of written communication and of the nature and course of development of a discipline by means of counting and analysis its various facets of written communication”.

There are number of definitions of Bbibilometrics given by different researchers such as Hlume, Raising, Fairthorne, Beck, Poter, Schrader, Sengupta, Kaibar and others. However a more elaborative concept of Bibilometric has recently expounded by Egge, who defined it as the development and application of mathematical (including statistical and optimization of models and techniques to all aspects of communication

### **2.3.2 BIBILOMETRICS-SCOPE**

According to Pritchard (1969, 1968) the purpose of Bibilometrics was:

1. To shed light on the process of written communication and the nature and course of development of a descriptive means of counting and analyzing the various facts of written communication.
2. To provide information about the structure of knowledge and how it is communicated.

Stevens (1953) considered Bibliometrics as a quantitative science and divided it into broad areas of several sub-areas as follows.

1. Descriptive Bibliometrics or productivity count.
  - (a).Geographic
  - (b).Different periods of time; and
  - (c).Different disciplines.
- (2) Evaluative Bibliometrics or Literature usage count
  - (a) Reference count; and
  - (b) Citation count

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### **2.3.3 APPLICATION OF BIBILIOMETIRCS**

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According to Ravichandra Rao (1983) bibliometric techniques are used in the identification of trends in a subject and also in the study of scientific communication. He states that “Bibiliometrics has been accepted as a research area that gives us additional understanding of the form and structure of scientific communication”

As Bibliometrics lies between the broader area of the social science, its techniques have extensive application equally in sociological studies of science, information management, librarianship, history of science including science policy, study of science of science and scientist and also in different branches of social sciences. Some of the areas where Bibliometric techniques are consistently being applied have been enumerated by Sengupta (1992)

- ❖ To identify research trends and growth of knowledge in different scientific disciplines;
- ❖ To estimate comprehensiveness of secondary periodicals;
- ❖ To identify users of different subjects;
- ❖ To identify authorship pattern and trends in documents on various subjects;
- ❖ To measure usefulness of adhoc and retrospective SDI services;
- ❖ To identify core periodicals in different disciplines;
- ❖ To formulate an accurate need-based acquisition policy within limited budgetary and accurate weeding and stacking policy;
- ❖ To initiate effective multilevel network systems;
- ❖ To study obsolescence and dispersion of literature
- ❖ To predict productivity of publisher, individual authors, organization, countries or that of an entire discipline;
- ❖ To design automatic language processing for auto-indexing auto-abstracting and auto-classification; and
- ❖ To develop norms for standardization

To summarize, Bibliometrics studies have a wide range of application in such areas as book and journals acquisition, study of communication patterns, library use analysis, obsolescence of literature, identification of specialties and in identification of influential authors and papers.

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#### **2.3.4 BIBLIOMETRIC LAWS**

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The statistical data relating to the world of scientific information and document collection such as; scattering of subject, pattern of authorship, citation trends, and distribution pattern of information element have engaged the attention of statisticians and librarians for over 50 years. Attempts have been made collect and interpret these data and to study the underlying principles. The branch of library and information science activity was named as Librametrics by Ranganthan,(1959) and Bibliometrics (Pritchard,1969). The Bibliometric laws are useful in understanding some of the information phenomena and may help in planning many of the library activities, as they indicate certain basic patterns and relationship governing information items and activities. The study throw light on the pattern of literature growth, productivity and influence of authors, interrelationships among different branches of knowledge, distribution of terms in information storage retrieval, pattern of collection development, their use and the like. Following three empirical Bibliometric laws that provided tremendous boost in the research activities on Bibliometrics

## **SIGNIFICANT LAW'S OF BIBLIOMETRIC STUDY:**

- a) **BRADFORD'S LAW:** Scattering of articles over different journals
- b) **LOTKA'S LAW:** Productivity of authors in terms of scientific papers
- c) **ZIPF'S:** Frequency of occurrence of words in a text

### **2.3.4.1 BRADFORD'S LAW: Scattering of articles over different journals**

Bibliometric studies have been very popular in recent years, and the literature on the subject has been growing rapidly over the past five decades. Bibliometrics is the study and measurement of the patterns of all forms of recorded information and their products. Bradford first observed that periodical articles on a subject may be scattered over different periodical titles according to "zones" of decreasing productivity of these titles. Many later studies confirmed this phenomenon of scattering in various indexing/abstracting services of machine readable data bases. According to Bradford (1934) a large number of the articles that relate to the same topic tend to be concentrated in a few journals. If we arrange journals, in a descending order according to the number of related articles appearing in them, with the journals yielding the most articles at the top of the list and the yielding the fewest at the bottom, and if the journals are divided into series, each group will contain the same number of articles, then the number of journals contained in each succeeding, main group will be of journals contained in each succeeding group will be proportional to the series: 1: J: J<sup>2</sup> ..... For some constant J. Thus a linear increase in the number of articles requires a geometric increase in the number of journals. This is Bradford's law which has been an important research topic in the area of Bibliometrics.

Vickery (1948) shows that Bradford's law implies a j shaped curve with an initial concave segment leading to a large linear segments and that such a curve gives a good fit to available data. Subsequently, Chen and Leimkuhler (1978) identified six different shapes of Bradford's graphs, including the so-called convex "drop" in the tail of the graph Naran(1989) Egghe,(1990), Qui & Tague (1990),<sup>33</sup> Pravdic & Vulcovic,(1991). Most efforts have relied on a priority model of the relationship among journal size, rank and frequency.

Chen and Leimkuhler (1987) took a different approach. They used an index approach to explicitly recognize the presence of graphs in the raw data where the actual numbers of articles in the journals do not run consecutively from '1 to 'n. the gaps play an important role in three significant regions of a Bradford graph. The first region includes the "significant few" journals that contain the majority of related articles and the corresponding graph may be concavely increasing, linear increasing convexly increasing. The second region includes the 'middle class" journals where the curve is approximately linear. Finally the third region represents the large number of journals that publish only few related articles. Here the publication pattern can be concavely increasing, linear increasing, or convexly increasing. These differences pointed out by the dynamic nature of Bradford's law.

### **2.3.4.2 LOTKA'S LAW: Productivity of authors in terms of scientific papers**

The frequency distribution of productivity of authors of scientific papers was first studied by Alfred Lotka, (1926) who proposed that the number of authors making 'n' contributions is about  $1/N^2$  of those making one contribution, and the proportion of all contributions, who make s single contributions is about 60% or 'a (N) = K/N<sup>2</sup>' where a is the number of authors producing 'n' papers and 'k' is constant.

Lotka's inverse square law "might reflected an underlying pattern in the behavior of those people who produce publication, whether those publication are books or journals articles".

Lotka's law has been in the study made by the Library of Congress (LC) of all author headings on its MARC tapes, and study of personal authors in the card catalogue, of the University of Illinois Library, these studies were conducted to aid in planning for the implementation of the second section of AACR2.

**2.3.4.3 ZIPF'S LAW:** If the words are ranked on the basis of the frequency of their occurrences in a long text in decreasing order, the law states the frequency of occurrence f (r) of word is the reciprocal of its rank 'n' (Zipf,1949). The law is represented by  $f(r) = c/n$ .

Where 'c' is a constant or  $\log f(r) + \log n = \log c$

The laws represents only an approximation of the relationship between rank and frequency, which is hyperbolic .Zipf's formulation, has been further refined and may generalized forms have been derived (Mandelbrot; Wyllys, 1981)

The rationale behind the rank-frequency phenomenon has been stated by Zipf's as the "principle of least efforts". In any language, the words which have a high frequency of occurrence are those that cost less in usage or require less effort in communication. A feature of Zipf's law is that it highlights the phenomenon that once, by chance a group has achieved a dominant position it retains that position for a long time and indeed, is more likely to be promoted than the less fortunate groups (Scarrot, 1974).this feature is also known as the "success breeds success' phenomenon, i.e. success increases the chances of further success.

Though the law has been applied to study the length of monographs in The Harvard University College Library through the measuring of the number of pages and vocabulary control in the design of information retrieval (IR) systems, its real significance to a library is yet to be brought out. Against this, the least-effort principle has significance, in all areas of library activities. Those planning and designing of library systems must consider the tendency of human nature to seek things involving least effort.

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## 2.4 CITATIONS ANALYSIS

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The citation represents relationship between the cited and citing documents. The study of this relationship in all aspects is the function of a citation analysis, which is an important area of Bibliometrics. The study of citation analysis has count of age, practically after the launching of Science citation index, Social Science Citation Index and Art and Humanities

Citation Index by the institute for scientific information (Garfield, 1972, 1980, 1981) and the use of computers.

#### **2.4.1 CITATION DEALS WITH TWO TYPES OF DATA**

- (1) Reference or cited: An item designating the source unit; thus it is always pre-dated with reference to the citation.
- (2) Citation or citing: An item designating the receiving unit; thus it is always post-dated in relation to the reference.

The coverage of citation analysis has now been extended from citations of articles to other items, such as books, journals, authors, institutions, and organizations, academic departments, Universities, countries, and many other areas. The prominent techniques of citation study are citation counting, bibliographic coupling and co-citation analysis.

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#### **2.4.2 HISTORY OF CITATION ANALYSIS**

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Although citation analysis was first used in 1848 or 1927, depending on the source historically, it is a by-product of citation indexes. Gross and Gross in 1927 used citation count to rank the periodicals in chemistry, which was regarded as the first user study of a significance based on a more systematic citation count that became the basis and a methodological direction to the Bradford's law of scattering, the institute of international Scientific Information (ISI) produces these indexes that organized in the 1960's. The subject coverage in the citation index has been expanded from the initial Science Citation Index (SCI), to include the Social Science Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI). Citation counting techniques are used in the evolution of scientific activities for few decades. The main objective of the citation analysis is to evaluation and to interpret citations received by articles, authors, institutions and other aggregates of scientific activities. It is also used as a tool for measuring communication links in the sociology of science.

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#### **2.4.3 IMPORTANCE OF CITATION**

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The importance of citation includes the following:

1. Giving credit to related work,
2. The reference to standard methodology or a piece of equipment that has been used citing than describing it in detail,
3. Providing broad background to the topic
4. Correcting or criticizing the previous papers;
5. Equating earlier papers that offer collaboration for one's ideas or claims,
6. Drawing attention to previous works that of not well known, but ought to be,

7. Identifying the earlier publication form, which the author obtained the original idea for his or her work,
8. Altering researchers to their forthcoming work
9. Citing major figure because it makes your look more respectable
10. Citing major figure because you think he or she may be your look More respectable,
11. Citing major figure because you think he or she may be reference to the paper, when you submit it to the journal
12. Citing articles that fit the authors' perceptions of the journals readers and what they are expecting.
13. In other words, the characteristic and status of the journal and the authors are submitting the number of paper.

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#### **2.4.4 CITATION COUNTING**

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This technique involves counting the number of citations received by a given document or a set of documents over a period of time from a particular set of citing documents the documents are co-cited if both of them are commonly cited in papers published subsequently. Co-Citation links two or more documents published earlier in relation to later document. Citation analysis has been criticized for both the assumptions behind it and the method employed (Smith, 1981) these assumptions are as follows.

- (1) Citation of a document implies use of the document by the citing authors.
- (2) Citation of document (Author, Journal articles) reflects the merit quality, significance, and impact) of that document.
- (3) Citations are made to the best possible works.
- (4) A cited document is related in content to the citing document; if two documents are bibliographically coupled and co-cited they are related in content.
- (5) All the citation are equal, with reliability of citation data is affected by the problems posed by; (a) Multiple authorship; (b) Self-Citations; (c) Homographs; (d) synonyms; (e) Type of source; (f) implicit citations; (paper referring to or discussing a work or idea without citing it) (g) Fluctuations in citing policy with time;(h) Field/subject variations; and (i) errors.

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#### **2.4.5 APPLICATIONS**

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Citation analysis has been applied extensively to study various aspects of documents in their subject context and use environment. As an emerging technique, it provides a new approach to the study of information phenomena. The uses of the technique (Smith, 1981; Narian and Moll, 1977) broadly fall into the following categories

##### **(1) COLLECTION DEVELOPMENT, USER STUDIES:**

Citation analysis has been employed to formulate journal subscription policy by evaluating journals on the basis of the number of times a journal is cited. Another use is the formulation of weeding out policies based on citation. The relative values of different types of documents to various categories or users have also been studied

**(2) INFORMATION RETRIEVAL:**

Citation analysis also helps been to develop document surrogates, user-document-keyword relationship and search strategy, computer identification of citing statements, and access to interdisciplinary literature.

**(3) DEVELOPMENT AND GROWTH OF SUBJECT AND THEIR LITERATURE:**

Productivity of authors and their influence on others have been measured, through citation, citation coupling and co-citation. These techniques have also been employed to study the structure of scientific growth to map boundaries of a subject

**(4) HISTORICAL AND RESEARCH STANDARD STUDIES:**

This includes tracing the development of subject through time, density and context of the citation and using a citation network as a measure to assess interrelationships and influence of different authors and their works on other works.

## **(5) PATTERN OF RESEARCH COMMUNICATION:**

Another area of application of bibliographic techniques is to measure the impact of isolation due to barriers of language, distance, and non-availability of literature and scientific papers on scientific communications.

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### **2.4.6 UTILITY OF CIATIONS ANALYSIS**

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1. Citation analysis is used to study the citation links between scientific papers. Technical notes and reviews, for example it may be used by the professionals in periodical section for study the structure of literature and to identify core journals,
2. Citation analysis provides relevant measures of utility and relationship of journals where a primary function is to communicate research results.
3. Citation analysis helps in identification of key documents and creation of core lists of journals.
4. It helps in clustering of documents according to common references and citations, and
5. Provides the study of the attributes of literature including growth rate, obsolescence, citation practices.

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### **2.4.7 LIMITATONS OF CITATION STUDIES**

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A number of factors contribute to limit the various values and applications of the information system.

- a) Theory provides only incomplete and biased record of the working of the information system.
- b) Data have been collected by one hand although citation indexes published by scientific institutes can used sometimes
- c) Insufficient research has been conducted into the rationale behind the citing, to enable direct application of the data

A citation study by definition excludes all those publication that neither cites nor is cited, so as citing trends may be the province of particular subjects and publication. Certain specific areas are discriminated against.

Science citation index (SCI) is multidisciplinary index to the world literature annually. It processed thousands of articles; lakhs of articles and with millions of references. Each source article and its link with the cited articles are mapped by this context. This type of analysis reflects a wider notation of the present study.

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## **2.5 SCIENTOMETRICS**

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This term was introduced and came into prominence with the founding of the journal named 'Scientometrics' by Braunin, (1977). The scope of the journal is to publish all those studies of quantitative aspects of science as discipline of economic activity. Scientometric is a part of the sociology of science and has application to science-policy making. It involves quantitative studies of scientific activities, including among others, publications, and so overlaps Bibliometrics to some extent Scientometrics is a branch of the of Science.

Scientometric has Defined this term,"as a sub-field which applies quantitative methods to the study of science as an information and promoters of communication" (NALOMOV AND MULCHENKO 1969)

Haituntreats defines (1977) "Scientometric" as scientific discipline which performs reproducible measurement of science activity and reveal its objectives of quantitative regularities"

### **2.5.1 SCOPE OF SCIENTOMETRICS:**

The main aim of 'Scientometrics is to determine the state and prospects of a subject and its further development. Several, Scientometrics indicators are used for this purpose, and one of the most significant indicator is the measure of research topically in a given field. These indicators are on the way to become standard tools of evaluation and analysis in research management of science policy making. Considerable attention has been paid in recent years to measure scientific information, which may be used for the control of science development in two ways' viz. practical and strategic. In practical way it includes search of information for users. As far as the strategic use of information is concerned it implies the monitoring of science development and the analysis of the changing structure of science.

### **2.5.2 APPLICATION OF SCIENTOMETRICS**

The mathematical and statistical techniques had made possible the process of quantifying the number of publications and the number of people participating in the social system of science, research or R & D. Although there might be methodological difficulties, still it was relatively easy since it was a process of counting. The question, however, is whether such a procedure is really adequate if one has to do with the quantification of the 'intellectual products' of scientists or researchers. It presupposes the emphasis on qualitative studies which should be descriptive in nature. This notion has promoted researchers in this field, in the decades, to develop special type of procedures and quantitative techniques to study the features of a given discipline and to observe changing structural pattern of the discipline over a period of time. It helps in developing.

1. Ability to map literature of a discipline intelligibly at different levels;
2. Ability to create useful indicators of development in science and increasingly in technology
3. Ability to model dynamic aspects of literature, mathematically with good-to excellent fits;
4. Growing skills in using computerized databases and practical software for Bibliometrics ends

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## 2.6 INFORMETRICS

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The term "Informetrics" connotes the use and development of a variety of measures to study and analyze several properties of information in general, and documents in particular. The term was first coined by Otto Nacke in 1979 and was later adopted by VEROSHIISKY INSTITUT NAUCHNOI I TEKHNICHESKOI INFORMATSII (VINITI) and International Federation of Documentation (FID). The scope of it; covers bibliometrics, Scientometrics, and other quantitative studies related to information science. Informetrics seeks to develop statistical and mathematical techniques to evaluate and improve the efficiency of information services and their use. Its important applications fall in the areas of collection management and library and information services. Most of the informetric studies are connected with different types of users and the extent to which the user needs are fulfilled.

From simple data analysis of library statistics, informetrics has now grown to a well-defined concept, involving, applied statistics, modeling, simulation, cluster analysis etc. The trend in "Informetrics" is mostly towards discovery of theory and or a generalized mathematical model, which can help, in achieving efficiency in fulfilling Ranganathan's five laws of library science.

I.N Sengupta Defines "Informatics studies different aspects pertaining to information" )

Morales Defines "The term informetrics covers almost all aspects of Bibliometrics and Librametrics"

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## 2.7 WEBOMETRICS-DEFINITION- CONCEPT

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The term, 'webometric' was coined from two English words i.e. "web" & "metrics". The word 'web' is the short of World Wide Web and 'metrics' denotes the mathematical theory of measurement. The ODLIS defines webometrics as "description and evaluation of the impact of the Internet as a scholarly communication tool, primarily by means of quantitative analysis of web-based scholarly and scientific communications" (ODLIS). Sometimes it is used synonymously with 'cybermetrics'. Simply, Webometrics, therefore, is the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the Web, drawing on bibliometric and informetric approaches.

The World Wide Web has now become one of the main sources of information on academic and research activities and therefore it is an excellent platform to test new methods of evaluating webometric activities. Webometric studies have focused their analyses mainly in the performance of the academic web domains, because academic institutions like colleges and universities are stable and well-defined institutions on the Web since long time ago. Furthermore, this interest is due to the possibility of building Web indicators which explain the academic activity and production (Scharnhorst and Wouters, 2006; Thelwall, 2001, 2002).

Academic institutions, web sites, in many countries, are large multifaceted communication devices, and are increasingly used for a wide variety of purposes, from attracting new students to providing online library catalogues. In terms of research, academic institutions, web sites can announce the existence and promote the achievements of individuals, research groups, institutes and departments. They can also disseminate their findings, either by hosting online articles or by publishing summaries, data sets or tools. The pages themselves can be created centrally, by administrators or webmasters, or locally by individuals for themselves or their research team or projects. Potential benefits of an effective web presence include greater research impact, attracting students, media interest and commercial contacts. In this context, it is quite logical to investigate the measures of the effectiveness of web sites, both to study the communication activity that they represent and to build useful evaluation metrics (Vaughan and Thelwall, 2005).

According to Bjerneborn and Ingwersen (2004) the definition of webometrics is “the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the Web drawing to bibliometric and informetric approaches.”

The term webometrics has also been introduced, coined by Almind and Ingwersen (1997). Webometrics has also been introduced, “the study of web based content with primarily quantitative methods for social science research goals using techniques that are not specific to one field study.”

The Online Dictionary of Library and Information Science defines a web page as “an electronic document written in HTML script, stored on a Web server and accessible using Web browser software at a unique Internet address (URL), usually one of a group of related, interlinked files that together comprise a Web site. A Web page may include formatted text, graphic material, audio and/or video elements, and links to other files on the Internet” (DLIS).

Bojerneborne (2004), on the other hand, defined webometrics as “the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the web, drawing on bibliometric and informatic approaches. This definition covers both the construction and usage aspects of the web, which embrace the following four key domains of webometrics study:

1. Web page content analysis.
2. Web link structure analysis (e.g. hyperlink, self link and external link).
3. Web usage analysis (e.g. exploiting log files for users searching and browsing behavior).
4. Web technology analysis, (including search engine performance)

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## **2.8 Summation**

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Bibliometric as a technique has extensive application in identifying the research trends in a subject, trends in subject-wise authorship pattern and collaboration in research core periodical obsolescence and dispersion of scientific literature useful in estimating comprehensiveness of secondary periodicals, studying the author productivity, characteristics of subject literatures including structure Knowledge, historical and

sociological aspects of science and helpful in formulation of need based collection development policy, weeding and stacking, science policy and etc.,

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### **2.9 Questions to be answered**

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1. Define Bibliometrics? Explain the application of Bibliometric Laws?
2. Define scientometrics: and its Scope
3. Define the webometric?

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### **2.10 References**

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## Lesson-4 Recent Trends in Library and Information Science Research

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### Structure

- 4.0 Aim and Objectives of the Study
- 4.1 Introduction to Library and Information Science Research
- 4.2 Meaning of Research
- 4.3 Objectives of Research
- 4.4 History of Librarianship Research
- 4.5 Current trends in LIS Research
- 4.6 Interdisciplinary Area of Library Research
- 4.7 Future of Library Research
- 4.8 Summation
- 4.9 Questions to be answered
- 4.10 References

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### 4.0 Aim and Objective of the Study

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- Know the Recent trends in Library and Information Research
- Know the development of the Library Science
- Know the users attitudes towards the Library and Information Centers
- How to develop the Libraries in recent days

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### 4.1 Introduction to Library and Information Science Research

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Research is an intellectual process whereby a problem is perceived, divided into its constituent elements, and analyzed in the light of certain basic assumptions; valid and relevant data are collected; hypotheses (if any) are through objective testing, rejected, amended, or proved. The generalizable results of this process qualify as principles, laws, or truths that contribute to man's understanding of himself, his works, or his environment. Stated another way, research is the systematic attempt to discover new facts or sets of facts, or new relationships among facts, through the formulation of a preliminary explanation or hypothesis which is subjected to an appropriate investigation for validation or disproof and "The men (researcher) of experiment are like the ant; they only collect and use: the researchers resemble spiders, who make cobwebs out of their own substance. But the bee takes a middle course; it gathers its material from the flowers of the garden and of the field, but transforms and digests it by a power of its own." Clearly, to be an effective research investigator one must resemble the bee purposeful, industrious, and imaginatively selective in the assembling of evidence.

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## 4.2 Meaning of Research

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There are numerous scholarly books and articles on scientific research and almost as many definitions. Scientists and philosophers or historians of science, are fascinated with the problem of defining what scientists do to establish new knowledge. J. H. Shera's classic essay on "Darwin, Bacon, and Research in Librarianship" written for an earlier issue of *Library Trends* describes it by following way:

Shorn of its mysticism and its methodology, research since (at least) the time of Bacon has been an answering of questions by the accumulation and assimilation of facts which lead to the formulation of generalizations or universals that extend, correct, or verify knowledge described in terms of its sequential acts, "research is an intellectual process whereby a problem is perceived, divided into its constituent elements, and analyzed in the light of certain basic assumptions; valid and relevant data are collected; hypotheses (if any) are through objective testing rejected, amended, or proved"

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## 4.3 Objectives of Research

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The purpose of research is to discover answers to the 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 still. Though each research study has its own specific purpose we may think of research objectives as 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 formulate research studies);
2. To portray 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 occur or with which it is associated with something else (studies with this object in view are known as diagnostic research study)
4. To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis testing research studies)
5. Motivations in Research

What makes people to understand research? This is a question of fundamental importance. The possible motives for doing research may be either one or more of the following:

1. Desire to a research degree along with its consequential benefits;
2. Desire to face the challenge in solving the unsolved problems, e.g. concern over practical problems initiate 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.
6. Formulation of Research Problems

Formulation of a research problem: A persuasive problem statement consists of three parts: 1) the ideal, 2) the reality, and 3) the consequences for the reader of the feasibility report. Well constructed problem statements will convince spectators that the problem is real and worth having present investigates. research strategy is one of contrast: by situating the ideal scenario

next to the situation as it exists, researcher can not only persuade the reader that a problem exists, but then go on to emphasize the consequences of ignoring or addressing the problem. Formulation of problem statement is the backbone of the research study and the feasibility report. By giving careful consideration to how should construct it for the study, it must use when doing your research and writing for the proposal as well as the progress and the feasibility research report. Following are five steps to formulate the Research Problem

1. Specify the Research Objectives A clear statement of objectives will help you develop effective research. It will help the decision makers evaluate your project. It's critical that you have manageable objectives. (Two or three clear goals will help to keep your research project focused and relevant.)
2. Review the Environment or Context of the Research Problem As a marketing researcher, you must work closely with your team. This will help you determine whether the findings of your project will produce enough information to be worth the cost. In order to do this, you have to identify the environmental variables that will affect the research project.
3. Explore the Nature of the Problem Research problems range from simple to complex, depending on the number of variables and the nature of their relationship. If you understand the nature of the problem as a researcher you will be able to better develop a solution for the problem. To help you understand all dimensions, you might want to consider focus groups of consumers, sales people, managers, or professionals to provide what is sometimes much needed insight.
4. Define the Variable Relationships Marketing plans often focus on creating a sequence of behaviors that occur over time, as in the adoption of a new package design, or the introduction of a new product. Such programs create a commitment to follow some behavioral pattern in the future. Studying such a process involves: Determining which variables affect the solution to the problem. Determining the degree to which each variable can be controlled. Determining the functional relationships between the variables and which variables are critical to the solution of the problem. During the problem formulation stage, you will want to generate and consider as many courses of action and variable relationships as possible.
5. The Consequences of Alternative Courses of Action There are always consequences to any course of action. Anticipating and communicating the possible outcomes of various courses of action is a primary responsibility in the research process

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#### **4.4 History of Librarianship Research**

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It was Ralph A. Beal who categorized library literature into the tripartite classification of Glad Tidings, Testimony, and Research, finding precious little of the last This poverty of research in librarianship was explained by C. C. Williamson, in an address delivered at Western Reserve University in 1930 and subsequently published as the opening essay of the first issue of the *Library Quarterly*, as a consequence of the fact that librarians are basically empiricists, untrained in research and the scientific method. There exists, he charged, a deep rooted prejudice among library workers against subjecting their activities to scientific scrutiny.” This was undoubtedly the attitude of the typical librarian in 1930, and there is still much of it today. Research is emotionally disquieting; it does question old beliefs and sweeps aside tradition, often leaving in its wake disbelief, uncertainty, and shattered ideals. Yet, despite the

librarians' conventional antipathy for research, at the University of Chicago in the decade of the 1930's) some progress was made in laying a solid foundation for the application of research to the library as a social invention. Pierce Butler attempted to formulate the principles of a science of librarianship; Carleton Joeckel encouraged studies in the application of the techniques of scientific management and administration to the operation of libraries; William Randall focused the attention of his students upon the application of theories of the organization of knowledge to principles of library classification and bibliographic organization generally; Douglas Waples went beyond librarianship to the fundamental problem of the social effects of reading. And Dean Louis Round Wilson set forth, in *The Geography of Reading*, the social, cultural, economic, and other environmental influences related to the geographical distribution of libraries and library resources. The advent of the Second World War exerted two powerful influences upon research in librarianship. First, it abruptly terminated the developments at Chicago by dispersing the faculty, and from this interruption the program initiated by Wilson and his colleagues never really recovered. Second, the War raised research in general to such a high level of prestige, and rewarded its practitioners with such rich endowments, that librarianship was forced into a form of activity which had been largely alien to the profession and for which librarians generally were certainly unprepared. To this pressure for research, librarians responded in a variety of ways, and most of them hastily devised and ill-considered. The library schools began to talk glibly of research and to establish courses and seminars in library research and research methods. They substituted for the fifth year

Bachelor's degree the degree of Master of Science in Library Science, and they rushed all unawares into doctoral programs. Wanting desperately to "do research," they looked to such fund granting agencies as the Federal government and the foundations, and the response to their applications was surprisingly generous. Dollar diplomacy came to librarianship, with research as the key by which the coffers of wealth were to be unlocked. One can scarcely blame the librarians even a starving man will founder if his normal diet is not restored by degrees, and librarians had been hungry for a very long time. Because research had for so long been foreign to librarianship, when librarians did take the plunge, they became overenthusiastic converts to method. Librarians, as John Livingston Lowes once wrote of the humanists, tended to become enamored of the methods, and at times to forget the end; to allow, in a word, the fascination of the means to distract [them] from the very object for which they are employed." Because librarianship used as a model the methods of social science research, it relied so heavily upon statistics that, for a time, research in librarianship came to mean, almost inevitably, statistical investigation; and the value and significance of a research project came to depend upon the demonstrated degree of skill in statistical manipulation. Because the methods and techniques of librarianship itself had been empirically derived, it is not surprising that research in librarianship was also empirical at first. As a result, much library research has been little more than what Beal's called "testimony," the implications of which are almost always personal and hence likely to be idiosyncratic. The evidence offered in support of testimony is experience, usually undifferentiated experience consisting of impressions and appraisals of complex phenomena. While in some situations valid experience rightly interpreted can contribute to the research process, yet of much library research one cannot but wonder whether the process of winnowing the data has been carried far enough to yield wholly trustworthy results; whether the size and character of the sample are such that the results can be reliable; whether the reporters of the data were skilled analysts and observers; whether conditioning factors had been isolated and appraised with accuracy; whether central tendencies had been slighted in favor of the



picturesque, the unusual, or the fortuitous; and finally, whether the conclusions reached would be respected by qualified authorities. To be sure, for the solution of many stubborn library problems, undifferentiated experience is the only source of information available to the investigator, but it requires careful scrutiny and judicious appraisal if it is not to be misleading. Because of the empirical character of library research, and its excessive dependence upon local observations and limited data, more frequently than not it is provincial and parochial rather than general in applicability.

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#### **4.5 Current trends in LIS Research**

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There is a significant change in the selection and approach to research topics over the years. In 1970's reflect the conventional studies and case studies, user studies of Information sources, LIS education professions etc. The topics are studied

1. Public Library system, Academic Library system and Special Library System
2. Promoting Reading Habits and Interests
3. Information analysis and consolidation
4. Citation analysis of Specific Subjects
5. Use patterns of Information sources
6. Librametry
7. User studies Attitudes

1980's Application of computers in Library operations, Bibliometric analysis in addition to the traditional areas the areas may be categorized as

1. Resources sharing
2. User studies
3. Indexing System
4. Application of Technologies, Software development, computer approach
5. Marketing of Information Products
6. Library Networks and development
7. Impact of IT and assessment of different Library System

In 1990 have witnessed the development of LIS research on Information Technology to Information Handling like USA, UK

1. Profession- Education and Training
2. Public Library System, Academic Library System
3. Library user Education
4. Library user and user studies
5. E-Resources / development/ Problems in Acquisition
6. Multimedia Techniques
7. Library Management: TQM/ PERT/
8. Networks/ Internet/ Intranet
9. Digital Preservation/ Digital Preservation Techniques/ Digital Archival Management
10. Green Libraries
11. Searching Databases

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#### **4.6 Interdisciplinary Area of Library Research**

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The manifold multi faceted implications of industrialization for India typically spell out the need for scientific social research on a fairly large scale. To provide for a scientific understanding of nature of problems, sound diagnosis and an effective treatment plan. In fact, the complexity of the situation (of which title is known) calls for some kind of an inter-disciplinary collaboration among researchers from specialized disciplines-economists, political scientists, sociologists, psychologists and anthropologists, etc. making for an effective multi-pronged attack on these social maladies. Information is Interdisciplinary: Information has how become Interdisciplinary in nature. The old division of knowledge into separate discipline has virtually broken down. Each discipline is now interacting with other disciplines and in the process. New disciplinary information is generated. J.H Shera stated that “today there are unmistakable indications that all higher education is moving away from a vertical toward a horizontal dimension that transcends traditional disciplinary boundaries to seek a universal function common to all curricula. Topology of Interdisciplinary:

Heinz Heckhausen identified the following six types of Interdisciplinary among subjects;

- 1) Indiscriminate Interdisciplinary: All “encyclopedic endeavors” end up with “curricular mix-ups” Librarianship is a typical example of an encyclopedic Endeavour.
- 2) Pseudo-Interdisciplinary: disciplines using the same analytical tools are at times considerate to produce Interdisciplinary fields. This association represents ‘phase relation’ among disciplines. The so called Interdisciplinary expected on the basis of analytical tools being common is pseudo-Interdisciplinary because there is no integration between the tool discipline and the host disciplines.
- 3) Auxiliary Inter-disciplinarily: this type of Interdisciplinary results from cross disciplinary use of methods, one discipline being constantly dependent upon the method of another auxiliary discipline. Use of Boolean logic in the retrieval process is an example of auxiliary Interdisciplinary. Here library and information science depending on Boolean logic and thus logic is regarded as an auxiliary discipline.
- 4) Composite Interdisciplinary: here diverse disciplines are brought together as problem solving techniques. The respective materials fields do not overlap, yet present a composition. In Ranganathan’s terminology these are described as “clustered” subjects.
- 5) Supplementary Interdisciplinarity: this type of inter disciplinary exists between disciplines in the same material field. Their respective subjects’ matters partially overlap. Communications is an example of this type of Interdisciplinary. Ranganathan called these subjects as “Compound” subjects.
- 6) Unifying Interdisciplinarity: when two or more disciplines move towards their unification at their theoretical integration level, a unifying Interdisciplinarity results. These are the “fused subjects.” Inter-disciplinary research is a common feature of today. Rather, it is the need of the day. Inter-disciplinary research brings out a number of view disciplines by way of lamination, loose assemblage, agglomeration and fusion. One can identify a number of areas in which library research could profitably seek assistance from other branches of intellectual activity: Library administration: political science, government, management theory, operations, research, system analysis, personnel management, budgeting.

- 7) Knowledge and society: epistemology, cultural anthropology, social psychology, communication research, social organization, philosophy, library criticism.
- 8) Education and communication: the structure and operation of the brain, psychology, the assimilation and utilization of information, linguistics, the new media, educational theory, communication theory.
- 9) Man-machine relationships: automation, cybernetics, information science and systems, logic, theory of classification, scientific method, structural linguistics. The areas here designated are intended to be no more than suggestive; certainly they are not definitive.

They may, however, serve to indicate the opportunity for enrichment of research in librarianship through synthesis with other disciplines, some of which are themselves quite new and as yet not fully formalized. One should also point out that in certain areas (e.g. the neurophysiologic); the librarian can do little but evaluate the findings of others in terms of their relevance to his professional responsibilities.

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#### **4.7 Future of Library Science Research**

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What would be the future for research in librarianship. Because libraries will disappear, as newer ways to communicate information supplant the recorded forms in use today. It seems more likely, however, that librarianship will continue its transformation into whatever name is given to the field for professionals who mediate between information in any form and the people who need to use it. Because the environment out of which those needs will arise is becoming more and more complex and the forms of conveying information are becoming more diverse, it seems evident that librarianship, by whatever name it is called, will need the understanding of information and its uses which scientific research can provide. Fortunately, there is a growing body of people concerned with libraries and information services that are educated to understand research and trained to conduct it. Fortunately, also, there is a growing appreciation among practitioners of the value of research. In the short term, none of what we have today is enough and leaders of the research community complain that improvements must be made. In the long term, however, the field is far advanced from where we were fifty years ago when the Graduate Library School was struggling to be born at the University of Chicago. The November 1980 issue of the *Journal of the American Society for Information Science* featured Laurence Heilprin's article on "The Library Community at a Technological and Philosophical Crossroads: Necessary and Sufficient Conditions for Survival." Heilprin explained the two conditions for survival as follows: "In order to attain control over its own destiny the library community must keep its own members up to date educationally; and beyond this must perform the research that alone creates and keeps leadership in its field. Heilprin believes that unless appropriate and sufficient research is conducted, the library community will not be able to transform itself but will be absorbed by other groups that will take over the information function for society. The challenge is clear: the connection between research and librarianship must be changed from one that is uneasy to one that is firm. Thus, Librarians need to pay careful attention to several factors: to the numerous meanings of the word research and the different ways each kind of research affects librarianship; to educational programs that develop an ability to understand and conduct scientific research; to publications and programming that discuss work in progress and disseminate final results; to increasing the availability of funding; and, finally, to the incorporation of a research perspective into the way librarians think about what they do.

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#### **4.8 Summation**

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A profession that would know itself-that would anticipates or must support and engage in productive research. Research is too important to be left to dilettantes and amateur, and its pursuit should be reserved for those who are qualified for it by aptitude, education, and motivation.

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#### **4.9 Questions to be answered**

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1. Explain the Interdisciplinary Research in Library and Information Science
2. Write a easy on Recent trends in LIS Research
3. Describe the future of Library and Information Science Research

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#### **4.10 References**

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